result would be an overall rate of near zero in a sample of two to three years. Our samples are so small (usually an hour a week) that they would fail to catch these occurrences. Only less frequent verbs, discounted by Marcus and colleagues, might show evidence of strong overregularization. In fact, that they do was shown for R. Brown's two low-overregularizing subjects Adam and Sarah (see, e.g., 1973). For Adam, for example, the average overregularization rate was a strong 55 percent for his 21 lower-frequency verbs. The same rate was found even in samples after the child first produced the correct irregular form of a verb. Arguments from sampling considerations indicated that such overregularizations were still persisting after tens or even hundreds of uses. Recent work from a more intensively recorded subject, Peter (Maslen et al. 2004), has strongly supported these analyses and extended them to noun plurals. These data indicate that overregularizations do often appear frequently after the irregular past is known, contrary to blocking. Our samples' restrictions just make it difficult to capture them for the more frequent irregular verbs whose numbers dominate overall rates.

Suppose these analyses do indeed indicate that the low-rate blocking account is incorrect. Do they also show that the connectionist account is therefore correct? Actually, they only indicate that a competition process of some sort is involved. As noted, older rule-based models also assumed a competition between regular rule and individual entry. The current association of competition with connectionism and with non-rule models thus reflects current disputes, not the basic analytic problem. The conflict between connectionist and rule-based approaches will thus have to be resolved ultimately, if it can be, using other data and arguments.

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P

PARABLE

Standard definitions, such as the one given in the *Oxford English Dictionary,* conceive of parable as a literary term; it is said to be the expression of one story through another. Literary historians have modified this conception by placing limits on the kind of story that counts as parable, attempting to distinguish it from, for example, fable or allegory.

There are, however, even among literary scholars, some who see parable as a much larger phenomenon, belonging not merely to expression and not exclusively to historical genres but, rather, as C. S. Lewis (1936, 44) observed, *to mind in general.* (See also Louis MacNeice's discussion of literary critical perspectives on parable in MacNiece [1963] 1965, 5.)

For the language sciences, parable is not only, or even chiefly, a kind of story; it is not an expression at all but, rather, a mental faculty that allows the human mind to integrate two conceptual stories or narratives into a third story, thereby creating a **CONCEPTUAL BLENDING** network that has emergent meaning.

Straight history, or the observation of human interaction, often can serve as the material for such parabolic blending. For example, Sun Tzu's *The Art of War* treats 13 aspects of warfare. It has been studied in the West by military strategists since the eighteenth century. Written in the sixth century B.C. in China, it precedes by a couple of millennia the origin of modern business management. But in the 1980s, it underwent extensive parabolic rendering in numerous books and articles for the purpose of offering guidance to twentieth-century graduate students of business and investment on how to conduct their professional lives.

Parable frequently blends two stories that have strong conflicts in their content. It is a scientific riddle why human beings should be able to activate two conflicting stories simultaneously, given the evident risks of mental confusion, distraction, and error. Yet, uniquely among species, human beings can evidently not only activate fundamentally conflicting stories simultaneously and construct connections between them but also blend them to create emergent meaning. This ability to blend two conceptual arrays with strong conflicts in their **FRAMING** structure is central to higher-order human cognition and is a hallmark of the cognitively modern human mind. It is known as "double-scope blending" (Fauconnier and Turner 2002).

Consider a parable from the Fourth Gospel. In John 10:11–18, Jesus presents Himself as the good shepherd, who lays down His life for the sheep, in contrast to the hired hand, who does not care for the sheep and flees in the face of the wolf. He says the Father loves Him because He lays down his life and that no one takes it from Him. Rather, He has the power to lay it down

and take it up again. The clash between the story of the shepherd and the blend Jesus proposes is astonishing. It is quite implausible that a shepherd would choose to *die* defending the sheep, because then the sheep would be without a defender. Yet this consequence is not projected to the blend: The actual shepherd cannot return after being killed to look out for the flock, but in Jesus's blend, He can. The **EMERGENT STRUCTURE** in the blend is crucial: Jesus's narrative blends *dying* with *physical manipulation of an object*. (Physical manipulation is at the root of human understanding. See Chapter 4 of Turner 1996, "Actors Are Movers and Manipulators.") In the story of manipulation, we can lay down an object and pick it back up. Blending manipulation of a physical object with the state of being alive or dead, Jesus achieves the remarkable ability of self-revival.

As discussed in Chapter 4 ("Analogy") of *Cognitive Dimensions of Social Science* (Turner 2001), almost all the mental achievements analyzed by analogy theorists as **ANALOGY** involve considerable unrecognized blending. In general, analogy involves dynamic forging of **MENTAL SPACES**, construction of connections between them, and blending of the mental spaces to create a conceptual integration network of spreading coherence, whose final version contains a set of what are recognized, after the fact in the rearview mirror, as systematic, even "obvious" analogical connections. But those analogical connections are more often the outcome of conceptual blending than its preconditions. Put differently, what is commonly discussed as analogy manifests the faculty for parable.

It is also important to recognize that a parable is not, in general, a **CONCEPTUAL METAPHOR** for understanding one conceptual domain in terms of another. Consider 2 Samuel 12. The prophet Nathan creates an elaborate blend in which a rich man is blended with King David, a poor man is blended with Uriah the Hittite, Uriah's wife Bathsheba is blended with a favored ewe lamb, and there is a traveler who comes to dinner. The point of the complex blend is that David has done wrong. The **SOURCE AND TARGET** are complicated, drawing on many conceptual domains, and the principal connection is that in both of them, one man abuses another and deserves punishment. No general conceptual metaphor provides this set of cross-space connections. Most of them are not metaphoric.

Parable as a form of literary expression might be of interest to historians, anthropologists, and critics. But parable as a species-specific mental faculty that can activate, connect, and blend sharply conflicting stories to produce new emergent meaning is a far larger and more fundamental topic, posing one of the central riddles of the cognitive and language sciences.

– Mark Turner

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PARALANGUAGE

Nuances, connotations, and innuendos, which are integral characteristics of verbal communication, are given the vague term *paralanguage*. These meanings arise from sources both within and outside of standard linguistic structure. Linguistic elements – **WORDS, WORD ORDER, SEMANTICS**, grammar – can be utilized for paralinguistic communication. These combine with variations of speech melody in ways that often defy structural description. Paralanguage (as the term implies) both draws on and lies over the known and describable *ortholinguistic* levels of **PHONETICS, PHONOLOGY, MORPHOLOGY** and lexicon, **SYNTAX**, and semantics. All of these elements can be harnessed for paralinguistic communication, as is well known from baby talk, from connotational meaning differences in terms such as *skinny*, *slim*, *slender*, and from word-order choices such as Herman Melville's "That inscrutable thing is chiefly what I hate." In addition, emotion, attitude, **INTENTION** mood, psychological state, personality, and personal identity can be communicated without referring to words. Because of the power of the **INTONATIONAL** contribution to paralanguage, the notion of two *channels* in the speech signal has been invoked, but their intimate interplay has been emphasized (Bolinger 1964). Words can communicate emotions, but when prosody does so using a different channel, the paralinguistic intent overrides the ortholinguistic content, as in "I'm not angry!" spoken with increased **PITCH**, amplitude, and rate.

Much of paralanguage is carried over longer stretches of utterance than the phonetic element or the single word. Lexical and syntactic choices may interact with intonational features with a cumulative effect. Formulaic and nonliteral expressions may be called into play. "It has come to my attention that your stonewalling is holding up the works" contains conventional and **METAPHORIC** utterances that build to a message more fraught with paralinguistic content than "I've learned that your hesitation is contributing to a delay." Although subtle contrasts can be conveyed on short utterances (see "Nine ways of saying yes" in Crystal 1995), paralanguage prefers a larger canvas. Repetition of words (Shakespeare's "a little, little grave") may have a powerful paralinguistic effect. Movement from low to high pitch across an intonational unit displays surprise or amazement; temporal units are "stretched" to express sadness or disappointment; increased intensity signals aggression or thematic emphasis; voice quality becomes "creaky" to communicate victimization or breathy to signal excitement.

Prosody, a major vehicle of paralanguage, can be decomposed into measurable elements: timing, pitch, amplitude, and voice quality. These measures combine into complex patterns, such that associating acoustic cues with paralinguistic meanings is far from straightforward. "John didn't drive the car" can be intoned with sadness, happiness, fear, or disgust, and may enfold attitudes such as incredulity, relief, perplexity, or amusement. Contradiction or denial, and conversational presumptions, such as sincerity and truthfulness, are carried by phrasal intonation. Take a common paralinguistic trope, sarcasm (see IRONY), in

"That was a good effort." We know sarcasm when we hear it, but exactly what in the signal conveys that the speaker is intending to communicate the opposite of the usual lexical meanings is difficult to specify. In one version, the sarcastic utterance utilizes higher pitch and greater amplitude on the first word followed by falling intonation, pharyngeal voice quality, tensed vocal tract, and spread lips. While morphological, lexical, and syntactic meanings can be structurally analyzed using units, features, and rules, paralinguistic meanings constitute a brew of unstable, fleeting, and subjective qualities. These paralinguistic qualities shade into one another, and they impinge on "purely" linguistic uses of prosodic contrasts, as in question and statement intonation. The auditory-acoustic cues that comprise paralanguage are graded, in that they are not perceptually allocated by the listener into discrete, contrastive categories as are the acoustic signals for phonetic and lexical elements. Using deft combinations and placements of prosodic cues, a speaker can communicate more or less fear, gradations of perplexity, and degrees of denial.

The development of the **PRAGMATICS** of **COMMUNICATION**, a branch of linguistics that studies language use in conversation (see CONVERSATION ANALYSIS), jokes (see VERBAL HUMOR), and storytelling, has advanced understanding of paralanguage. Communicative elements such as turn-taking, inference, and theme (topic of the discourse), and how they are signaled by the speaker and comprehended by the listener, are investigated. The fields of prosody and pragmatics have provided another valuable impetus for the productive study of paralanguage: investigation of the communicative competence of the **RIGHT HEMISPHERE LANGUAGE PROCESSING** in humans. While it has long been known that the **LEFT HEMISPHERE** modulates language processing, studies of pragmatics and prosody indicate involvement of the right hemisphere in processing emotions and attitudes, inference and theme. The notion of two channels, ortholinguistic and paralinguistic, is supported by the model that allocates processing to left and right hemispheres, respectively. Paralinguistic nuances are intimately woven into the propositional message, so much so that synthesized speech is often judged as unpleasant. A goal of speech synthesis is to produce more natural-sounding speech, which means infusing paralanguage, a challenging but worthy goal.

– Diana Van Lancker Sidtis

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PARAMETERS

The term *parameter* is used in linguistics on analogy with its usage in mathematics and engineering. In mathematics, the parameters of a function are those aspects of the function that are held constant when defining a particular function, but which can vary in a larger context so as to characterize a family of similar functions. For example, the function for a line in analytic geometry is f(x) = mx + b, with *x* the variable and m and b parameters of the function (the slope and the *y*-intercept). In the definition of any one line, the parameters m and b are held constant, while the value of *x* varies, giving the different points on the same line. In a broader context, however, the parameters m and b can vary so as to define a family of similar functions: the set of all lines. In the same way, parameters in linguistics are properties of a grammatical system that are held constant when characterizing one particular human language, but which are allowed to take different values in a broader context so as to characterize a whole family of possible human languages. The idea that the observed variation in human languages can be understood as the fixing of certain parameters within an otherwise **INNATE** and invariant system of principles (**UNIVERSAL GRAMMAR**) is most commonly associated with the Chomskyan approach to formal generative linguistics (see GENERATIVE GRAMMAR). As a result, this approach is sometimes called the **PRINCIPLES AND PARAMETERS THEORY**. The idea is, however, a very general one, and it can also be used in the context of other views about the nature of the human language faculty.

This notion of linguistic parameters was introduced into linguistic theory by Chomsky (1981) and Rizzi (1982), during the **GOVERNMENT AND BINDING** period. The paradigmatic case was the *pro-drop parameter* (or *null subject parameter*). It was observed that languages like Spanish and Italian differ from French and English in several ways that appear to be interrelated. First, Spanish and Italian allow the subject pronoun of a finite clause to be omitted, whereas French and English do not:

(1) a. Verrà. (Italian: "He/she will come")
b. *Came. (English)

Second, Spanish and Italian allow the subject to come after the verb as well as before it, whereas French and English generally do not:

(2) a. Verrà Gianni (Italian, "Will-come Gianni")
b. *Came John (English)

Third, the subject of an embedded **SENTENCE** in Spanish and Italian can be moved to the beginning of the sentence as a whole, even when there is an overt complementizer, whereas in French and English some sort of accommodation is needed in sentences like these:

(3) a. Chi credi che – verrà? (Italian)
Who you-think that will-come
b. *Who do you think that – came? (English)

Although these are clearly three distinct properties of the languages in question, they have a common theme: Informally put, French and English require that there be an overt noun phrase in the canonical subject position immediately before the finite

verb, whereas Spanish and Italian do not. This difference in the **SYNTAX** of subjects was also related to a **MORPHOLOGICAL** difference: The **AGREEMENT** morphology on the finite verb is rich enough to uniquely identify which pronoun would be in the subject position in Spanish and Italian, whereas in French and English it is not. The universal syntactic condition, then, is that finite clauses require subjects (the extended **PROJECTION PRINCIPLE**); the parameter concerns exactly what kind of subject is necessary to fulfill this condition. In Italian and Spanish, the rich agreement on the verb means that null or displaced subjects are permissible because (roughly) much of the information concerning the sort of subject it was is locally available on the finite verb. In French and English, the agreement on the verb is of little help, and so an overt subject in the canonical subject position is required. A parameter, then, is a way of attributing a unified theoretical account of the systematic differences that distinguish one class of languages from another.

While the pro-drop parameter was the first important parameter to be proposed, it is by now not considered the best case. A look at a wider range of languages – both "nonstandard" dialects of the Romance languages and languages from other families – quickly showed that the properties in (1)–(3) do not correlate with one another as closely as was thought (Jaeggli and Safir 1989). This implies that the pro-drop parameter as it was originally conceived is either false or highly oversimplified.

That does not mean that the idea of a parameter was ill-conceived, however. The current paradigmatic example is what is sometimes called the *head directionality parameter* (terminologies vary). This can be stated as an open factor in the principles of **PHRASE STRUCTURE** (see X-BAR THEORY). Roughly put, when a **WORD**-level category **X MERGES** with a phrase Y to create a phrase of type X, there are two ways that the elements can be ordered: The order can be X-Y within XP, or it can be Y-X. Setting the parameter in the first way gives head-initial languages like English, in which complementizers come before embedded clauses, **TENSE** particles come before verb phrases, verbs come before their objects, prepositions come before their objects, and so on:

(4) John *will think* that Mary showed a picture to Sue.

Setting the parameter in the second way gives head-final languages like Japanese, in which complementizers come after embedded clauses, tense particles come after verb phrases, verbs come after their objects, prepositions come after their objects, and so on:

(5) Taroo-ga Hiro-ga Hanako-ni syasin-o miseta to OMOTTE IRU.
Taro SUBJ Hiro SUBJ Hanako to picture OBJ show that thinking be
"Taro is thinking that Hiro showed a picture to Hanako."

In this way, a parametric theory can account for many of the most robust Greenbergian universals (Greenberg 1963; Dryer 1992) concerning **WORD ORDER** in an elegant way. These two very common and stable language types fall out of a simple and unity choice that is made in the precise formulation of a universal principle of language.

Parameters vary widely in the range and scope of the effects that they are supposed to capture. Some theorists have proposed parameters that are intended to account for the large-scale differences among the major classes of languages discovered by **TYPOLOGY**. The head directionality parameter is a parameter of this sort. Another early example was Ken Hale's (1983) *nonconfigurationality parameter*, which was designed to explain why Australian languages like Warlpiri tolerate free word order and discontinuous phrases, whereas languages like English do not. Similarly, parameters have been proposed to capture the difference between *ergative* languages (like Basque and Eskimo), in which the object of a transitive clause is treated in some respects like the subject of an intransitive clause, and *accusative* languages (like English and most Indo-European languages), in which all subjects are treated similarly. These proposals range from radical differences in how syntactic structure is initially constructed (Marantz 1984) to relatively minor differences in how *case* and agreement morphology are assigned in a simple sentence (Bittner and Hale 1996). Mark Baker (1996) proposes a *polysynthesis parameter* that attempts to give a unified characterization of the difference between many native American languages, in which a large part of the expressive burden is placed on verbal morphology, and languages like English, in which the primary expressive burden is borne by syntactic combination. Taken together, some set of parameters such as these might characterize the major linguistic types we observe.

Other parameters operate on a smaller scale, defining the differences between historically-related languages or **DIALECTS**. The pro-drop parameter was a parameter of this sort, distinguishing French from Italian. Another example is the parameter that determines whether the subject of a clause moves from its original position inside the verb phrase to the highest position in the clause or not; this accounts for the difference between English, which has subject-finite verb-object word order, and Celtic languages like Welsh, which have finite verb-subject-object word order (Koopman and Sportiche 1991). Jean-Yves Pollock (1989) argues that there is a parameter that says that verbs move to a higher position in French than they do in English; this accounts for a cluster of subtle word-order differences having to do with the placement of verbs, negation, and adverbs in the two languages (e.g., *John kisses often Mary* is normal French but bad English). A third example is Jonathan Bobaljik and Dianne Jonas's (1996) proposal that some Germanic languages have an extra position available for subjects that other Germanic languages don't have; this makes sentences like "There have some trolls eaten Christmas pudding" possible in some Germanic languages but not others, among other things. (See Baker 2001 for a general overview of these parameters and several others.)

In the early days of parametric theory, it was thought that virtually any syntactic principle could be parametrized, and parameters were proposed that were relevant not only to X-bar theory but also to **MOVEMENT**, the theory of **BINDING**, and even the projection principle. On that view, there would be a modest number of parameters (dozens or perhaps hundreds), each of which would have a relatively large impact on the language generated. But this view has been questioned in more recent work. Hagit Borer (1984) proposed almost immediately that the syntactic principles themselves are invariant, and what is parameterized is the features associated with individual lexical items. Rather than saying that the syntax of French is different from

the syntax of English in that verbs raise to the tense/infl node in French, this view says that the lexicon of French is different from the lexicon of English in that French has tenses that require the verb to move into them, whereas English does not.

Borer's view has the conceptual advantage that it largely reduces the learning of syntax to the learning of individual lexical items. It also suggests that there might be thousands of parameters, rather than dozens, because each distinct lexical item is a possible locus of parametric variation (see especially Kayne 2005). Each individual parameter, however, will affect only a relatively narrow part of the grammar since it is limited to those structures in which a particular item appears. This view is compatible with the fragmentation of the pro-drop parameter, which is now seen as a cluster of small-scale distinctions, each of which can vary independently of the others, giving one the flexibility to describe the various intermediate patterns found in the dialects of southern France and northern Italy. As a result, Borer's view has been championed by Richard Kayne (2005) as the one that is supported by his methodology of comparing closely related dialects.

Baker (1996, 2008), however, argues that there may also be syntactic parameters in more or less the original sense, in addition to the fine-grained lexical parameters. Taken strictly, Borer's view does not really account for the unity of the head directionality parameter. Even the smaller-scale parameters do not seem to vary lexical item by lexical item. For example, it is not the case that some tenses trigger verb-adverb-object order in French and others do not; rather, all the different tenses trigger that order in French, whereas none of the English tenses do. Perhaps, then, the proper locus of much parameterization is neither the individual lexical item nor the syntactic principle, but rather a natural class of lexical items. How to state this and what its implications are continue to be topics of discussion.

– Mark C. Baker

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PARIETAL LOBE

Anatomy

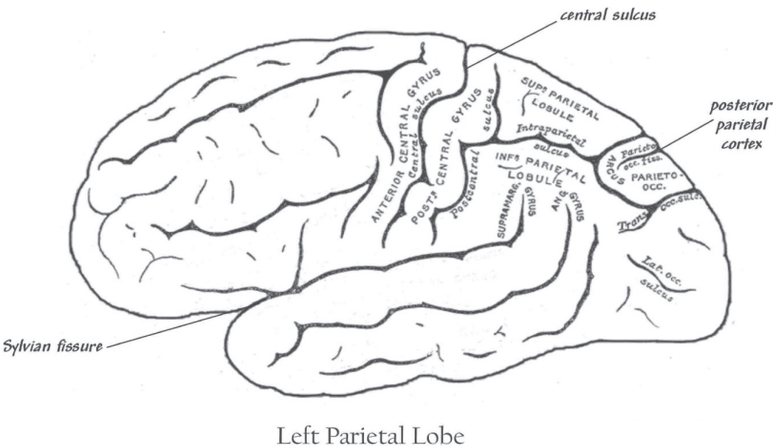
The parietal lobe is situated superior to the occipital lobe and posterior to the frontal lobe. More specifically, it extends from the central sulcus anteriorly, to the imaginary boundary of the parietal-**OCCIPITAL** fissure posteriorly, to the sylvian fissure (**PERISYLVIAN CORTEX**) inferiorly. The parietal lobe(s) can be further subdivided into three main areas. These include: 1) the somatosensory strip, also known as the postcentral gyrus (Brodmann's area [BA] 1, 2, 3, 43), 2) the superior parietal lobule (BA 5), and 3) inferior parietal lobule (includes BA 39-angular gyrus and 40-supramarginal gyrus). The latter two areas are separated by the intraparietal sulcus (see Figure 1). Medially, the parietal lobe(s) comprises the postcentral gyrus extension of the paracentral lobule, the precuneus, and part of the cingulate gyrus (see Figure 2).

Physiology

There are two parietal lobes, one in each hemisphere, which are divided functionally on the basis of dominance. The dominant lobe is typically the left one and the nondominant the right. There are many different non-language functions performed by the parietal lobe, for example, perception and localization of touch, pressure, pain, and temperature on the opposite side of the body, and visuospatial processing. The variety of language-related functions associated with the parietal lobe will be especially highlighted in the context of non-language functions.

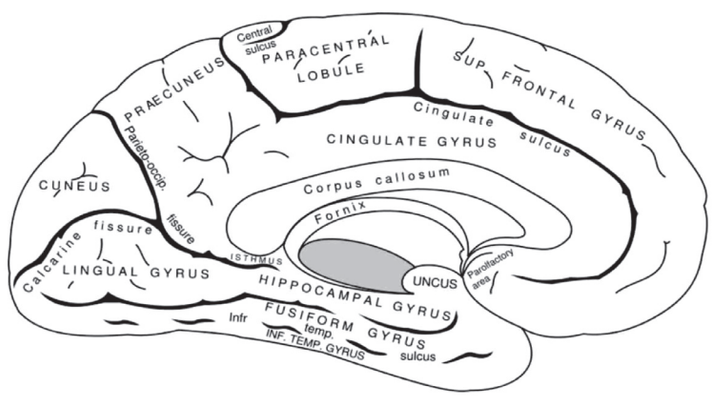
The dominant parietal lobe is involved primarily in integrating sensory information to create a particular perception. The inferior portion of this lobe, particularly the supramarginal gyrus and angular gyrus, is involved in structuring information for reading and writing (see **WRITING AND READING, NEUROBIOLOGY OF**), performing mathematical calculations, and perceiving objects normally.

Damage to the dominant lobe can result in apraxia (motor planning deficit) aphasia (language disorder), agnosia (abnormal perception of objects), and sensory impairment (e.g., touch, pain). Lesions to the inferior portion of the dominant lobe involving the angular gyrus can result in Gerstmann's syndrome, which is characterized by left–right confusion, difficulty pointing to named fingers (finger agnosia), impaired writing ability (agraphia), and inability to perform mathematical calculations (acalculia).



Left Parietal Lobe

Figure 1.



Left cerebral hemisphere - medial surface

Figure 2.

The nondominant parietal lobe, however, is involved in a different set of functions that are mostly non-language related. In particular, this region is responsible for visuospatial functions as it receives and integrates input from the visual system (occipital lobe) to make sense of the spatial order of the world around us. M. A. Eckert and colleagues (2005) found that Williams syndrome, whose phenotype (visuospatial deficits) and genotype (deletion on chromosome 7) are well characterized, is linked to superior parietal impairment. Williams syndrome, thus, may provide a valuable system for understanding parietal lobe function.

Damage to the right parietal lobe can result in a constellation of deficits involving spatial and body relations. Bilateral lesions may result in Balint's syndrome, which affects both visual attention and motor skills. If both the parietal and temporal lobes are damaged, memory impairments and personality changes may result. Specifically, if this damage occurs on the dominant (left) side, it may result in verbal memory deficits and difficulty in the retrieval of strings of numbers. If the damage is on the right side, it will affect nonverbal memory functions and will significantly impair personality.

History

For more than a century, the exact role of the parietal lobe has been debated by neuroanatomists and psychologists, with much of the research involving humans with brain damage and animal studies using rhesus monkeys. Sir William Turner (1873) is considered the first to describe in detail the intraparietal sulcus (BA 40). Before being scientifically discredited, phrenologists proposed that damage or disease to the parietal lobe(s) was a major cause of melancholia (depression), and "parietal eminence" was believed to relate to cautiousness (Hollander 1902). Due to the wide variety of symptoms reported from brain damage studies, the parietal lobes were accurately but vaguely thought to be a general "association area" combining all the information from various functions, specifically visuospatial and attention; however, details as to how this function occurred physiologically were lacking until modern times.

Josef Gerstmann ([1924] 1971) first described finger agnosia in a patient with a left parietal stroke, and the effects of various lesions on the parietal cortex were identified and cataloged in detail by John McFie and Oliver L. Zangwill (1960). Much of the early parietal research was pioneered by scientists Macdonald Critchley and later Juhani Hyvarinen in their respective works *The Parietal Lobes* (1953) and *The Parietal Cortex of Man and Monkey* (1982).

A great deal of neurological investigation has been conducted on rhesus monkeys, and there appears to be significant overlap between the human and monkey parietal lobe in both function

and form, though it is noteworthy that differences have been identified, such as larger parietal cortex, asymmetry of the lobes, and more neural subdivisions in humans (Kolb and Whishaw 1990).

Language

Continuing the classical **CONNECTIONIST** tradition of Hugo Liepmann, Norman Geschwind (1965) championed the simplified yet controversial position that the parietal lobe acts as the "association area of association areas." Neural tissue damage to this area often results in the classical *disconnection syndromes*, for example, apraxia and others.

Aleksandr Romanovich Luria (1973) considered the parietal cortex one piece in his two-part model of "mental activity," stating that it was important for understanding "reception, analysis, and storage of information." Lesions to the left parietal lobe were understood to result in afferent motor aphasias (difficulty in finding the correct articulatory positions for specific phonemes), particularly lesioned primary and secondary sensory areas affecting speech motor control and lesioned tertiary sensory area resulting in aphasia (the loss of speech production and/or comprehension).

Recent research, such as that of Gregory Hickok (2000), suggests that the inferior parietal lobe serves as the connection between phonological representations and motor control for those representations, that is, the auditory-motor interface, which is part of a larger network of interfaces and systems subserving language function. Marco Catani, D. Jones, and H. Dominic (2005) in a significant paper, confirm the analysis that includes the inferior parietal lobe in the use and possibly the acquisition of language via a new "circuit" connecting the traditional language areas of **BROCA** and **WERNICKE**. It has been labeled "Geschwind's territory" in honor of Geschwind's original proposal that the parietal lobe is critical to language function.

In sum, the left parietal cortex has particular areas that are responsible for various linguistic functions. However, there are other extralinguistic processes that the parietal lobe is known for as well.

Extralinguistic Processes

ATTENTION. The function of the parietal lobe in attention mechanisms has been discussed over a period of time. Michael Posner and Steven E. Peterson (1990) outlined the different subsystems of attention: a) orientation to sensory events (not conscious), b) signal detection for focal processing (conscious), and c) maintenance of a vigilant state (conscious). From the available neurocognitve evidence, the researchers assert that the posterior parietal lobe plays an important role in attention mechanisms, specifically in orientation and signal detection that are essential for linguistic processing. Earlier, Luria (1973) identified this parietal region that mediates attention as an "involuntary orienting" system. However the posterior parietal attentional mechanisms are greatly impacted by the frontal regions that subserve alerting mechanisms as well.

MEMORY. Traditionally, episodic memory, or declarative memory, has been attributed to the medial temporal lobe (MTL); however, recent evidence (Wagner et al. 2005) suggests that the parietal lobes may have a role to play in it as well. The role of declarative memory in language has been attributed to word learning or vocabulary storage. Wagner and his colleagues suggest three theories explaining the contributions of the parietal lobe in episodic memory retrieval. They highlight that, indeed, the parietal lobe does not play an independent role in this retrieval; rather, it mediates the major pathways in which the MTL subserves episodic memory.

In sum, a number of neurolinguistic positions have been taken from available neuropsychological and brain-mapping data (Stein 1989). These include the parietal lobe as a) a sensorimotor association area such that the posterior parietal cortex (PPC) becomes a junction of somaesthetic and visual information that interacts in a complex fashion, b) a sensorimotor integration area, which is very similar to the previous theory except for the addition of an actual "integral" function, and c) a command apparatus that is actually able to initiate a motor activity from the accumulated sensory information. The authors propose that although it is possible that the parietal lobe is involved in some motor processes, it is more likely that the process is one of maintenance than of initiation and is d) a region for directing attention to stimuli of interest. Here, the PPC and the pathways it receives are postulated to direct attentional focus to the target stimulus while coordinating and communicating with the inferotemporal cortex. J. Stein advocates that the PPC does not have a single narrow neurocognitive focus; nevertheless, it could have a common underlying function that integrates its multifaceted involvement in cognitive as well as automatic linguistic and extralinguistic processes.

Overall, the parietal lobe is crucial for several language functions, most importantly, naming, semantic processing, and phonological shaping of words, as well as reading and writing. In addition, it mediates attention and memory, both essential at different levels of language processing.

– Yael Neumann, Hia Datta and Daniel P. Rubino

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PARSING, HUMAN

In general, parsing refers to breaking something into its constituent parts. Thus, machines (see PARSING, MACHINE) and humans can decompose a message (such as print or spoken language) into phrases, **WORDS**, and **MORPHEMES**. Most commonly human parsing has been considered in the context of **SENTENCE** processing, particularly its **SYNTACTIC** and **SEMANTIC** aspects. Language – spoken, written, and signed – can also be described in terms of smaller functional units, including **SYLLABLES, PHONEMES**, features, and **GESTURES**.

An understanding of grammatical constraints has guided the development of descriptive representations (e.g., sentence diagrams) and formal systems of language structure and use. Parsing models also have been influenced by linguistic, **PSYCHOLINGUISTIC**, and cognitive theory and by techniques used in **COMPUTATIONAL LINGUISTICS**, natural language processing, and speech recognition (Chomsky 1965; Bresnan 1982; Jurafsky and Martin 2000). Representative approaches include linguistic, statistical, **CONNECTIONIST,** and dynamical systems models (Charniak 1993; Hale 2006; McClelland and St. John 1989; Steedman 1999; Tabor and Tanenhaus 1998; see also SELF-ORGANIZING SYSTEMS).

The scale at which we can break the signal into pieces depends upon both our attention to detail and to our descriptive goals, as can be seen in numerous psychological studies that range from **AMBIGUITY** resolution (Frazier and Fodor 1978; Frazier 1987) to assessment of our ability to perceive, produce, and use information at various levels of description. Parsing linguistic information is not restricted to sound and print but can include a consideration of the gestures underlying the production of language by voice (the coordinated movement of speech articulators, such as the tongue body, tongue tip, jaw, and lips; see SPEECH PRODUCTION) and sign (manual, facial, and body orientation) (Battison 1978; Browman and Goldstein 1990; Fowler and Brown 2000).

– Philip Rubin

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PARSING, MACHINE

The query "Over which strait in North Wales did Thomas Telford build a suspension bridge?" shows that natural languages have complex **SYNTACTIC** structures (see also PHRASE STRUCTURE). Comparison of the question with the answer "He built a suspension bridge over the Menai Strait" reveals that the phrases including "strait," occur in different positions in the two utterances, and that the verb position is quite different, leading linguists to propose a **CONSTITUENT STRUCTURE** like (1) for the question:

(1) [[over/Preposition [which/Determiner [strait/Noun [in/ Preposition [North/Noun Wales/Noun]NN]PP]N1] NP]PP [did/V_{aux} Thomas_Telford/NP [build/Verb [a/ Determiner [suspension/Noun bridge/Noun]Noun]NP t/ PP]VP]S_{inv}]S_q

A *parser* is a program that analyzes *sentences* in order to figure out their structure, using a list of rules describing the grammar of the language, such as:

(2) $S \rightarrow NP\ VP$
$S_q \rightarrow PP\ S_{inv}$
$S_{inv} \rightarrow V_{aux}\ NP\ PP$
$PP \rightarrow Preposition\ NP$
$NP \rightarrow Determiner\ N1$
etc.

Most parsers begin by determining the part of speech of each word (see WORD CLASSES). A *bottom-up* parser then attempts to

group the words into phrases and phrases into clauses, according to the grammar rules, keeping track of multiple possible analyses because of the extensive **AMBIGUITY** of natural languages. *Top-down* parsers, though perhaps less intuitive, are also frequently used: They essentially work by attempting to *generate* the input sentence.

Standard parsing algorithms for analyzing any **ARTIFICIAL LANGUAGE** (such as programming languages) have been developed and can be used with any context-free grammar. Thus, linguists can write the grammar rules: They do not need to be programmers. But linguists' grammars of natural languages often make use of additional devices, such as **AGREEMENT** or subcategory features (as with S_{inv} and V_{aux} in [1] and [2], denoting inverted sentences and auxiliary verbs). **GENERATIVE GRAMMARS,** therefore, usually augment constituent structure with additional information: There may be labels to uniquely identify individuals or additional levels of information, such as meanings. Work on feature-based frameworks such as **LEXICAL-FUNCTIONAL GRAMMAR** and **HEAD-DRIVEN PHRASE STRUCTURE GRAMMAR** has gone hand in hand with the development of complementary parsing methods.

– John Coleman

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PASSING THEORIES

Passing theories are utterance-specific formal semantic theories; they specify the correct interpretation, or literal meaning, of particular linguistic utterances: sentences uttered by particular speakers at particular times. The expression "passing theory" was coined by Donald Davidson in his 1986 paper "A Nice Derangement of Epitaphs," which was part of his attack on accounts of linguistic communication essentially involving conventionally determined, shared meanings ([1986] 2005).

According to Davidson, expressions like *language*, *meaning*, or *sentence* are theoretical terms used for describing, or explaining, successful linguistic communication (cf. [1992] 2001, 108 f). For communicative success, regular or conventional use of words is not necessary; what is necessary is only that the hearer understand what the speaker intends to mean. For instance, if by the words "a nice derangement of epitaphs" the speaker intends to mean a nice arrangement of epithets and the hearer understands that, we have a case of successful linguistic communication. Davidson suggests characterizing communicative success in terms of the semantic intentions of the speaker. These he construes as intentions to be interpreted in a particular way on a particular occasion and by a particular hearer. Moreover, they are of a Gricean, self-referential form (see COMMUNICATIVE INTENTION): A semantic intention is an intention to achieve the end of being interpreted in a certain way by means of the intention's being recognized by the hearer (Davidson [1986] 2005, 92 f). Any utterance is made with a number of intentions that can be ordered in terms of means to ends; the first intention in such a sequence (as ordered by "in order to") specifies its literal, or "first," meaning. "A nice derangement of epitaphs" thus literally means a nice arrangement of epithets if uttered with the relevant semantic intention and understood accordingly. According to Davidson, this does not obliterate the distinction between literal meaning and speaker's meaning; speaker's meaning – for instance, metaphorical meaning – always comes later in the order of intentions.

According to Davidson, Tarski-style theories of truth (T-theories) can be used as formal semantic theories. To specify the literal meaning of any utterance, be it ever so idiosyncratic, a full T-theory is required. In the case of malapropisms and other novel or idiosyncratic use, these theories will be of a transient, "passing" character; they might not hold for more than a single utterance. If they hold for a certain utterance, Davidson speaks of speaker and hearer "sharing" a passing theory (for that utterance). "Prior theories," on the other hand, specify the interpretations speakers expect hearers to make, and hearers are prepared to make, prior to actual utterances (cf. Davidson [1986] 2005, 101ff).

Davidson then uses the terminology of "prior" and "passing theories" to renew his argument against any account of linguistic competence essentially involving the prior mastery of a system of shared semantic and syntactic conventions or rules: "[S]haring such a previously mastered ability [is] neither necessary nor sufficient for successful linguistic communication" (Davidson [1994] 2005, 110; cf. also [1982] 1984). To model successful linguistic communication, systematic semantic theories of passing and prior nature are required, but sharing of prior theories is not sufficient for successful linguistic communication. Even if speaker and hearer share a prior theory, the ability to interpret in accordance with that theory does not account for those cases of successful communication where words are used in novel or idiosyncratic ways. Nor is a shared prior theory necessary for communication to succeed – all that is necessary is that the passing theory be shared. Sharing passing theories, however, does not amount to sharing a previously mastered ability: "In conclusion, then, I want to urge that linguistic communication does not require, though it very often makes use of, rule-governed repetition; and in that case, convention does not help explain what is basic to linguistic communication, though it may describe a usual, though contingent feature" (Davidson [1982] 1984, 280).

Davidson's 1986 paper has been heavily criticized, among others by Michael Dummett. Part of the criticism is due to the provocative formulation Davidson gives there to his conclusion: "[T]here is no such thing as a language, not if a language is anything like what many philosophers and linguists have supposed" ([1986] 2005, 107). A controversy between Davidson and Dummett ensued regarding the questions of whether the notion of an idiolect is to be explained in terms of a communal language or the other way around, and whether meaning is essentially normative or prescriptive. Davidson argues that "any obligation we owe to conformity is contingent on the desire to be understood" ([1994] 2005, 118), and he explicitly opposes those forms of social **MEANING EXTERNALISM** (such as Tyler Burge's), according to which the literal meaning of words is essentially a matter of the linguistic practices of the community surrounding the speaker (Davidson [1994] 2005, 119). Just as for Gricean accounts of meaning, there are also issues of psychological realism that arise

for Davidson's account of successful linguistic communication in terms of the complicated semantic intentions of the speaker.

– Kathrin Glüer

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PERFORMANCE

The study of performance investigates communicative practices in their sociocultural contexts from three perspectives. First, it foregrounds the performativity of communicative forms and practices as modes of action or means of accomplishing social ends. Second, it directs attention to the poetics of communicative practice or to the forms of verbal artistry through which communicative acts are crafted and communicative skill is displayed. Third, it focuses attention on performances as a special class of events, such as rituals, spectacles, festivals, or fairs, in which a society's symbols and values are publicly displayed, interpreted, and transformed. Within language study, the first and second perspectives have been foregrounded.

The contemporary focus on the poetics and performance of communicative practice emerged in the subdiscipline of linguistic anthropology from a line of inquiry called the *ethnography of speaking*. Developed by Dell Hymes and his students during the 1960s and 1970s, the ethnography of speaking highlights performance in two linked ways: as speaking practice and as artfully marked ways of speaking (Bauman and Sherzer 1975). Its centerpiece is what Hymes called the speech event or communicative event, a framework that allowed scholars to analyze multiple components of language in use, including *setting*, *participants*, *ends* (goals, purposes), *act sequences*, *key* (tone, tenor), *instrumentalities* (channel, code), *norms*, and *genres* (the SPEAKING acronym provides a mnemonic) (Hymes 1967). The interest was not simply in cataloging these components but, rather, in understanding how speakers use language within the conduct of social life. In highlighting the emergent and creative nature of speech performance, the ethnography of speaking focused attention on linguistic forms as "resources for living," in Kenneth Burke's ([1941] 1973) sense. Further, it proposed a new unit of study, the speech community, defined as an organization of diversity that had to be constituted and managed via performances, rather than as a preexisting homogeneous entity.

In his concern with how language functions in society, Hymes was inspired by the work of the prewar Prague School (1929–38) and, in particular, by Roman Jakobson (1896–1982). Working against Russian Formalism's emphasis on the inner laws and formal structure of text without regard for context, the Prague School focused attention on the multifunctionality of language. Jakobson (1960), building on work by Karl Bühler and Jan Mukařovský, identified six constitutive factors of a communicative event and postulated that each factor was associated with a particular language function. Jakobson's constitutive factors include addresser, addressee, context, message, contact, and code; he termed their associated functions expressive (or emotive), conative, referential, poetic, phatic, and metalingual. Thus, for instance, an utterance (such as "eee-gads!") that directs attention to the addresser (speaker) would be associated with the expressive function, and so on. This model provided a basis from which scholars could investigate the relationships among form, function, and meaning.

In attending to speaking as a social accomplishment, the ethnography of speaking opened the way for studies of language as an arena for the performance of social identities (see IDENTITY, LANGUAGE AND). Earlier studies tended to focus on the organization of communicative life in small, often face-to-face communities, highlighting the differential distribution of linguistic resources by **AGE, GENDER,** ethnicity, or other status markers (see Bauman and Sherzer 1974). Later works consider how particular linguistic performances are both embedded in and help to shape wider political or cultural formations, such as race relations, subcultural or national identities, multiculturalism, secularism, and the like. Linguistic anthropology's historical emphasis on ways of speaking, strategies of voicing, participation structures, and orientation to audiences made the field especially amenable to the approach of the Russian literary theorist Mikhail Bakhtin (1981), whose work on **DIALOGISM AND HETEROGLOSSIA** inspired studies in areas including language **IDEOLOGY**, genre, and **INTERTEXTUALITY** (Silverstein and Urban 1996).

By foregrounding speaking as a social performance, the ethnography of speaking countered an alternative use of the term *performance* proposed by Noam Chomsky (1965). Drawing on a distinction made by Ferdinand de Saussure ([1907] 1959) between language (*langue*) and speech (*parole*), Chomsky defined performance as the incomplete and imperfect realization of language by particular speakers. He opposed performance to **COMPETENCE**, an internalized set of general rules that constitute one's knowledge of a language, abstracted from particularities of performance. In contrast, theorists of performance, along with many linguistic anthropologists and **SOCIOLINGUISTS**, emphasize communicative competence, understood not as a hypothetical capacity for language but as the contextually grounded and culturally acquired "ability to speak in socially appropriate ways" (Bauman 1977, 11). Here, speaking is understood as a creative and emergent act through which social life is accomplished. As such, speaking is inherently risky; it involves skill and accountability and is subject to critical evaluation.

Richard Bauman highlights the dimensions of risk, responsibility, and accountability in what has become a classic definition of performance: "Performance as a mode of spoken verbal communication consists in the assumption of responsibility to an audience for a display of communicative competence" (1977, 11). Inspired by Hymes, Bauman has been particularly interested in the forms of verbal artistry through which communicative skill is put on display. His work generated a pivotal shift in folklore studies from a classificatory concern with texts independent of their contexts of use to an interest in the performance of verbal art as a constitutive ingredient of social life. Performance in this sense may range from "sustained, full performance to a fleeting breakthrough into performance, with hedged or negotiated performance lying somewhere in between" (Bauman 2004, 110; the phrase "breakthrough into performance" comes from Hymes 1981). Both Bauman and the interactional sociologist Erving Goffman have been interested in how performances are framed or keyed, but whereas Goffman's approach is dramaturgical, highlighting how social actors move from "back stage" regions to perform the "face work" associated with an array of social roles (Goffman 1959), Bauman's interest lies in **POETICS**, **VOICE**, and genre as verbal resources for the accomplishment of social ends.

Thus far, performance has been considered from two related vantage points, each grounded in particular disciplinary perspectives: Performance as speaking practice has been a focus of linguistic anthropology and sociolinguistics; performance as verbal art has been highlighted in folkloristics and linguistic anthropology. A third approach views performance as a special class of marked events in which a society's symbols are displayed for commentary, interpretation, or transformation. This approach, pioneered by Victor Turner (1967, 1969), is less concerned with language per se. Through its focus on collective representations, cultural symbolism, and collective effervescence, or "communitas," it is located in a Durkheimian paradigm, with inspiration from Arnold Van Gennep's work on rites of passage. Increasingly, however, scholars are drawing on aspects of all three approaches. One example of how the three approaches may be productively considered together is Jane Goodman's analysis of a children's performance in the Kabyle Berber region of Algeria (2005).

The performance in question took place at a wedding, understood as a festive occasion in which villagers suspended interpersonal or political conflicts and came together to collectively celebrate the new union. The wedding was set apart from everyday life by various formal markers: location (an outdoor public square), timing (late evening), dress, music (traditional band), and activities (dance). Special forms of verbal art also marked the occasion: A hired poet recited a poem after henna was applied to the groom's hand; older village women sang traditional songs to mark transitions. Wedding guests danced to show support for the new couple. In this village, men and women shared the same dancing space but typically danced sequentially rather than concurrently; in no case did they dance as couples. One summer, however, village youth active in the national Berber Cultural Movement formed a mixed-gender children's chorus as a way of changing gender relations in the community and, more broadly, fostering a commitment to forms of social relationship aligned with the democratic aspirations of their movement (the Berber Cultural Movement was a minority **ETHNOLINGUISTIC**, subnational, and secular opposition movement in a majority Arabo-Islamist nation). A chorus offered a way of teaching children new gender roles while displaying new modes of gender interaction to the wider community. To accomplish this, the young men created a new, highly marked event within the already marked wedding: They mounted a stage, rented microphones, hung lights, and thus configured an entirely new relationship between performers and audience, placing the guests in an unfamiliar spectator role. The children sang political songs that, while well known, were not typically associated with weddings. This repertoire provided the backdrop for yet a third performance: An adolescent girl recited a poem on gender relations written by her brother (the chorus director) – a novel form of verbal art that until then had no possibility of public performance in the village. Yet the girl appeared to be only partially invested in serving as a spokesperson for her brother's text (she animated the text, in Goffman's sense); at one point, she stumbled over the words, and her brother prompted her, mouthing the words from the sidelines. The event culminated in a rousing dance in which the children spontaneously organized themselves into male–female couples, a transformation of gender roles in dance that galvanized the audience for nearly an hour.

This multilayered performance highlights the use of verbal art (songs, poems) alongside other performance modes to effect a transformation of the social relations of gender. It also illustrates differential relations to linguistic resources and linguistic authority (a concern of the ethnography of speaking): The children's chorus had access to political repertoires but not to women's traditional songs or henna poems. A young man could fashion himself as the author of a poem; a young woman could only animate it, and was subjected to her brother's corrective voicing from the sidelines. Further, it shows how the participant structure (first made salient in Hymes's SPEAKING model) was both creatively altered for political ends and amenable to multiple interpretations. Putting girls on a public stage constituted a display of political commitment to democracy for the young men; for the girls, in contrast, their appearance on stage was a highly controversial and far more ambivalent deviation from the social norms of female performance. Beyond gender considerations, this performance clearly reoriented what was typically framed as a purely local event to wider ethnolinguistic and subnational concerns. Yet embedding this political orientation into the already sanctioned frame of the wedding entailed less risk (and ensured greater audience) than mounting a stand-alone political event might have done.

In sum, the study of performance provides a point of entry for research into social life as it is constituted, critiqued, and transformed through communicative practices. It highlights the emergent, creative, and transformative nature of language use in a sociocultural context. Finally, performance offers a compelling vantage point on the mutually constitutive relationship between seemingly microlevel practices and wider processes, ideologies, and political formations.

– Jane E. Goodman

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PERFORMATIVE AND CONSTATIVE

The distinction between performative and constative utterances was first introduced by J. L. Austin, and is illustrative of a reaction within language philosophy to the doctrine of **LOGICAL POSITIVISM**: This paradigm holds that **SENTENCE MEANING** can be captured in terms of truth conditions (see TRUTH CONDITIONAL SEMANTICS) and logical relations, and that sentences that cannot be thus verified are essentially meaningless. In contrast, **ORDINARY LANGUAGE PHILOSOPHY**, as conceived by philosophers such as J. L. Austin, Peter Strawson, and H. P. Grice (see COOPERATIVE PRINCIPLE), examines language in use, and thus lies at the basis of the development of modern **PRAGMATICS**. Austin observes that there are utterances, such as *I (hereby) bequeath my watch to my brother*, for which any evaluation in terms of truth and falsity is irrelevant; this type of utterance he labeled (at least at the outset) performatives, or utterances that perform an action, as opposed to constatives, which describe a state of affairs.

The seminal source for this distinction is Austin (1962), published posthumously as a written record of lectures delivered in 1955 (and based on earlier, largely unpublished ideas). This is important for two reasons. First of all, much of Austin's thinking is actually contemporary with (though probably largely uninfluenced by) Ludwig Wittgenstein's ideas on **LANGUAGE-GAMES**. Secondly, the 1962 monograph records an evolution in Austin's thinking, in which he starts from a distinction between two utterance classes and ends up drawing the conclusion that this distinction is untenable and that all utterances "perform." In order to understand this major shift, it is necessary to trace the evolution in his model in some detail.

Constatives are defined as utterances that have truth conditions, the prototype case being desciptions of states of affairs (e.g., *The sun comes up in the East*). In contrast, Austin's original performatives do not have truth conditions, in that they do not commit the speaker's beliefs to the **PROPOSITION** expressed. Utterances such as *I hereby baptize this child John Doe* "do things": They perform actions, in that they change reality from one in which a child named *John Doe* does not exist to one in which such a child does exist. Performatives do not have truth conditions but, rather, **FELICITY CONDITIONS**; that is, they are only performed successfully (or happily, to use Austin's term) in specific circumstances. For instance, baptizing is only performed happily if the speaker has the proper authority to perform the procedure (e.g., a priest), if the procedure is carried out correctly and completely (using the appropriate verbal format), and if the parties involved carry out any necessary subsequent conduct.

The question arises whether performatives and constatives have any formal identifying features, such as grammatical or lexical devices, that provide cues for the hearer about their pragmatic status. Austin originally thought that so-called performative verbs might be a good candidate; in an utterance like *I (hereby) promise I'll finish the essay on time*, the matrix verb *promise* marks the performance of the action of promising. Constatives appear to lack such a marker. Since performative verbs are easily identified (they are first person present **TENSE** indicative, they collocate with *hereby*, etc), they may function as powerful cues and can be said (following Searle 1969) to function as **ILLOCUTIONARY FORCE** indicating devices (or IFIDs).

The assumption that performatives must have performative verbs proves untenable, however. A slightly variant formulation of the aforementioned promise, such as *I'll finish the essay on time*, is functionally very similar, if not identical, to the version with *promise*. The problem is that the second version does not contain a performative verb; therefore, if one assumes that both versions perform the same action, it must necessarily follow that performative utterances do not need to have explicit performative verbs. This leads Austin to posit a distinction between explicit and implicit performatives (or, as he called them, primary performatives).

We have now lost any kind of formal marking of performatives since both constatives and implicit performatives lack overt performative verbs. In fact, once one posits the existence of implicit performatives, the possibility is raised that a constative such as *The sun rises in the East* is, in fact, an implicit version of the more

explicit *I (hereby) state that the sun rises in the East* (since *state* here has all the characteristics of a performative verb). What is more, one could claim that statements also have felicity conditions in the sense that they are only uttered happily if the speaker is reasonably sure about the truth of the proposition expressed. Conversely, many performatives need to bear some relation to actual facts and, thus, have at least some propositional content. The question thus arises whether constatives are similar to performatives in that they also "perform" an action. Austin admits that they do, namely, the action of committing the speaker to the truth of the propososition: "Once we realize that what we have to study is not the sentence but the issuing of an utterance in a speech situation, there can hardly be any longer a possibility of not seeing that stating is performing an act" (Austin 1962, 139). The performative–constative distinction thus becomes untenable, and one can only conclude that *all* utterances are actions. Austin's original two utterance classes are then merely subclasses of "acts performed through language," or **SPEECH-ACTS**, which consist of three distinct types of act: locution, illocution, and **PERLOCUTION**.

The locutionary act can be more or less equated to the semantic meaning of the utterance and is "roughly equivalent to uttering a certain sentence with a certain sense and reference" (Austin 1962, 109). Illocutionary acts are "utterances which have a certain (conventional) force" (1962, 109), such as baptizing, promising, and all of Austin's original performatives, but also former constatives such as informing and stating. Perlocutionary acts, finally, are "what we bring about or achieve by saying something" (1962, 109), that is, the consequences that utterances trigger (which may, but need not be verbal), such as convincing, deterring, or frightening. In short, all utterances perform three different acts: the act *of* saying something (locution), what the speaker's intention is *in* saying something (illocution), and what its consequences are *by* saying something (perlocution). In much of the subsequent literature, the term *speech-act* has become virtually synonymous with the illocutionary force of the utterance, but it is important to stress that, for Austin, performing a speech-act involves performing all three kinds of act simultaneously.

Since all utterances are now considered to be performative speech-acts, the question is raised as to how many different classes of speech-acts can be distinguished on linguistic grounds. Out of the three acts involved, locution does not provide any useful distinguishing criteria since the same propositional content can be employed for creating various speech-acts; neither does perlocution since the perlocutionary effect of a speech-act is difficult to predict. However, utterances do differ systematically with regard to their illocutionary force and, thus, presumably have different felicity conditions. It should, therefore, be possible to develop a new taxonomy of illocutionary acts based on these felicity conditions or the linguistic realizations thereof.

Austin did, in fact, develop a rudimentary taxonomy, but it was left to his pupil J. R. Searle to come up with a more systematic classification (see Searle 1979). Searle distinguishes five major classes of illocutionary act:

(i) Representatives (e.g., stating, describing, concluding), which commit the speaker to the truth of the expressed proposition;

(ii) Directives (e.g., requests, suggestions, commands), which consist of attempts by the speaker to get the hearer to do something;

(iii) Commissives (e.g., promising, threatening, offering), which commit the speaker to some future course of action;

(iv) Expressives (e.g., apologizing, congratulating, thanking), which express a psychological state;

(v) Declarations (e.g., declaring war, baptizing, chistening), which effect immediate changes in some institutional state of affairs, typically relying on elaborate extralinguistic institutions.

This classification, despite having been hugely influential, raises some serious problems. First of all, some speech-acts seem to belong to more than one category: A complaint such as *I'm upset that you forgot to put the trash out* presumably expresses the speaker's psychological state (expressive) but might also be interpreted as an attempt to get the hearer to take the trash out (directive). Secondly, illocutionary acts reflect the **COMMUNICATIVE INTENTION** of the speaker, who hopes that this intention will be recognized and interpreted accurately by the hearer. Again, this raises the question as to *how* hearers are able to do so. Searle's answer is the *performative hypothesis*, whereby every utterance U has an underlying format of the form *I (hereby) Vp you (that) U*, Vp representing the (explicit or implicit) performative verb. This still begs the question how hearers know that, for instance, *The door is standing wide open* is the implicit version of *I apologize for leaving the door open*, rather than of *I am complaining that you left the door open* (or, for that matter, an indirect version of the request *Could you close the door?*) The three traditional sentence types (declarative, interrogative, imperative) potentially offer some help by functioning as IFIDs, as may some lexical reflexes associated with certain illocutionary acts (e.g., *please* appears to co-occur exclusively with directives). However, the fact remains that most speech-act realizations contain neither a performative verb nor any other IFID. Such utterances, which exhibit no overt structural marking of their speech-act status (as in *The door is standing wide open* when intended as a request), Searle labels *indirect speech-acts*. However, since most usages of speech-acts appear to be indirect rather than direct, it remains unexplained how hearers are capable of computing the speaker's intended illocutionary force in the absence of structural signals. A possible explanation is that people rely on contextual cues, working out the implicit meaning by relying on Grice's cooperative principle through **CONVERSATIONAL IMPLICATURES**.

The fact remains that Searle's classification offers little help in assigning speech-act status to stretches of verbal interaction in ethnographic data. Ultimately, it could be argued, the interpretation of an utterance will depend on the *speech event* in which it occurs, that is, the "culturally recognized social activity in which language plays a specific, and often rather specialized, role" (Levinson 1983, 279). In classroom interactions, for instance, teacher questions regularly violate Searle's sincerity conditions since the speaker already knows the answer and is thus not sincere in trying to obtain a missing piece of information.

A radically different approach to the interpretation problem (i.e., how the speaker's communicative intention is recognized in the absence of linguistic cues) is offered by the

ethnomethodological paradigm of **CONVERSATION ANALYSIS**. Consider the following exchange:

S: Another glass of wine would hit the spot.
H: I don't think so mate, you've had enough.

S's utterance, despite being a declarative, is clearly not interpreted as simply stating a fact by H; rather, H's response (a refusal to comply) shows that it was interpreted as a request for another glass of wine. The basis for interpretation here lies in the conversational sequencing of the two contributions: They are conditionally reliant upon each other, by virtue of being two parts of a request-refusal **ADJACENCY PAIR**. The question as to the intended illocutionary force of S's turn becomes moot in this approach; what matters is that H has clearly interpreted it as request-like, having provided an appropriate second part to the adjacency pair. Of course, H might provide an incorrect interpretation, but if this is the case, it will become appararent in the subsequent interaction. Such an inductive approach avoids some of the pitfalls inherent in attempts to classify speech-acts according to the nonobservable, and therefore unfalsifiable, intentions of the speaker.

– Ronald Geluykens

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PERISYLVIAN CORTEX

Beginning in the late nineteenth century, the application of deficit-lesion correlations based on autopsy material to the problem of the regional specialization of the brain for language yielded the fact that human language requires parts of the association cortex in the lateral portion of one cerebral hemisphere (Broca 1861; Wernicke [1874] 1969), usually the left in right-handed individuals (Broca 1865). This cortex surrounds the sylvian fissure and runs from the pars triangularis and opercularis of the inferior frontal gyrus (Brodman's areas [BA] 45, 44: Broca's area), through the angular and supramarginal gyri (BA 39 and 40) into the superior temporal gyrus (BA 22: Wernicke's area) in the dominant hemisphere (Figure 1).

Classical Clinical Models of the Functional Neuroanatomy of Perisylvian Cortex for Language

The first theories of the functional neuroanatomy of language pertained to this cortical region. The pioneers of aphasiology – Paul Broca, Karl Wernicke, John Hughlings Jackson, and other neurologists – described patients with lesions in the left inferior **FRONTAL LOBE** whose speech was hesitant and poorly articulated, and other patients with lesions more posteriorly, in the superior **TEMPORAL LOBE**, who had disturbances of comprehension and fluent speech with sound and word substitutions (see APHASIA). These correlations led to the theory that language comprehension went on in unimodal auditory association cortex (**WERNICKE'S AREA**, BA 22) adjacent to the primary auditory cortex (Heschl's gyrus, BA 41), and motor speech planning went on in unimodal motor association cortex in **BROCA'S AREA** (BA 44 and 45) adjacent to the primary motor cortex (BA 4). These theories incorporated the only principle that has ever been articulated regarding the localization of a language operation. According to this principle, language operations are localized in relation to their sensory-motor requirements. Speech planning goes on in Broca's area because Broca's is immediately adjacent to the motor area responsible for movement of the articulators, and Wernicke's area is involved in comprehension because it is immediately adjacent to the primary auditory cortex. These ideas and models were extended by Norman Geschwind and his colleagues in the 1960s and 1970s. Geschwind (1965) added the hypothesis that **WORD MEANING** was localized in the inferior **PARIETAL LOBE** (BA 39 and 40) because word meanings consist of associations between sounds and properties of objects, and the inferior parietal lobe is an area of multimodal association cortex to which fibers from unimodal association cortex related to audition, vision, and somasthesis project.

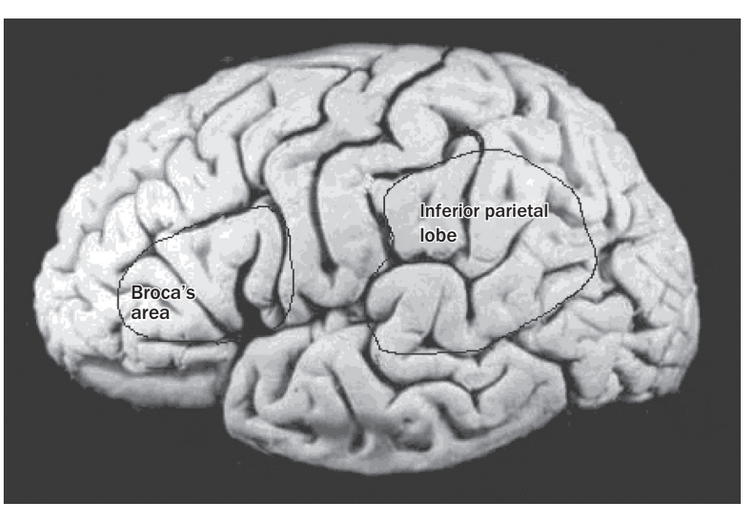

Figure 1. A depiction of the left hemisphere of the brain showing the main language areas.

Despite its widespread clinical use, however, this model has serious limitations. It deals only with words, not other levels of the language code. From a linguistic and **PSYCHOLINGUISTIC** point of view, the syndromes are all composed of many processing deficits, which are different in different patients. The syndromes themselves do not provide a guide to the localization of more specific components of the language processing system. As reviewed in the following, Geschwind's critical contribution regarding the role of the parietal lobe receives no empirical support.

Linguistically Oriented Models of the Functional Neuroanatomy of the Perisylvian Cortex for Language

Since approximately 1975, psychologists and linguists have approached language disorders and their neural basis in a more systematic fashion, informed by models of language structure and function. I briefly review two areas of work that relate these models to the functional neuroanatomy of the persiylvian cortex and other brain regions.

LEXICAL SEMANTIC PROCESSING. As noted, traditional neurological models of the neural basis for word meaning maintained that the meanings of words consist of sets of neural correlates of the physical properties that are associated with a heard word (Wernicke [1874] 1969), all converging in the inferior parietal lobe (Geschwind 1965). It is now known that most lesions in the inferior parietal lobe do not affect word meaning (Hart and Gordon 1990), and functional **NEUROIMAGING** studies designed to activate word meanings do not tend to activate this region (see the following). A. Damasio (1989), therefore, modified this model, suggesting that the meanings of words included "retroactivation" of neural patterns in unimodal association primary sensory cortex. Evidence for this comes from functional neuroimaging results that reveal activation for different classes of words in different areas, each related to the sensory-motor associations of the word (frontal cortex for verbs and manipulable objects; inferior temporal cortex for concrete nouns) (see Caramazza and Mahon 2006, for review). However, it is not clear that these activations reflect the meaning of words, rather than properties commonly associated with words. Word meanings include much more than sensory and motor associations; the essence of word meaning is itself quite mysterious (Fodor 1998). In any event, word meanings are part of a network that relates a word to a complex set of concepts and contexts (Tulving 1972).

There is evidence that a critical part of this semantic network is located outside the perisylvian cortex, in the anterior inferior temporal lobes. Patients with semantic dementia, a degenerative disease that affects the anterior inferior temporal lobe, and herpes encephalitis, with somewhat more posterior lesions, have initially selective and ongoing major problems with many aspects of **SEMANTIC MEMORY** (Davies et al. 2005; Gorno-Tempini et al. 2004; Warrington and Shallice 1984). Activation studies have implicated the inferior temporal cortex in representing concepts and word meanings (Caramazza and Mahon 2006). Some studies of the neural generators for the N400 event-related potential (ERP) wave, which reflects some aspect of semantic processing (Kutas and Hillyard 1980; Holcomb and Neville 1990), present evidence that this wave originates in the inferior temporal lobe (Nobre and McCarthy 1995), though perhaps more posteriorly than the lesion studies would suggest. Other brain areas that have been suggested as loci for semantic processing (the inferior frontal lobe: Petersen et al. 1988; Dapretto and Bookheimer 1999) are much less clearly related to this function.

In the past two decades, studies of impairments of word meaning and functional neuroimaging have suggested a finer-grained set of distinctions within the class of objects. Both deficits and functional activation studies have suggested that there are unique neural loci for the representation of categories such as tools (frontal association cortex), animals and foods (lateral inferior temporal lobe), and faces (medial inferior temporal lobe) (see Caramazza and Mahon 2006, for review). Debate continues as to whether such divisions and localizations reflect different co-occurrences of properties of objects within these classes or innate, neurally localized human capacities to divide the world along these lines.

SYNTACTIC PROCESSING. Most researchers also subscribe to localizationist views regarding aspects of syntactic processing. A well-known hypothesis is the *trace deletion hypothesis* (Grodzinsky 2000), which claims that patients with lesions in Broca's area have deficits affecting certain moved constituents (**TRACES** in Chomsky's theory). The evidence supporting these models is based on correlating deficits in syntactic comprehension to lesions. However, there are two issues that such data must face. First, it is often not clear whether a patient has a deficit in a particular **PARSING** operation or a reduction in the resources available to accomplish syntactically-based comprehension. Second, there is virtually no consistency in an individual patient's performance across tasks, raising questions about whether a patient who fails on a particular structure has a parsing deficit (Caplan, DeDe, and Michaud 2006 and Caplan, Waters, Dede, et al. 2007).

Assuming that patients' performances reflect deficits in particular parsing operations, the relation of these deficits to lesions does not support invariant localization models. We have recently reported the most detailed study of patients with lesions whose syntactic comprehension has been assessed (Caplan, Waters, Kennedy, et al. 2007). Lesion size in multiple, cytoarchitectonically different small areas of cortex both within and outside the perisylvian and non-perisylvian area, not connected by major fiber tracts, predicted performance, ruling out invariant localization as the mode of neural organization for the operations supporting this function that were assessed. At the same time, patients who performed at similar levels behaviorally had lesions of very different sizes in larger areas of the brain (such as the perisylvian association cortex, or the entire **LEFT HEMISPHERIC** cortex) in which it has been suggested that syntactic processing might be distributed, and patients with equivalent lesion sizes in these larger areas varied greatly in their level of performance, arguing that syntactic processing in comprehension is not distributed in these areas. The data are consistent with a model in which the neural tissue that is responsible for the operations underlying sentence comprehension and syntactic processing is localized in different neural regions in different individuals.

Functional neuroimaging studies have been said to provide evidence for the localization of specific parsing and interpretive operations in Broca's area (Ben-Shachar et al. 2003; Ben-Shachar, Palti, and Grodzinsky 2004; Bornkessel, Fiebach, and Friederici 2005; Fiebach, Schlesewsky, and Lohmann 2005). However, most neuroimaging studies actually show multiple cortical areas of activation in tasks that involve syntactic processing, and different areas have been activated in different tasks. Overall, these data also suggest variation in the localization of the areas that are sufficient to support syntactic processing within the language area across the adult population, although invariant localization models are not ruled out (Caplan, Chen, and Waters 2008).

Overview

The left perisylvian association cortex appears to be the most important brain region supporting human language. However, it is not the sole area involved in these abilities. How this area and other brain regions act to support particular language operations is not yet understood. There is evidence for both localization of some functions in subparts of this region and other brain areas, and for either multifocal or distributed involvement of brain areas in other language functions. It may be that some higher-level principles are operative in this domain. For instance, content-addressable activation and associative operations such as those that underlie **PHONEME** recognition, lexical access, and **LEXICAL SEMANTIC** activation, may be invariantly localized, while combinatorial computational operations such as those that constitute the **SYNTAX** of natural language may not be. However, many aspects of these topics remain to be studied with tools of modern cognitive neuroscience.

– David Caplan

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PERLOCUTION

In **PRAGMATICS**, perlocution refers to the effect **SPEECH-ACTS** have on the hearer (H). J. L. Austin (1962) distinguishes three types of act that utterances perform simultaneously: locution (roughly equivalent to the "meaning" in a propositional sense), illocution (the intended force of the speech-act), and perlocution. Austin characterizes perlocution as follows: "Saying something will often, or even normally, produce certain consequential effects upon the feelings, thoughts, or actions or actions of the audience, or of the speaker, or of other persons: and it may be done with the design, intention, or purpose of producing them" (1962, 101). H's reaction to an illocutionary act might be verbal (e.g., asking a question might prompt an answer), or nonverbal

(e.g., an insult may result in a slap in the face), but also an internal psychological or emotional state (e.g., a threat might result in H being frightened or angry).

Although Austin intended perlocution to be an integral part of a speech-act, later developments of speech-act theory have focused almost exclusively on illocution, that is, the speaker's mental state or intention (e.g., Searle 1969). As a result, the term *speech-act* has become virtually synonomous with **ILLOCUTIONARY FORCE**. This is perhaps unsurprising, given that perlocutions do not always consist of observable behavior (and might therefore be argued to fall outside a linguistic theory of pragmatics; but see Gu 1993). Moreover, perlocutions are hard to classify: Not only do certain illocutions allow for a range of possible perlocutions (a request, for instance, may result in either compliance or rejection by the hearer); there is often no way of knowing whether the achieved perlocution is actually the one the speaker (S) intended to achieve (a warning, say, may be intended to make the hearer {H} take evasive action but may only result in frightening him/her). Nevertheless, it is easy to demonstrate that perlocutions are intrinsic parts of speech-acts since their successful performance often depends on them. As Austin points out, an utterance such as *I bet you 10 dollars the Knicks will win by 5 points* is felicitous only if it receives *uptake*, that is, if H acknowledges and accepts the bet (see FELICITY CONDITIONS).

CONVERSATION ANALYSIS (Sacks 1992) offers a potential alternative, inductive approach to (verbal) perlocutions based on local sequential organization. Consider the following exchange:

S: Have a cookie

H: ehm no thanks I've just had dinner

In this exchange, S's contribution can be labeled an offer by virtue of its being the first part of an offer-refusal (or offer-acceptance) **ADJACENCY PAIR**. If H recognizes S's utterance as such, he/she will have to provide a sequentially appropriate response (or perlocution). The second part is thus conditionally reliant on the first part.

– Ronald Geluykens

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PERSON

Person is a morphosyntactic property of nominal phrases (nouns and pronouns) used to indicate the discourse role of their referent. English personal pronouns show three person distinctions: first person, indicating speakers (*I*, *we*); second person, indicating addressees (*you*); and third person, indicating discourse nonparticipants (*he*, *she*, *it*, *they*). Some languages also distinguish inclusive and exclusive *we*: Ojibwa has *kiinawint* for groups including speakers and addressees, and *niinawint* for groups including speakers but excluding addressees. Further divisions include an impersonal category and a sentient/nonsentient third person opposition. Like **NUMBER** and **GENDER MARKING**, person can also be indicated on agreeing elements, particularly finite verbs. Present tense English verbs show only third person singular agreement (*walk-s*), while **AGREEMENT** on Italian indicative verbs distinguishes three persons in both singular (*parl-o* "I speak," *parl-i* "you speak," *parl-a* "he/she/it speaks") and plural.

Linguistic phenomena related to person include **MORPHOLOGICAL** categories of pronouns and agreement; partial morphological syncretisms among person categories, in pronouns or agreement; interactions of person with the ordering of pronominal **CLITICS**; interactions of person with **CASE**, agreement, or structural position; and surprising restrictions on person combinations, usually involving direct and indirect objects (the **me lui* effect, or *person case constraint*). Such phenomena form the empirical basis of morphosyntactic theories of person.

There are three principal theoretical approaches to person. A traditional insight represents person categories within a hierarchy of nominals influencing pronoun morphosyntax, for example, case and agreement marking in transitive clauses (Dixon 1994, 85). Cross-linguistically, third person is the least marked, ranking below first and second. For example, in Georgian, first and second person objects are indexed by verbal morphology, while verbs with third person objects resemble intransitives. In Dyirbal, first and second person pronouns have nominative/accusative case marking, while third person pronouns, proper names, and common nouns show an ergative/absolutive opposition. Some scholars rank first person highest (Zwicky 1977), while others regard the ranking of first and second person as variable.

Another approach seeks to derive morphosyntactic effects by representing person as a complex category built from elemental features. One such **FEATURE ANALYSIS** locates person features such as [participant], [speaker], and [addressee] within a universal geometry of privative pronominal features, in which the availability of one feature may depend on the presence of another. An influential paper by Heidi Harley and Elizabeth Ritter (2002) outlines this approach. Another type of analysis treats person features as binary rather than privative; this allows the grammar to refer to negative values, such as [–speaker]. Robert Rolf Noyer (1992) makes a significant case for the binary-feature analysis.

A third approach, potentially compatible with the second, associates different persons with different syntactic representations (Ritter 1995; Déchaine and Wiltschko 2002; Bejar 2003).

Within the featural approach, most commentators assume the existence of features corresponding to first and second person. However, third person is widely treated as simply lacking such features (Zwicky 1977; Noyer 1992). This analysis correctly predicts certain limits on the **TYPOLOGY** of person categories (Greenberg 1966). As noted, some languages have separate categories for inclusive and exclusive *we*, whose use depends on whether addressees are included. Thus, [addressee] is a distinctive feature; inclusive ([speaker, addressee]) has it, while first person ([speaker]) does not. However, there is no parallel contrast between categories whose use depends on whether nonparticipants are included. For example, no known languages have

separate categories for inclusive and exclusive plural *you*, whose use depends on whether nonparticipants are included. Such observations imply that there is no third person feature, therefore no categories such as [speaker, addressee, nonparticipant], [speaker, nonparticipant], or [addressee, nonparticipant]. Third person pronouns thus refer to nonparticipants by default, lacking the features that allow reference to discourse participants. Nevertheless, some phenomena seem to require reference to nonparticipants, for example, syncretism in Mam pronominal enclitics (Noyer 1992) or the Spanish "spurious *se*" rule (Bonet 1991). An obvious solution is to permit limited reference to negative values, such as [–speaker, –addressee]. The success of the privative approach depends on identifying plausible alternative analyses for such cases.

Although the [speaker] and [addressee] features are sufficient to generate the four main person categories attested cross-linguistically, there is evidence for an additional [participant] feature, shared by first and second person (Farkas 1990; Noyer [1992] 1997; Halle 1997). For example, while Winnebago agreement distinguishes first and second person, free personal pronouns only distinguish participants from nonparticipants (*nee*, "I" or "you," "*ʔee*" "he/she").

The argument against a [nonparticipant] feature also applies to the [addressee] feature in languages without an inclusive category (McGinnis 2005). Such languages treat the inclusive as first person, not second (Zwicky 1977; Noyer 1992). Thus, in such languages, [addressee] is non-distinctive: There can only be an opposition between [speaker] and non[speaker] participants, not between [addressee] and non-[addressee] participants. If [nonparticipant] is nonexistent because it is never distinctive, then [addressee] is likewise nonexistent in languages without an inclusive category. This suggests that the morphosyntactic contrast between first and second person is sufficient to activate [speaker], while [addressee] can be activated only by an additional contrast between inclusive and first person. In such cases, [addressee] is indeed necessary to capture widespread (and non-default) syncretisms between inclusive and second person – most famously identified in Algonquian languages but common among languages with an inclusive category. For example, the inclusive pronoun in Ojibwa (*kiinawint*) shows syncretism with both second person (*kiin*, plural *kiinawaa*) and first (*niin*, plural *niinawint*), but not with third (*wiin*, plural *wiinawaa*).

– Martha McGinnis

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PHILOLOGY AND HERMENEUTICS

This entry briefly outlines some aspects of the study of linguistics leading up to the twentieth century. As two of the earliest, most thoroughgoing attempts in the West to understand written texts and spoken discourse, philology and hermeneutics represent vital precursors of today's language science. Still synonymous with classical studies and **HISTORICAL LINGUISTICS**, *philology* as both word and practice can be traced to ancient Greece and Rome. While it is likewise based on a Greek word and while the problem of interpretation engaged many ancient thinkers, *hermeneutics* is often narrowly associated with vigorous philosophical debates centered in late eighteenth-century Germany and originating in Reformation treatises on the right interpretation of scripture. Today, the heritage of philology and hermeneutics persists in the modern organization of university disciplines, as well as in many indispensable scholarly monuments, such as *The Oxford English Dictionary*.

Philology implies "love of language" and once stood for "linguistics." Hermeneutics can be defined more specifically as "the art (or science) of interpretation." The progress from amateur art to professional science marks the history of both. In their heydays, philology and hermeneutics were deemed central to all disciplines, whether scientific or humanistic; at other times, either discipline could also be reduced to trivial pedantry. Among their more prescient discoveries are Sir William Jones's hypothesis of a common "genetic" origin for the evolution of all Indo-European languages – nearly a century before Charles Darwin's *On the Origin of Species* – and the hermeneutic circle, the feedback-like cycle of interpretation formulated by Friedrich Ast almost 150 years before the birth of cybernetics.

The historical survey to follow highlights the respective origins, development, and interrelations of philology and hermeneutics – and is singularly appropriate, given the historical predilection of both fields. Because of the limitations of space, the focus remains on the European intellectual tradition. However, the theme emphasized here, that early investigations of language sometimes uncannily anticipated modern scientific paradigms, applies equally to non-Western traditions. In South Asia, for instance, the classical Sanskrit grammar of Panini (ca. sixth to fifth cent. B.C.) strongly prefigures **GENERATIVE GRAMMAR**.

Interest in the nature and origins of human language goes back to the earliest Western literature, such as the Tower of Babel in Genesis. There is also a fascinating folktale retold by Herodotus, in which an Egyptian pharaoh isolates two children from birth in order to see what language they will speak – presumably the

world's oldest. Nevertheless, although both *philology* and *hermeneutics* have Greek roots, neither was avowed as a primary concern of leading classical philosophers such as Plato and Aristotle. In classical Greek, the keyword *logos* signified "discourse" in many diverse senses, including "speech" (both "language" and "oration"), "argument" (a single "proposition" or an entire "line of reasoning"), "prose," "story," "history," "reason," and "thought." Eventually, *philologia*, like *philomatheia*, would imply "studiousness, love of learning" in general, since all learning at that time revolved around gaining written (and mathematical) literacy, but Socrates could be called a *philologos* in the more original sense of "fond of speaking" – he famously refused to write down his ideas. Plato, on the other hand, had fewer compunctions about writing. (In order to elevate written dialogue to full-blown dialectic, Plato may himself have coined *philosophia* "philosophy" as a more rigorous alternative.) The first classical figure to embrace the title *philologos* was Eratosthenes, the "second Plato," who was one of the librarians of Alexandria and a true philomath: He wrote on such diverse fields as geometry, history, philosophy, poetry, and literary criticism.

In the classical era, *hermeneia* "interpretation" (sometimes in the sense of "translation") was a secondary philosophical concern, recalling the subsidiary status of the messenger god Hermes (Roman Mercury). Today, readers of Aristotle's *On Interpretation* (probably not Aristotle's title) may be disappointed to find that this short treatise deals exclusively with the logic of propositions. Similarly, Plato's dialogue *Cratylus* is mired in a shortsighted attempt to show that the names of things may be both conventional and natural, as if individual letters could somehow coherently "imitate" reality. (Socrates' commitment to sound symbolism is satirized in Aristophanes' comedy *Clouds*.) Nevertheless, the ancient world made great strides in one particular area, namely, grammar (*grammatike*), which ranged from the teaching of literacy (including to non-native speakers), to scholarly description and cataloging of word forms, to literary and textual criticism, to more rarified philosophical concerns. Like *philology*, *grammar* could entail a very wide disciplinary spectrum. In addition to the question of whether language was a product of nature (*physis*) or convention (*nomos*), an equally central and ultimately more fruitful debate among grammarians revolved around whether language should be understood in terms of "analogy" or "anomaly": *Analogia* implied that language was ultimately patterned and governed by regularity, and *anomalia* that language was irreparably disorganized and marred by exceptions. To analogy can be traced the systematicity that still dominates language science (to say nothing of the legacy of prescriptivist "correctness" in language use), and anomaly can be thanked for introducing an honestly empirical dimension to linguistic studies.

In the century after Plato, Stoic philosophers elevated the study of language to a separate philosophical concern, but their treatises have largely been lost. Under the Ptolemies, the Hellenistic librarians of Alexandria refined and advanced all earlier knowledge of language in their quest to amass, catalog, and edit as many texts in as many fields of knowledge as possible. This included gathering descriptive word lists of various Greek dialects, as well as making detailed analyses of orthography, parts of speech (see WORD CLASSES), **MORPHOLOGY**, and verbal **TENSE** and **ASPECT**. All these advances were authoritatively compiled by Dionysius Thrax in his *Treatise on Grammar* (ca. 100 B.C.), which was so influential that it was often called simply *The Manual* (and thereby probably subject to extensive later revision by others). Some of this work, such as the eightfold division of parts of speech and the treatment of Greek nominal and verbal systems, still appears in twentieth-century textbooks. In Rome, the Greek grammatical heritage was appropriated by writers from Varro (*On the Latin Language*, first cent. B.C., only partially preserved) down to Priscian (fiftth to sixth cent. A.D.), whose exhaustive *Principles of Grammar* (ca. 500), fortuitously designed to assist the Greek speakers of the longer-lived eastern Roman empire, would become the ultimate authority for learning Latin throughout medieval Europe. Although (as is so often the case) much Latin grammatical theory slavishly followed Greek models, it was impossible to ignore obvious differences between the two languages (e.g., Latin's lack of an article, one past tense fewer, and one additional **CASE**).

Since the dominant unit of linguistic analysis of the time was the **WORD**, and less so the **SENTENCE**, the primary achievements of classical language science lay in its descriptive and pragmatic dimensions, particularly in linguistic pedagogy and the accurate preservation, understanding, and annotation of written texts. For instance, we have the Hellenistic era to thank for the invention of such scholarly staples as footnotes, commentaries, critical editions, dictionaries, encyclopedias, and library catalogs. On the other hand, investigations of **PHONETICS** and **SYNTAX**, though found in some early classical theorists, remained rudimentary. And sadly, despite the story of King Mithridates of Pontus (or Mithradates VI, 120–63 B.C.), who was fluent in all 22 languages of his subjects, there was almost no formal ethnographic study of the many other now-extinct languages of the Mediterranean region; non-Greek speakers were simply "barbarians" (*barbaroi,* "babblers"). Lexicographical work was driven by the need to translate Greek and Latin, as well as to comprehend archaic texts (e.g., Homer), and many word lists have been preserved as *hermeneumata* "translations" and lists of "glosses" ("glossaries," from *glossai,* "unfamiliar words"). Although prodigious effort from Socrates on was invested in etymology (the pursuit of a word's *etymon*, "truth"), this was almost a complete failure since ancient philologists did not yet grasp how important **PHONOLOGY** and rules of sound change are for tracing the historical roots of words. The results ranged from the fanciful to the ridiculous. Thus, Latin *lignum* "wood" hid potential *ignis* "fire"; *lepus* "hare" was "light-foot" (compounding *levis* + *pes*); and words could stem from their opposites: *bellum* "war" was so named for being not at all *bellum* "beautiful." Much of this dubious heritage was compiled by Isidore of Seville (sixth to seventh cent. A.D.), whose *Etymologiae* remained influential throughout the medieval period. Many such classical and medieval compilations remain secondarily valuable, however, because they often preserve the sole remaining fragments of hundreds of ancient texts.

As a time of consolidation and preservation of the Greco-Roman heritage, the Middle Ages made relatively few significant contributions to the study of language, as for many centuries the Latin culture of Europe lagged behind the Greek learning of the eastern Roman or Byzantine empire and the Arabic scholarship of Moorish Spain. Based on Varro's lost writings on the

disciplines, Martianus Capella's *Marriage of Philology and Mercury* (fifth cent. A.D.) formalized the division of the seven liberal arts (the lettered *trivium* of grammar, logic, and **RHETORIC**, and the numeric *quadrivium* of geometry, arithmetic, music, and astronomy), cementing the philological basis of Western education for more than a millennium. Capella personified philology as the "mother" of the liberal arts (from Latin *ars*, better translated today as "science"), and the first art was grammar, the learning of literacy through the close study and imitation of classic texts. The advent of Christianity did not entirely displace the pagan past, but instead brought new urgency to the problem of how to comprehend this legacy in the context of the new worldview. One result was the famous multileveled system of allegory, a hermeneutics that invited medieval thinkers to integrate three competing cultural systems: the Hebrew Bible and the Jewish religion; Greco-Roman mythology, literature, and history; and orthodox Latin Christianity. Also known as *typology*, allegorical interpretation was not limited to biblical texts but could be extended to read *types* ("emblems," "characters") everywhere in God's creation, including the natural world (the "second book" after the Bible).

Although it foreshadows modern linguistic procedures, medieval allegory now seems as empty as classical etymologizing. It is not overly unfair to the philology of the Latin Middle Ages to say that it is bracketed by its two greatest authors, its first and its last: Augustine and Dante. Certainly, there were important contributions to the understanding of language in between these landmarks, such as the brilliant attempt at orthographical reform via phonetic analysis by the so-called First Grammarian of twelfth-century Iceland, but it seems typical that this work was forgotten until the nineteenth century. And there were the scholastic authors of speculative grammars (often under the rubric of *modi significandi*, "the means of signifying") who began the ongoing search for universal principles in language. Yet long before, around the fifth-century fall of Rome, Augustine brilliantly anticipated modern **SEMIOTICS** in *On Christian Doctrine,* and he was the first ever to consider the problem of childhood language acquisition in the autobiographical *Confessions.* Augustine also helped Christianize Capella's seven pagan liberal arts. Meanwhile, the Latin language itself was undergoing change, and Augustine could no longer hear the vowel quantities that underlaid Virgil's poetic **METER**: the Romance languages were slowly differentiating across Europe. A millennium later, Dante (who also took the theory and practice of medieval allegory to new heights in his *Divine Comedy* and elsewhere) wrote a milestone work on language entitled *On the Eloquence of the Vernacular* (ca. 1305). Though necessarily and paradoxically written in Latin, this unfinished treatise argued for the propriety of using vernacular languages like Italian in literature, and is the earliest mapping of European languages based on differences that seem to have evolved over time. It was the first articulation of the problem of language change.

The fact that Johannes Gutenberg worked simultaneously on printing his famous Bible alongside an edition of the still-ubiquitous Latin grammar of Donatus (fourth cent. A.D.) reveals how the classical world still dominated the early Renaissance. Soon, the rediscovery and promulgation of less-digested ancient texts and ideas caused a surge in textual criticism and the study of languages. In 1440, Lorenzo Valla used historical-linguistic evidence to demonstrate that *The Donation of Constantine,* a lucrative grant to the church, was a forgery, thereby founding the forensic philology of *diplomatics*. The Renaissance humanists also revived the learning of Greek, along with Arabic and Hebrew (considered the original human language), and in the wake of Dante, various vernacular languages of Europe and even some languages of "foreign" lands received grammars of their own. The languages of the world began to be surveyed, and Joseph Justus Scaliger sharpened Dante's analysis of the language families of Europe (*Diatriba de Europaeorum Linguis*, 1599). Meanwhile, the fundamentals of human thought explored by René Descartes and John Locke also inspired such works as the Port-Royal *General and Rational Grammar* (1660) and utopian attempts at inventing universal communication systems, such as John Wilkins's *Essay towards a Real Character and a Philosophical Language* (1668). The Italian rhetorician Giambattista Vico argued for what he called *The New Science* (1725; revised 1744), an ambitious philological recreation of the history of human mental and cultural development via a succession of master tropes embodied in ancient language, laws, and other social institutions. In short, the Enlightenment brought a return to Eratosthenes' multidisciplinary philology: The famous French *Encyclopédie* of Denis Diderot and others (1751–2) cites *philologie* as a universal discipline bridging the sciences and the humanities.

The year 1768 is justly remembered as a watershed in the history of linguistics: It is the date of the famous paper of the legal scholar William Jones to the Royal Asiatic Society in Calcutta. Assigned as a colonial judge in the subcontinent, Jones had set about learning Sanskrit, the ancient language in which India's religious and legal texts are preserved, much as Latin had done for Europe. After only a few months of study, Jones's brilliant surmise was that certain obvious similarities among Sanskrit, Latin, Greek, and other European languages implied a common ancestor, which, crucially, might no longer survive. Such groupings had been noticed before, as by Dante and J. J. Scaliger, but had been explained by the mechanisms of borrowing or decay, rather than by the process of gradual and divergent evolution from a now-dead proto-language. The modern discipline of historical and comparative linguistics had been born, and the Enlightenment's passionate but effete search for language origins was given a fresh scientific direction: the problem of proto-linguistic reconstruction.

The year 1768 also marked the birth of Friedrich Schleiermacher, so influential in the field of hermeneutics. Since the Reformation, increasing philological concern had been brought to bear on the text of the Bible. Though a philological monument in its own right, Jerome's Latin Vulgate (trans. ca. 380–405) was no longer sufficient for the new commentaries and vernacular translations desired by the Reformers who knew the original Hebrew and Greek. This biblical hermeneutics would develop into the influential "higher criticism," one of the troubling scientific advances that precipitated the Victorian "crisis of faith." Higher criticism described scripture not as an inspired and inerrant document but as a layered tissue of competing sources that had been edited together at some intermediate time. Stemming from the patterns of stylistic differences in biblical accounts (e.g., the varying names for "God") first noticed

by Reformation commentators, the *documentary hypothesis* suggests that the canonical five books of Moses (the Pentateuch) are carefully patched together from a number of distinct source texts.

Just as Dante had thought fit to apply sacred allegory to his own secular literary production, so did Enlightenment students of the Bible acknowledge that no special method of interpretation should be required for the word of God. As hermeneutic theorist Johann August Ernesti put it in 1761, "the verbal sense of Scripture must be determined in the same way in which we ascertain that of other books" (quoted in Palmer 1969, 38). The parallel development of secular higher criticism was also underway. In his *Introduction to the Correct Interpretation of Reasonable Discourses and Books* (1742), Johann Martin Chladensius became the first hermeneuticist to argue for the importance of "point of view" (*Sehe-Punckt*) in interpreting historical texts. Similarly, the classical scholar Friedrich August Wolff, who famously insisted on taking his doctoral degree in philology, rather than philosophy, published his *Prolegomena to Homer* (1795), which asked the still-vexed "Homeric question": Was there really a single author behind the *Iliad* and *Odyssey*? The concept of the linguistic family tree of William Jones also found application in secular textual editing, as Karl Lachmann (1793–1851) perfected the method of "stemmatics" to posit nonextant *archetypes* from which various groups of manuscripts descended and thus to help eliminate a text's accumulated errors.

While Wolff and others developed *Altertumswissenschaft* ("classical scholarship") and biblical critics analyzed scripture, Schleiermacher, who himself published on both classical and biblical philology, elevated hermeneutics to a general practice that would ultimately bring it far away from traditional philological concerns. (The primary source for Schleiermacher's general hermeneutics are detailed outlines he prepared for his university lectures, notes partly published in 1819). Hermeneutics followed this philosophical direction throughout the nineteenth century; Wilhelm Dilthey, for example, located hermeneutics as the supporting discipline for the university's *Geisteswissenshaften* ("human sciences," literally "sciences of the spirit"). Following the phenomenology of Edmund Husserl, the hermeneutic project was furthered by Martin Heidegger and has continued down to the present in a debate between Hans-Georg Gadamer and Jürgen Habermas, with wider theoretical ripples still being felt in the French and Anglo-American discourses of modernism and postmodernism. General hermeneutics grew to be concerned not only with interpretation per se but also with the very nature of understanding, being, and reality itself. Today, hermeneutics has grown more at home with the purer varieties of literary theory and aesthetics than with traditional philology's "lower criticism."

Philology became an increasingly technical mode of historical linguistics during the nineteenth century. Comparative philologists such as Rasmus Rask, Jacob Grimm, and Franz Bopp assembled exhaustive phonological and morphological data on modern and ancient global languages in order to trace their development and interrelationships (sometimes with a troublingly Orientalist attitude; see Boeckh [1886] 1968, 10, 44). Eventually, philology's scientific hypertrophy drove the foundation of separate humanistic departments devoted to texts as "literature." Another great paradigm split was marked by the publication of the one-time philologist Ferdinand de Saussure's *Course in General Linguistics* (1916). Perhaps a victim of its own success, diachronic philology, which so carefully traced the evolution of *parole,* eventually yielded its disciplinary headship of language study to Saussure's synchronic *langue* (see SYNCHRONY AND DIACHONRY and STRUCTURALISM).

Presently partitioned among various university disciplines, philology and hermeneutics still govern the fields of medieval and classical studies, historical linguistics, literary theory and criticism, textual editing, lexicography, prosody and metrics, and many others (see Cerquiglini [1989] 1999; Gumbrecht 2003). Today, though the "normal science" of language emphasizes such synchronic contexts as society, psychology, and the brain, there is little doubt that philology and hermeneutics will persist and reappear, like Hermes and Mercury, in many new guises in the future.

– Christopher M. Kuipers

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PHONEME

The phoneme is the smallest unit of speech that discriminates one **WORD** from another in a particular language. Phonemes are represented by symbols between slashes – thus /p/ or /b/. Phonemes may have alternate forms, called allophones. For example, in English, the same phoneme /p/ is produced differently in ***p****it* and *s****p****it*. Minimal pairs are used to determine whether two speech sounds are allophones or separate phonemes. For example, in English, the phonemes /p/ and /b/ distinguish the word ***p****ull* from ***b****ull*, and /t/ and /d/ distinguish the word *ba****t*** from *ba****d***.

– Miwako Hisagi

PHONETICS

What Is Phonetics?

Phonetics is the area of language science research that studies the articulation, acoustic properties, and auditory perception of

speech units (see SPEECH PRODUCTION, ACOUSTIC PHONETICS, ARTICULATORY PHONETICS, and SPEECH PERCEPTION, respectively). More specifically, phonetics can be understood as linguistically informed speech science, and research phoneticians are generally trained linguists who bring to bear their knowledge of the structural properties of language. Rather than focusing only on one particular language or on universal anatomical properties of hearing or articulation, a phonetician has a special interest in understanding the full range of distinct possibilities in human speech or signed communication. Because of the important role that linguistics plays in phonetic study, most often phonetics finds itself housed academically as a linguistic discipline, though sometimes it finds its home in engineering, psychology, or in a language-specific setting. The most prominent textbook used in educating phoneticians is P. Ladefoged's *A Course in Phonetics* (2006), now in its fifth edition.

Within linguistics, phonetics is related to the field of **PHONOLOGY**, another area of theoretical linguistic research. Linguists vary in their opinions regarding the degree of distinctness and areas of overlap between the phenomena considered to be the objects of phonetic versus phonological research. Both are concerned with the component speech units or building blocks into which **WORDS** can be divided. However, the general view is that phonetics investigates measurable, physical properties of these speech units, such as the precise articulation of speech units, their detailed and contextually dependent acoustic properties, and cross-linguistic variation in these physical properties. Phonology, in contrast, is generally concerned with how these speech units are combined or organized into acceptable word forms within a language (e.g., allowable sequences) and with the underlying principles of organization shared across languages (see PHONOLOGY, UNIVERSALS OF). On analogy to chemistry, phonetics investigates subatomic structure, and phonology studies the formation of molecules out of basic atoms. Traditionally, the phonological structure has been viewed as cognitive or grammatical, while the phonetic structure has been viewed as purely physical and implementational. However, the dividing line between cognitive and physical has blurred or dissolved over the years (e.g., Browman and Goldstein 1995).

Well-Known Theoretical Puzzles in Phonetics

There are a number of well-known puzzles in the area of phonetics whose empirical and theoretical consideration has helped lead to our current understanding of some fundamental aspects of the linguistic speech system. As one example, phoneticians have an abiding interest in understanding how to reconcile a linguistic view of speech as being composed of concatenated symbolic units with its physical realization in articulation and acoustics in which there are no silences, separations, or obvious criteria for segmentation between these units. We can refer to this puzzle as *lack of segmentability*. It is famously acknowledged in Charles Francis Hockett's (1955) *Easter egg* analogy, which describes the phonetic speech production processes as making a smeared mess out of neat Easter eggs moving through a wringer. Gradually, however, the field has come to understand that rather than a "mess," the speech produced by humans is governed by lawful, albeit complex, physical properties. A second puzzle that has been much discussed in phonetic research is the puzzle of *lack of invariance*. This refers to the difficulty of reconciling the linguists' view that language calls on a small fixed set of phonological (or contrastive) units in organizing its words with the observation that there are no invariant properties of these units in the speech signal. Indeed, experiments using **SINEWAVE SYNTHESIS** have shown that even signals completely lacking normal speech cues can nevertheless be perceived as speech and understood. One, but not the only, source of lack of segmentability and lack of invariance is the phenomenon of coarticulation. This refers to the fact that neighboring speech sounds are, in fact, articulatorily coproduced in time and thus interact with one another and mutually shape the speech signal. Consequently, phonological units in natural speech are realized in a highly variable, context-dependent fashion.

Speech perception research in both children and adults probes, in part, how human listeners are able to recover phonological units from the speech signal (see, e.g., SPEECH PERCEPTION IN INFANTS) and engage in lexical access (word identification; see WORD RECOGNITION, AUDITORY) (Pisoni and Remez 2005). This involves understanding how listeners deal with variability in phonetic form and how prior speech and language experience shapes these processes. Investigation of these puzzles has informed phoneticians' theoretical views regarding the fundamental nature of speech units.

Ways of Doing Phonetic Research

There are a number of areas of inquiry in the field of phonetics, and these generally fall under the purview of articulatory phonetics, acoustic phonetics, or speech perception. We encounter some issues related to each of these areas in the following, but first, it is worthwhile to consider the two general approaches to phonetic research. The first focuses on the description, classification, and transcription of speech sounds, the second on experimental phonetics.

Traditionally, the first approach was done by ear, thanks to the carefully trained abilities of phoneticians, often trained in a direct line of descent from one practitioner to another. The *International Phonetic Association* is a more than century-old organization whose aim is to promote the scientific study of phonetics and its practical applications. The association has provided, with regular updates over the years, a consensus International Phonetic Alphabet (referred to as the IPA, as is the association itself) that serves as a notational standard for the phonetic transcription of all sounds known to exist contrastively in the world's languages (and many noncontrastive variations of these sounds) (IPA 1999). The latest version of the IPA was published in 2005 and is displayed in Figure 1.

This transcription system is a standard reference in the field of phonetics and has been an important tool for description and classification. Phoneticians doing work of this sort must determine what the linguistically relevant speech categories are – that is, what counts as linguistically the same and different and what principled (or idiosyncratic) variation is observed among these speech units. As can be seen from the IPA chart, phoneticians have identified important dimensions of variation, in particular, for consonants:

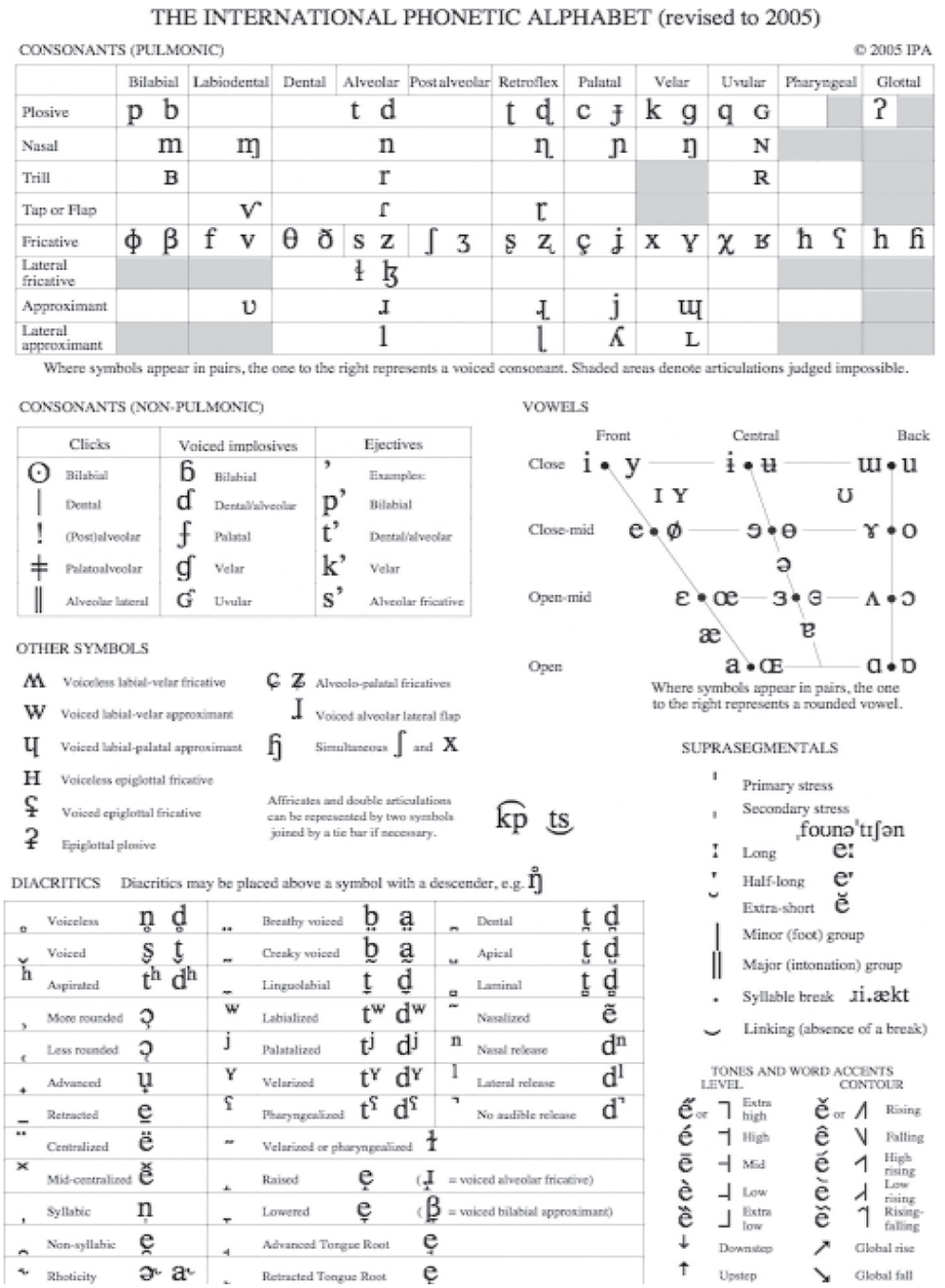

Figure 1. The IPA Chart. Reprinted with permission from the International Phonetic Association. Copyright 2005 by International Phonetic Association.

- *place* in the vocal tract at which a consonant is articulated or creates its constriction;
- *manner* of articulation, which refers generally to the type of constriction: complete closure for stops, narrow closure for fricatives, constrictions having nasal or lateral airflow; and
- *voicing*, whether the vocal folds are vibrating or not.

For vowels, the variations are captured in a continuous plane whose dimensions can be identified with auditory properties called:

- *height* [high-mid-low], related to the lowest resonant frequency (the first formant) of the vowel; and
- *backness* [front-central-back], related to the distance between the first and second resonant frequency (formants) of a vowel.
- *Rounding* or lip protrusion or compression is also encoded in the symbol choice itself.

In addition, in order to adequately describe speech units, the mechanism by which the air moves in the vocal tract must be

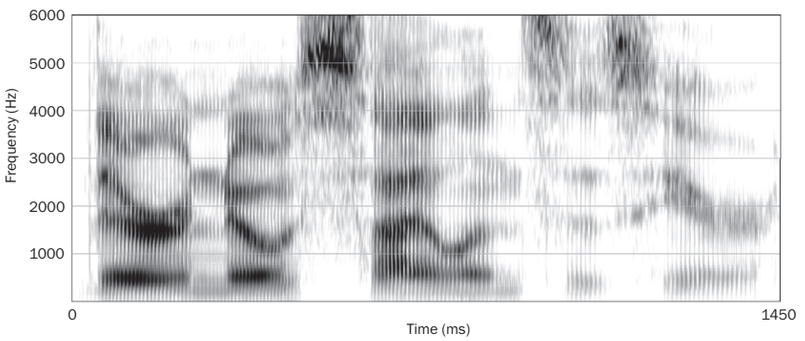

Figure 2. A spectrogram of the sentence "There are no silences here." In a spectrogram, time is displayed on the x-axis, frequency (in Hz) on the y-axis, and amplitude in grayscale darkness.

identified. All languages use pulmonic sounds with air flowing out from the lungs, but some languages also move air by laryngeal (*glottalic*) or tongue (*velaric*) maneuvers. Other important linguistic properties of speech units can include distinctions in the **TONE** (i.e., placement in and/or movement through the speaker's pitch range), phonation type (i.e., the mode or quality of vocal fold vibration and amount of laryngeal airflow), and VOT (*voice onset time:* the temporal coordination of an oral constriction with a laryngeal event).

Much of the most important phonetic work of this sort has been done in the field by phoneticians working with native speakers of languages (Ladefoged 2003), often languages that are poorly documented or possibly endangered. The most authoritative description of the consonants and vowels of the world's languages can be found in *The Sounds of the World's Languages* (Ladefoged and Maddieson 1996). In addition to describing the range of possible variation in the units used to build human speech, phoneticians also address the question of universal properties of human speech systems. Finally, descriptive phonetics can also address variation within a language, such as geographical **DIALECT** variation. This is one type of sociophonetics (other types include investigations of gender, age, or class, for example.) For English, an impressive example of this type of phonetic investigation can be found in the *Atlas of North American English* (Labov, Ash, and Boberg 2006).

Whereas descriptive phonetics was traditionally done by ear, a wide variety of current instrumental techniques is brought to bear as well. Instrumental phonetics might utilize acoustic analysis – such as digitized waveforms, and spectrograms (see Figure 2); pitch and formant tracking; articulatory analysis, such as provided by laryngoscopy, palatography, magnetometry, ultrasound, and MRI; and perceptual information – such as that provided by discrimination and categorization experiments and even eye-tracking and **NEUROIMAGING**.

Work on the other general type of phonetic research, experimental phonetics, also utilizes a wide variety of instrumental approaches, but in this case, the data characterize human behavior in the processes of producing and perceiving speech, or reflect quantitative rather than purely qualitative properties of speech. Experimental phonetics often investigates how linguistic variables, such as segmental context, **SYLLABLE** structure, or prosody, influence the detailed properties of speech, such as its timing, articulation, spectral characteristics, or **INTONATION.** Alternatively, it might examine how nonlinguistic variables, such as age, gender, speaking rate and style, affect, or language background, influence these detailed speech properties.

In experimental phonetics, the development of speech synthesis played a critical role in researchers' ability to design and execute speech perception experiments by allowing for stimuli with well-controlled acoustic properties. This ushered in a new era of experimental speech perception research that examines how humans utilize all of the myriad informational cues present in the acoustic signal. Another particular body of experimental work called *laboratory phonology* seeks to inform questions of linguistic representation and processes in phonology via experimental phonetic data. This work generally takes a cognitive science perspective and has been archived in the multivolume *Papers in Laboratory Phonology* collection (arising from a regular Conference on Laboratory Phonology, which has met every other year since 1987). Browman and Goldstein (1991) and Beckman and Edwards (1994) provide classic examples of this type of phonetics.

Other Areas of Phonetic Inquiry

Other important areas of inquiry in the field of phonetics include investigation of the biomechanics or functional behavior and coordination of the moving vocal tract (Saltzman and Munhall 1989; Guenther 1995), the role of audition and auditory processing in speech communication (e.g., **PSYCHOPHYSICS OF SPEECH**), and the vocal tract as a sound-producing device, often characterized in terms of *source-filter theory* (Stevens 1998; Fant 1960). Source-filter theory has provided a sophisticated mathematical understanding of how noise sources at the larynx and along the vocal tract are shaped by the geometry of the vocal tract and its particular resonance properties to yield the output speech. The nonlinear properties of the articulatory-acoustic mapping have been argued to be important in understanding constraints on the sound inventories of languages (Stevens 1989). Other phoneticians focus on listener-oriented motivations, such as maximizing auditory distinctions in shaping sound systems, rather than speaker-generated influences. Clearly, speech systems are adaptive to communicative and situational demands (Lindblom 1990). Speaker–listener interactions may give rise to change in word forms over time, that is, diachronically (see PHONOLOGY, EVOLUTION OF; SYNCRHONY AND DIACHRONY), and they may give rise to synchronic adjustments specific to the interlocutors and the situation.

Connections to Other Fields

Phonetics is an interdisciplinary area of linguistics; for example, we have sketched its connection to phonology. It also can closely tie into other areas of experimental linguistics, particularly **PSYCHOLINGUISTIC** research on spoken language production and processing and neurolinguistic research on brain function. Knowledge of the phonetic properties of languages and of the characteristics of the speech signal is critical to the design of experimental linguistic and neurolinguistic research programs that examine speech production and processing (see PHONETICS AND PHONOLOGY, NEUROBIOLOGY OF; BRAIN AND LANGUAGE). Such speech-related work might address lexical access, speech production planning, neural localization of various functions related to speaking and speech understanding (see LEXICAL PROCESSING, NEUROBIOLOGY OF), the integration of visuofacial and auditory information, and the relation of action and perception (see MIRROR SYSTEMS, IMITATION, AND LANGUAGE).

Furthermore, there are many fields outside of linguistics on which phonetics has a direct bearing. In the area of speech technology, linguistic phonetic knowledge can contribute – sometimes directly, sometimes indirectly – to machine speech synthesis and recognition (see VOICE INTERACTION DESIGN). And conversely, much early work in acoustic phonetics grew out of the efforts of speech engineers, for example, at Bell Laboratories, Haskins Laboratories, Massachusetts Institute of Technology, the Joint Speech Research Unit in England, the Speech Transmission Laboratory in Sweden, and the Advanced Telecommunications Research (ATR) Institute International in Japan. Currently, in the field of speech engineering, there is interest in capturing linguistic knowledge in ways that will allow better system performance with conversational interfaces and with audiovisual speech.

Phonetic science also has utility in forensics, and forensic phonetics is a recognized area of applied science (see FORENSIC LINGUISTICS). Forensic experts bring both instrumental and expert–listening techniques to the determination of whether a suspect's voice is a likely or unlikely match to forensic evidence that investigators have in hand. It should be noted, however, that there is no unique identifier in the voice of an individual that is analogous to a fingerprint. Phoneticians are frequently called on in such speaker-identification cases to provide expert knowledge and testimony as to the many subtle properties that may distinguish one individual's speech from that of another.

Another field outside of linguistics is often, in fact, an individual's first contact with phonetics – second language pedagogy (see BILINGUAL EDUCATION). An accurate understanding of how a language's speech sounds are articulated proves helpful in pronunciation instruction. Instrumental techniques for displaying feedback on articulation, speech acoustics, or linguistic categorization can also help in training production and perception of non-native linguistic contrasts.

The paramount area of the influence of theoretical phonology and phonetics on pedagogy is in the teaching of **READING** (see TEACHING READING). Linguists from diverse backgrounds and groups have taken a leadership position in emphasizing the importance of phonemic awareness (see PHONOLOGICAL AWARENESS) for the acquisition of reading skills and for understanding **DYSLEXIA**. It is critical for educational success that reading teachers are made aware of the importance of characteristic differences between speech and reading, of how speech knowledge can be leveraged in the teaching of reading, and of how interference from the phonetic properties of native languages can influence the acquisition of reading in non-native languages (Rayner et al. 2002).

A synergistic relationship exists between phonetics and the field of biomedical imaging. Advances in imaging of the vocal tract and larynx have greatly illuminated our understanding of speech production. In turn, new techniques for upper airway and laryngeal imaging and image analysis have been developed by phoneticians. These techniques can be incorporated into the field of clinical phonetics and speech pathology. Traditional types of descriptive and instrumental phonetics have also found utility in the understanding of clinical challenges such as apraxia, stuttering, phonological disorders, and voice disorders. Indeed, the National Institute of Deafness and Other Communication Disorders is one of the largest funding sources for phonetic research. Currently, there is enormous interest in making cochlear implants as successful as possible for their user populations. Knowledge of the acoustic properties of speech and of methods for assessing perception adds to the broad body of technological, engineering, and audiological knowledge currently contributing to this effort.

Phonetics is one of the foundational areas of linguistic research and language science. It focuses on the descriptive, quantitative, and behavioral aspects of speech production, transmission, and perception. Phonetic knowledge helps guide our understanding of the phonological representations and patterning observed in human language. Phonetics also makes interdisciplinary contact with speech technology, biomedical imaging, forensics, and pedagogical and clinical fields.

– Dani Byrd

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PHONETICS AND PHONOLOGY, NEUROBIOLOGY OF

The study of the neurobiology of **PHONETICS** and **PHONOLOGY** focuses on the **BRAIN** mechanisms that support perception and production of linguistic phonological forms. This entry describes the neural structures and processes underlying phonetic and phonological processing and briefly discusses four current theoretical controversies that neurophysiological data can help address. First, are there invariant relationships between **ACOUSTIC** properties and phonological categories? Second, does speech have some special status apart from other acoustic information? Third, is there a **CRITICAL PERIOD** for language-specific learning? Fourth, to what degree does biology constrain the nature of phonological systems?

Neurobiological Underpinnings

The physiology (or function) of phonological processing is described in terms of the structures (anatomy) activated in processing and the function of these structures. A comprehensive understanding of the physiology requires explication at the micro- and macrolevels of processing. The microlevel describes the microstructures and their processing (neuron, axon, synaptic potential) and are general to brain function, whereas the macrolevel focuses on larger-scale structures and processes specific to a particular motor, sensory, or cognitive process (e.g., phonetic processing). Several points concerning the microlevel are necessary for understanding how neurobiological methods are used to examine phonetics and phonology (see Kandel, Schwartz, and Jessell 2000; Shafer and Garrido-Nag, 2007, for greater detail).

First, brain function is in terms of electrochemical messages between neurons. **NEUROIMAGING** methods index different aspects of these processes and the metabolic processes that support these. Electrophysiological methods (electroencephalogram [EEG], magnetoencephalogram [MEG]) record changes in electrical potential at the scalp. These changes are the result of the synchronous firing of large assemblies of neurons. Functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) measure changes in the metabolism of oxygen, and PET can also measure changes in the chemical aspect of the electrochemical signals sent between neurons. These changes in electrochemical and metabolic measures are used to make inferences about timing and localization of neural activity related to some stimulus or event.

A second point is that different brain regions have distinctive structure in terms of neurons and connectivity and that these distinctions are the basis of Korbinian Brodmann's classification system. For example, primary auditory cortex (Brodmann's area [BA] 41) has a thick layer of neurons specialized to receive information from the peripheral auditory system. These neurons then send signals to other cortical regions but not directly back to the periphery for motor responses. Ultimately, phonological functioning will need to be described in terms of connectivity at this neural level for a complete understanding of the brain–behavior relationship.

At the macrolevel, neurobiology of phonetics/phonology is described in terms of the activated brain regions and the timing of activation of these regions in perception or production (see SPEECH PERCEPTION and SPEECH PRODUCTION). These brain regions are referred to by Brodmann's areas, by names describing function (e.g., primary auditory cortex), by the scientist involved in identifying the regions (e.g., **BROCA'S AREA**), or by some term describing an attribute of the regions (e.g., Greek *hippocampus* for a region that is shaped like a seahorse).

The principal brain structures involved in phonetic/phonological perception are found in the **PERISYLVIAN CORTEX** and include primary (BA 41) and secondary (BA 42) auditory cortex for processing the acoustic-phonetic aspects of speech (Scott and Wise 2004) (see Color Plate 10). Sound in general (e.g., noise) activates bilateral regions of the dorsal plane of the superior **TEMPORAL** gyrus (STG) and regions of the lateral STG. In contrast with noise, temporally complex signals, including speech, more strongly activate the dorsal region of STG, and the lateral STG activation extends more ventrally. Auditory information identified as speech compared to non-speech leads to increased activation of regions of the STG and superior temporal sulcus (STS) that are more anterior and ventral (inferior). The left STS appears to be active in mapping speech onto **LEXICAL-SEMANTIC** representation. In contrast, the right STS shows sensitivity to melodic features. The left planum temporale (PT, in superior posterior temporal cortex) is believed to have a special role in phonetic/phonological processing and appears to support a motor/sensory interface for acoustic information. A left-greater-than-right asymmetry is generally stronger for speech than non-speech (see

LEFT HEMISPHERE and RIGHT HEMISPHERE). Anterior regions are also activated in speech perception. The left prefrontal cortex (BA 46) is activated in phonological processing in accessing, sequencing, and monitoring **PHONEMES** and processing transitions from consonants to vowels or vowels to consonants. Articulation of phonetic information is supported by motor (BA 4) and premotor/Broca's area cortex (BA 6, BA 44/BA 45).

Recent models have organized these observations into a simple framework in which the more dorsal regions (i.e., posterior and superior) are active in auditory-motor integration during speech perception and the more ventral regions (anterior and inferior) are more involved in the speech-meaning interface. This indicates that the phonetic aspects of processing, which are independent of meaning, will be carried out in more dorsal regions of the auditory and motor cortex, whereas the phonological aspects, which are the basis of meaningful distinctions, are processed in more ventral areas of the auditory cortex. The exact roles of STG, STS, and the two hemispheres in phonetic and phonological processing have not been definitively established yet, but it is known that these areas are all-important in speech processing (Poeppel and Hickok 2004).

Anterior and posterior brain regions involved in phonetic and phonological processing communicate directly via bundles of fibers (axons), such as the arcuate fasciculus, but also via more indirect routes, including the **BASAL GANGLIA**, **THALAMUS**, and **CEREBELLUM**. These additional structures are involved in general functions related to information processing, motor planning, and coordination and will not be discussed further here.

The timing of activation of levels of phonetic and phonological processing has largely been provided by EEG and MEG measures. The timing of auditory processes can be roughly related to levels of processing in the primary and secondary auditory cortex and to the timing of more basic (e.g., signal detection) versus higher-level cognitive processes (phonological discrimination). The principal method used to investigate these processes is event-related potentials (ERPs). The EEG/MEG is time-locked to a stimulus of interest (e.g., "ba"), and this stimulus is delivered multiple times (anywhere from 20 to 10,000, depending on the ERP "component" of interest). The portion of the EEG/MEG time-locked to the stimulus is averaged to remove "noise" (i.e., activity produced by unrelated processes).

ERPs are described in terms of the latency, polarity, and topography of *peaks* that vary with some stimulus property or cognitive process. These identified peaks are often referred to as components. The P and N in a component label refer to positive and negative polarity, respectively, and the number indicates the approximate peak latency (e.g., N400) or the position in a sequence (e.g., N2).

Studies of auditory processing have shown that auditory information enters primary cortical regions between 10 and 50 ms following contact with the outer ear and that a frontocentral positivity peaking around 50 ms (P1 component) and negativity peaking around 100 ms (N1 component) index activity in the primary and secondary auditory cortex. Neurobiological studies with animals suggest that P1 indexes input from the periphery into the superior temporal plane of the auditory cortex and that N1 reflects activity of neurons in the secondary auditory cortex receiving information from other cortical regions. P1 and N1 appear to index acoustic levels of processing. To date, there is no clear evidence that language experience at the phonological level directly affects processing in the time range of the P1 and N1 components.

ERP components occurring later in time are related to higher-level cognitive processes. Those showing modulation by phonological experience include mismatch negativity (MMN), N2b, P3b, and N400 (Näätänen 2001; Kujala et al. 2004). Listeners show more robust MMNs (peaking between 100 and 300 ms and indicating preattentive, automatic processing) in discriminating pairs of sounds with which they have had experience (Näätänen 2001). Specifically, the MMN is smaller or later to a contrast in speech sounds if the speech sounds are assimilated into one phonological category for listeners (e.g., Japanese listeners' perception of English [l] vs. [r]) or if the speech sounds are assimilated into two categories, but one or both sounds are poor exemplars of these categories (e.g., English listeners' perception of Hindi retroflex [Da] versus [ba]; Shafer, Schwartz, and Kurtzberg 2004). The later components, N2b, P3b, and N400, are observed when a participant is asked to actively discriminate a speech contrast. No discernible N2b, P3b, or N400 is observed if discrimination is very difficult (chance performance). If discrimination is better than chance but more difficult than for native listeners, then these components are later and larger than those found for the native group. For example, English speakers showed reasonably good discrimination of Japanese (JP) vowel duration ("taado" versus "tado"), but a later and larger P3b component compared to native Japanese listeners (Hisagi 2007).

Integrating the knowledge of location obtained from fMRI/PET and timing obtained from EEG/MEG indicates that acoustic-phonetic processing occurs in primary and secondary auditory cortical regions between 10 and 100 ms, followed by phonological aspects of processing, presumably in more ventral regions, between 100 and 400 ms. This model is supported by studies localizing the sources of N1 and the phonologically elicited N400 (Kujala et al. 2004).

Lack of Invariance Problem

A major theoretical debate in speech perception over the past 40 years has been the relationship between acoustic and phonological properties. Speech with similar acoustic properties may be assigned to different phonological categories, and, conversely, speech with different acoustic properties is sometimes assigned to the same phonological category. Much research focused on discovering invariant properties of speech sound categories that would allow for precise categorization has failed to do so.

A recent model can be used to illustrate how neurophysiological data can address the *lack of invariance* issue. In this model, speech is categorized and identified by an active process of hypothesis testing (e.g., Magnuson and Nusbaum 2007). Different types of information are used with regards to the type and amount of sensory and lexical information available. For example, clear auditory-speech information and knowledge of the possible phoneme categories of a language lead to reliance on auditory information in categorization. More ambiguous auditory-speech information can lead to greater reliance on visual information (e.g., lip closure for [p] but not [t]). In other words, there are many routes to phonological categorization.

If this model is viable, then neurophysiological data will show whether different sensory and motor cortex are activated when speech is more versus less clear and when other information (e.g., visual) is available. Several recent studies have shown more involvement of the motor cortex and visual sensory areas for ambiguous acoustic speech information when facial information is available, and less activation of these regions when only the speech signal is available (e.g., Skipper, Nusbaum, and Small 2006).

In summary, this example illustrates the importance of neurophysiological data for addressing long-standing theoretical controversies.

Does Speech Have Some Special Status Apart from Other Acoustic Information?

Over the past forty years, there has been a debate regarding whether speech requires a special type of auditory processing specific to humans. Behavioral studies have delivered mixed answers to this question. For example, studies have shown that speech (in particular, consonants) is perceived categorically, rather than continuously, and used this to argue for special status. On the other hand, other species (e.g., chinchillas) are shown to perceive speech categorically, and complex non-speech auditory sounds can be categorically perceived.

Neurophysiological data can help examine this question by determining whether the same structures and processes support processing of speech and non-speech. The current available data suggest that in one sense, speech and non-speech are similar. The same auditory cortical regions are activated in processing speech and non-speech, as described previously (also see Dehaene-Lambertz and Gigla, 2004). Furthermore, the sensory-motor links found for speech are similar to those seen for other sensory-motor links (e.g., tool manipulation using visual and motor regions) and seen in other species (see Skipper, Nusbaum, and Small 2006)

In another sense, the neurophysiological data suggest that the processing of speech differs from that of non-speech. Specifically, as described previously, more ventral areas (lateral and anterior superior temporal gyrus) become involved in phonological processing of speech sounds because these sounds are relevant for making meaning contrasts. It is possible that humans are the only species that fractionate sound symbols into subcomponents (phonemes) that can be manipulated to create novel symbols, and, in this way, speech is special.

Is There a Critical Period for Language-Specific Learning?

Researchers have long noted that learning a second language late in life typically results in a stronger non-native accent and poorer speech perception in the second language (see Strange and Shafer 8; see also SECOND LANGUAGE ACQUISITION). One explanation for this pattern is that there is a critical or sensitive period in which phonological information must be learned in order to lead to native-like performance (see PHONOLOGY, ACQUISITION OF). Some research suggests a gradual loss of ability to alter phonological categories up to puberty.

The reason for this change in ability is unknown. It could be that the auditory cortex is altered at an early level so that it loses the ability (or resolution) to respond to non-native contrasts. Alternatively, listeners may have difficulty refocusing their attention to the relevant cues needed for rapid processing of the second language (Strange and Shafer 8).

Neurophysiological data can address this question by examining where in the nervous system differences in processing are found for first and second language learners. The current research has not shown differences earlier than the MMN response. Furthermore, a recent study from our laboratory suggests that attention plays a role in loss of ability to learn novel categories. Specifically, listeners learn to automatically attend to relevant cues in their first language and can only overcome these weightings with great attentional effort. This result suggests that the loss of sensitivity in adjusting to novel phonological categories by second language learners is not directly due to a closure of a critical period for changing the sensitivity or resolution of the primary and auditory cortex; rather, it is due, at least in part, to attentional issues (Hisagi 2007).

These findings do not answer all the questions regarding critical and sensitive periods for setting up phonetic and phonological categories since second language learners acquired categories for a first language early in life. Recent research examining the neurophysiological and behavioral consequences of deprivation of hearing, which is reversed by cochlear implants, will have much to contribute for addressing this question. Recent advances have led to implantation at earlier ages, which is allowing researchers to compare the quality of phonological processing across different ages of first exposure to speech information. Improvements in these implanted devices will also allow examination of how the quality of auditory-speech input impacts phonetic and phonological systems. This emerging area of research is likely to provide less ambiguous evidence regarding a critical or sensitive period for speech.

To What Degree Does Biology Constrain the Nature of Phonological Systems?

A classic debate in linguistics concerns the extent to which language is **INNATE**. A more useful way to ask this question is what biological constraints are placed on the nature of phonological systems and how environmental input contributes to constructing these systems. Across languages, there are common patterns. For example, all languages contrast /i/ (“heep”), /u/ (“hoop”), and /a/ (“hop”) (although there can be slight variations in the actual production of these sounds), and some languages only contrast these three vowels. However, there is no existing language that only contrasts “i” (in bead), “I” (in bid), and “e” (in bed) without also contrasting /i/, /u/, and /a/. It is possible that these universal patterns are due to biological constraints. On the other hand, they may be attributed to environmental factors. Examination of the evidence suggests that the system is constrained by an interaction of biological and environmental constraints. For example, /i/, /u/, and /a/ are perceptually more distinct than “i” (in bead), “I” (in bid), and “e” (in bed), and this is a property of the auditory system; the environment (input) leads to less salient distinctions included in some languages, but many possible distinctions are never found in languages.

Neurobiological data will aid in further elucidating how development of phonological systems is constrained by instructions from the genetic code and emerges from patterns in the input. In

particular, examination of the way that genetic variation affects the development of speech processing and its neurophysiological substrate will help us understand the contributions of biology and the environment. For example, studies of congenitally deaf populations have revealed that some brain regions that are typically specialized for audition (e.g., regions of secondary auditory cortex) are used in visual processing and thus are highly sensitive to input. In contrast, more primary regions specialized for audition (primary auditory cortex and subcortical areas) do not reorganize to take on nonauditory functions and are thus less sensitive to input. An understanding of the relationship among the genetic code, neural connectivity, and plasticity of auditory and language-association brain regions will help to create realistic models of phonetic/phonological development and processing, which in turn will help to answer how biology and the environment contribute to the development of this system.

Conclusion

This entry illustrated the importance of neurobiological data in addressing significant questions concerning phonetic and phonological processing. In particular, an understanding of the neurobiology supporting phonetic and phonological processing will allow researchers to construct better models of processing and to address questions related to first and second language learning and disorders (such as **DYSLEXIA** and **APHASIA**) attributable to deficits in phonological processing.

– Valerie Shafer

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PHONOLOGICAL AWARENESS

Phonological awareness encompasses the broad class of abilities that enable one to attend to, isolate, identify, and manipulate the speech sounds in spoken words. The domain of phonological awareness abilities can be subdivided into two levels. The first, phonological sensitivity, pertains to conscious awareness of larger, more salient sound structures within **WORDS**, including **RHYMES** and **SYLLABLE** structures (i.e., syllables and subsyllabic units) (Scarborough and Brady 2002). (Rhymes, defined at the word level, consist of the **STRESSED** vowel and what follows [e.g., b*e*/w*e*; f*eather*/w*eather*]; subsyllabic units include onsets, i.e., the portion of each syllable preceding the vowel [e.g., *b*e; *sp*ot; *m*ag*n*et], and rimes, i.e., the remaining portion [e.g., b*e*; sp*ot*; m*agnet*]). The second level of phonological awareness, **PHONEME** awareness, refers to explicit awareness of the individual phonemes making up words. Generally, children acquire at least some degree of phonological sensitivity prior to phoneme awareness (see PHONOLOGY, ACQUISITION OF). However, questions remain as to whether attainment of phonological sensitivity is a necessary prerequisite for the development of phoneme awareness (Gillon 2005). When children begin to acquire phoneme awareness, they usually first are able to isolate and identify the external phonemes (i.e., the beginning and/or final phonemes in words). Ultimately, proficiency in phoneme awareness entails the ability to segment, identify, and blend all of the individual phonemes, including those within consonant clusters (e.g., in words such as "blast").

The significance of phoneme awareness stems from its role in **READING** acquisition (see WRITING AND READING, ACQUISITION OF). Understanding that spoken words are made up of individual speech sounds provides a conceptual foundation for understanding the alphabetic principle (i.e., that letters correspond with phonemes). This awareness, in turn, facilitates learning to read and **SPELL**. The relationship between phoneme awareness and **LITERACY** development is reciprocal: With some emergent awareness of phonemes, the student can start to acquire letter–sound knowledge. In turn, awareness of phonemes is heightened by experience with print.

Since the concept of phoneme awareness was established in the 1970s (e.g., Liberman 1971), evidence for the significance of phoneme awareness for reading achievement has accrued from correlational, prediction, and training studies. At all ages, including adulthood, less-skilled readers demonstrate weaker performance on phoneme awareness measures than better-reading peers, whether the same age or younger reading age controls. Prediction studies with kindergarten students document that phoneme awareness performance is one of the strongest predictors of their subsequent reading achievement, particularly for decoding and word recognition skills, but also for reading

comprehension (see TEACHING READING). Most compelling, intervention studies confirm a causal link between instruction in phoneme awareness and increased success at learning to read, with greater benefits when discovery of phonemes is linked with letter knowledge (Ehri et al. 2001).

– Susan A. Brady

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PHONOLOGY

As opposed to **PHONETICS**, which deals with the properties of sounds from a language-independent point of view, phonology constitutes the study of the sound structure of units (**MORPHEMES, WORDS**, phrases, utterances) within individual languages. Its goal is to elucidate the system of distinctions in sound that differentiate such units within a particular language, and the range of realizations of a given unit's sound structure as a function of the shape of other units in its context. These two goals – the study of invariants of sound structure and of the variation shown by these elements in combination – are obviously closely related, but attention has tended to shift between them over time.

Late nineteenth- and early twentieth-century study of sound structure focused on the details of sound production. As these studies (in both **ARTICULATORY PHONETICS** and **ACOUSTIC PHONETICS**) became more sophisticated, however, it was increasingly apparent that the resulting explosion of data about sound properties was obscuring, rather than enhancing, scholars' understanding of the way sound is organized for linguistic purposes. Much that is measurable in the speech signal is predictable, internal to the system of a given language, even though exactly comparable properties may serve to distinguish items from one another in a different language.

Vowels in English, for example, are relatively longer before certain consonants than before others, but the difference in the vowels of, for example, *cod* and *cot* is entirely predictable from this principle alone. By contrast, an exactly parallel difference between the vowels of *kaade* "dip" and *kade* "envious" in Finnish serves as the sole difference between these words. A focus on phonetic features alone fails to reveal the role played by sound properties within a language.

The result of this insight was the development within various theories of **STRUCTURALISM** of attempts (Anderson 1985) to define the **PHONEME,** a presumed minimal unit of contrast within the sound system of a single language. While there is considerable diversity among these views, it is fair to say that by and large, they focused on the elucidation of the contrastive properties of elements of surface phonetic form to the exclusion of other aspects of sound structure.

The Development of Modern Phonology

Poststructuralist theories fall broadly within the tradition of generative phonology, associated in its origins with Noam Chomsky and Morris Halle (1968). The distinguishing character of this view was its attention not simply to surface contrasts but also to patterns of alternation in shape, and its positing of an abstract underlying **REPRESENTATION** (where contrasts among elements are characterized) that is related to surface phonetic form by a system of rewriting rules. Each of these rules represents a single generalization about the realization of phonological elements (e.g., "Vowels are long before voiced obstruents"). Much of the theoretical discussion in the 1960s and early 1970s concerned the role of an explicit formalism for these rules.

The rules were presumed to apply in a sequence, with each applying to the result of all previous rules. As a consequence, some of the generalizations represented by individual rules may only be valid at an abstract level and not true of all surface forms to the extent subsequent changes obscure the conditioning factors of a rule or its effects, leading to the *opacity* of the rule in question. For example, in many varieties of American English, the medial consonants of words like *ladder* and *latter* are both pronounced as the same voiced flap [D]. The vowels of the initial syllables of such words continue to differ in length, however, reflecting the abstract difference in voicing between /d/ and /t/, even though that difference is obscured by the (subsequent) application of a rule of flapping that renders the vowel-length rule opaque. Much attention was paid in this period to the theories of rule ordering necessary for describing such phenomena.

In the years immediately following the publication of Chomsky and Halle (1968), a number of scholars reacted strongly to the perceived abstractness of the underlying phonological representations to which it appeared to lead. Various proposals that intended to restrain this aspect of the theory appeared, some of them based on the idea that if the rules themselves could be constrained so as to permit only highly "natural" ones, drawn from some substantively constrained universal set, the underlying representations would thereby be forced to be closer to surface forms. Others proposed to constrain the relation between phonological and phonetic representation directly (again, often in the name of "naturalness").

In general, these attempts to limit the power of phonological systems by fiat ran into apparent counterexamples that deprived them of their appeal. Other developments in phonological theorizing shifted scholars' attention away from this issue while also leading (as somewhat unintentional by-products) to a general reduction in the degree of abstractness of representation. Some of these elaborations and reorientations of the program of generative phonology are sketched here.

AUTOSEGMENTAL PHONOLOGY. The bulk of research during the "classical" period of generative phonology was concerned with segmental phenomena (although the main goal of Chomsky and Halle 1968 was an account of English **STRESS**). In the early

1970s, attempts to describe the phonology of **TONAL** systems led to important changes in assumptions about representations and a concurrent shift of attention on the part of phonologists.

The classical theory had assumed that phonological (and phonetic) representations were given in the form of a simple matrix, where each row represented a phonological distinctive feature and the columns represented successive segments. Such a representation is based on the assumption that there is a one-to-one relation between the specifications for any given feature and those for all other features, since each column contains exactly one specification for each feature.

Tonal phenomena, however, made it clear that features need not be synchronized in this way: A given feature specification might take as its scope either more or less than a single *segment*. A classic example of this, offered by W. Leben, is found in Mende, where each word bears one of a limited set of tonal patterns, regardless of the number of **SYLLABLES** on which this pattern is realized. Thus, the tone pattern "high-low" appears on a single syllable in *mbû* (and thus the low has scope over only the last half of the vowel), on two in *ngílà*, and on three in *félàmà* (where the single low of the pattern takes scope over two vowels). This led to the development of *autosegmental* representations, in which feature specifications were linked by lines of association (subject to specific constraints), rather than all being aligned into segments. The extension of this insight to other phenomena, and its consolidation, essentially displaced the earlier concerns of rule notation and ordering in phonologists' attention.

METRICAL PHONOLOGY. A similar development took place in the analysis of stress and the study of the syllable. The analysis in Chomsky and Halle (1968) treated stress as simply one more phonological feature, with a value assigned to some (but not all) of the segments in the representation of a word. This account was forced to attribute a number of basic properties to the feature [Stress], however, that had no obvious correlates in the behavior of other features.

It became possible to rationalize these properties by viewing stress not as a segmental feature but as a relational property of the organization of syllables into larger structures. This, in turn, required the recognition of syllables as significant structural units: a notion that was explicitly rejected in the earlier theory in favor of an attempt to reformulate all apparent syllable-based generalizations in terms of segmental structure alone. The organization of segments into syllables and these, in turn, into larger units called *feet*, which themselves are organized into phonological words (and phrases, etc.), allows for the elimination of the anomalous character of segmentalized stress. The study within metrical phonology of these units, their internal organization, and their relation to one another completed the enrichment of the notion of phonological representation begun within autosegmental phonology.

FEATURE GEOMETRY. A standard theme of classical generative phonology was that of natural classes of phonological segments, groups of segments that function in some parallel fashion in phonological rules to the exclusion of others. It was originally hoped that the analysis of segments into distinctive features would provide the solution to this issue: Segments sharing a feature (or set of features) were thereby characterized as similar to one another, and thus predicted to behave in the same way in rules.

It soon became apparent, however, that **FEATURE ANALYSIS** by itself does not exhaust this matter. When nasal consonants assimilate in place of articulation to a following obstruent, for instance, each individual place is specified by a distinct feature (or set of features), and the overall unity of the process as one applying exactly to all and only nasals, regardless of their place of articulation, is not expressed. Nothing in the notation, that is, makes it clear that a rule assimilating labiality, coronality, and velarity is more coherent in some sense than one assimilating labiality, voicing, and nasality.

The response to this problem was a program to treat the features themselves as organized into a hierarchy, such that all place-of-articulation features (for example), and no others, are daughters of a unitary node [Place]. On that approach, place assimilation could be viewed as a unitary association of the [Place] node itself, rather than individually to each of its various possible values, while no such single unit corresponds to the hypothetical alternative. Attention focused on such problems of the internal geometry of the feature system generally led to the assumption that the way to approach them was to assume that the theory of rules should be limited to a very simple set of reassociations and deletions within the autosegmental structure of an utterance, and that a single, universal feature hierarchy could be specified on the basis of which all observed "natural" rules (and no "unnatural" ones) could be formulated. Arguments for and against specific proposals about such a hierarchy have drawn considerable attention, though it is perhaps notable that the theoretical assumptions underlying the program have been much less discussed.

LEXICAL PHONOLOGY. In classical generative phonology, the interface between word structure and sound structure is quite simple. **MORPHOLOGICAL** elements are combined into words in the **SYNTAX**, these elements are provided with phonological (underlying) forms, and the resulting syntactically organized labeled, bracketed structure serves as the input to the phonology. At least some of the phonological rules were assumed to apply according to the principle of the **CYCLE**, based on this structure, in a uniform way. To the extent that morphological elements display different phonological properties in their combinations with others, this was represented as differences within an inventory of boundary elements separating them from adjacent items.

Originating from the apparent generalization that elements with the same phonological behavior (hence, associated with the same boundary type) tend to appear adjacent to one another, the theory of *lexical phonology* proposed a substantial revision to this architecture. Instead of constructing the entire representation once and for all and then submitting it to the phonology for realization, this view proposed that the lexicon of morphological elements is divided into multiple *strata* or levels. Basic roots can combine with elements of the first stratum; after each such morphological addition, the resulting form is subject to adjustment by the rules of a corresponding level of the phonology, and the output is then eligible to serve as the input to further morphological elaboration. At some point, addition of elements from the first stratum is replaced by use of the morphology and phonology

of the next, and, from then on, no further elements from the initial stratum can be added. This process continues (perhaps vacuously) through all of the strata of the lexicon, yielding a potential surface word. All of the words in a given syntactic structure are then subject to adjustment by another set of postlexical phonological processes.

There are a number of further points that characterize this view, including proposed differences in the properties of lexical and postlexical rules and the relations between rules on one level and those on the others. The central point for a broader theory of grammar, however, is probably the replacement of a syntax-based (but purely phonological) notion of cyclic rule application by a repeated cycle of morphological addition and phonological adjustment. This results, for example, in the possibility that a phonologically derived property (on one cycle) can be relevant to the conditioning of a morphological operation (on a following cycle), a possibility that has been shown to be quite real.

OPTIMALITY THEORY. In the early 1990s, a much more radical challenge to the classical model was presented by the development of **OPTIMALITY THEORY** (OT), a view of phonology based on a system of ranked, violable constraints on surface shape, as opposed to a system of ordered rules deriving the phonetics from an underlying phonological representation. These constraints govern (in the standard formulation) a one-step relation between underlying and surface representations (cf. **UNDERLYING STRUCTURE AND SURFACE STRUCTURE**), with no intermediate stages of the sort produced in a rule-based description. The constraints can be divided into general classes: a) **MARKEDNESS** constraints, which express universally preferred configurations, and b) *faithfulness* constraints, requiring that contrasts present in the phonological representation be preserved in the surface form. In general, these are in conflict, and the ranking of the constraints governs the resolution of those conflicts, in conformity with general principles of grammar.

Initially, OT seemed to offer its greatest promise in the analysis of stress, syllable structure, and related phenomena, but subsequent development has encompassed a full range of segmental and other facts. Descriptions in constraint-based terms are at least superficially very different from those couched in terms of traditional rules, and theoretical discussion in phonology since their introduction has been largely dominated by comparisons of the two frameworks.

Current Approaches to Phonology

The central issues in phonology in the first decade of the twenty-first century concern the comparative merits of OT and rule-based descriptions. On the one hand, constraint-based formulations seem much better equipped to describe global properties of phonological systems. It was noted in work from the classical period of generative phonology that multiple distinct processes in an individual language may all have the effect of ensuring (or avoiding) a single characteristic property of surface form, but no satisfactory account of the unity displayed by these "conspiracies" was ever achieved. OT, in contrast, provides a very direct description of such facts.

In some ways, the surface constraint approach goes beyond anything available in principle to the rule-based theory. For example, when languages accommodate loan words to the surface patterns of other words of the language, the adjustments needed to achieve this may include changes that do not correspond to any rule of the phonology of native forms. Constraints accomplish this directly and without further stipulation, whereas a system of rules may have to be arbitrarily extended to account for loanword adaptation.

On the other hand, some of the same issues that rule-based phonology dealt with (and at least largely resolved) have resurfaced as serious challenges to the architecture of grammar generally assumed in constraint-based theories. Most important among these is the problem of opaque generalizations. The standard model of OT assumes that its constraints apply directly to surface forms and govern a single-stage mapping between these and underlying phonological representations, and so has no place for generalizations that crucially apply to any sort of intermediate level. Nonetheless, a number of compelling examples of such phenomena have been demonstrated, and some sort of accommodation of these facts must be provided by an adequate phonological theory.

Some responses to this challenge have attempted to maintain the standard OT model by introducing new sorts of constraints. Mechanisms such as *output-output* constraints or *sympathy theory*, however, have not generally succeeded in dealing with all of the relevant phenomena and have been shown to produce new difficulties of their own.

One approach that seems promising is that of *stratal OT*, an architecture that grafts a constraint-based account onto the standard model of lexical phonology. The result is a framework in which the phonological mapping at each stage is a one-step process governed by a constraint system. Since the model is built on a cyclic interaction of phonology and morphology, however, it also provides for multiple successive stages in the overall derivation, thus accommodating opacity to the extent it can be related to morphological structure (as in the best-established examples).

Examples also seem to exist in which the specific changes through which a language achieves conformity with a general constraint on surface forms do not follow directly from the content of the constraint (together with other interacting generalizations). In such a case, something like a rewriting rule might be necessary, as a supplement to the constraint system – a notion that is clearly antithetical to the basic philosophy of OT.

A quite different problem concerns the very nature of the universals of phonological structure (see PHONOLOGY, UNIVERSALS OF). Phonological theorizing has generally accepted the premise that generalizations that are true of phonological systems *in general* result from the cognitive organization of the human language faculty and, thus, must be incorporated in some way into the architecture of phonological theory. Recently, however, it has been argued that at least some such typological regularities result not from the content of a **UNIVERSAL GRAMMAR** constraining synchronic systems but, rather, from the universals of language change (see LANGUAGE CHANGE, UNIVERSALS OF) governing the diachronic developments resulting in the systems we observe. To the extent that this is true, it requires investigators to examine closely the arguments for incorporating any

particular regularity into phonological theory per se, as opposed to seeking its basis elsewhere.

Conclusion

While there have, of course, been other trends not covered here, it seems fair to say that the bulk of the theoretical discussion in phonology from the 1960s to the present has been devoted to the elaboration and refinement of the generative program of Chomsky and Halle (1968). The most recent developments in that tradition, involving the wholesale replacement of rules by constraints as the mechanism for expressing regularities of a language's sound pattern, have shown great promise but cannot yet be considered wholly consolidated. Apparently, some appropriate synthesis of the classical and OT models remains to be found, and it is that search that dominates discussion today.

– Stephen R. Anderson

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PHONOLOGY, ACQUISITION OF

A diversity of issues informs work in the field of phonological acquisition, as it encompasses both first (L1) and second (L2) language acquisition examined by researchers in linguistics, psychology, speech–language pathology, and language education. In L1, there are questions such as how the acquisition of phonology interfaces with perceptual and motor development (Locke 1993), and how an examination of disordered development can illuminate the normally developing grammar (Bernhardt and Stemberger 1998; Dinnsen 1999). In L2, there are questions as to whether the acquisition process is fundamentally like L1 acquisition (Flege 1995), or whether L2 grammars are in some sense impaired due to, for example, L1 constraints that impede native-like attainment (see Brown 1998 on perception).

Due to space constraints, this entry focuses on L1, although many of the same issues arise for L2. The acquisition of phonology is examined from the perspective of **GENERATIVE GRAMMAR**; thus, a principal theme is to examine how acquisition research has used linguistic theory to inform development. This theme considers the null hypothesis to be that children's productions are largely system driven: Acquisition research strives to understand the system that relates children's stored representations to their productions, and to formalize the developmental paths that children follow.

Children's Grammars as "Possible" Grammars

The focus of research on phonological acquisition is on the shapes of early grammars in the segmental and prosodic domains; thus, it parallels research on end-state (adult) grammars. (Segmental phonology is concerned with individual speech sounds, prosodic phonology with larger units including syllables and feet.) There is typically a comparison drawn between the shapes of developing grammars and some end-state grammar. Order of emergence of segmental (Dinnsen 1992) and prosodic complexity (Fikkert 1994; Levelt, Schiller, and Levelt 1999/2000), as well as error patterns observed in the segmental and prosodic domains, whether these patterns are expressed through rules (Smith 1973; Ingram 1974), templates (Macken 1992; Fikkert 1994), or constraints (Pater and Barlow 2003; Goad and Rose 2004), are all considered in relation to some adult grammar.

One exception is a body of research that views children's grammars as self-contained systems subject to their own constraints (Stoel-Gammon and Cooper 1984; Vihman 1996). This research program developed in response to the observation that children's grammars are not simply "reduced" versions of the target grammar; indeed, variation across learners is rampant (Ferguson and Farwell 1975).

While children's grammars may be self-organizing in that they contain processes not present in the target language, they can still be viewed as "possible" grammars (White 1982; Pinker 1984) if these processes have correlates in other adult languages. The notion of "possible" grammar thus requires that, at each stage, children's grammars respect the constraints of adult grammars, even if they bear little resemblance to the target system. In **OPTIMALITY THEORY** (OT) (Prince and Smolensky [1993] 2004), for example, alternate routes observed across learners, as well as stages in the development of a single learner, are viewed from the perspective of the typological options that adult languages display: Both are accounted for by different rankings of the same constraints.

Markedness

Although children take different paths to the adult grammar, early phonologies are also strikingly similar (Jakobson [1941] 1968). As Roman Jakobson emphasizes, these similarities reflect cross-linguistically unmarked properties. **MARKEDNESS** constrains the shapes of linguistic systems such that less complex properties are favored. For example, there is a well-documented preference for consonant/vowel (CV) syllables among children (Ingram 1978; cf. Grijzenhout and Joppen-Hellwig 2002); this is also a syllable shape that no end-state grammar forbids (Jakobson 1962). Since unmarked patterns are systematically observed across learners, one might reasonably infer that they reflect early grammatical organization. However, markedness has not always been well integrated into the theory of grammar (as part of the theory of representations or formulation of rules/constraints). This begs the question of whether markedness should instead be part of the theory of acquisition, which interfaces with, but is independent of, the theory of grammar.

Table 1.

Ambient form:	Stage	Grammar:	Stored form:	Grammar:	Produced form:
[əwei]	1	M >> F-perc, F	/wei/	M >> F-perc, F	[wei]
	2	F-perc >> M >> F	/əwei/	F-perc >> M >> F	
	3	F-perc, F >> M		F-perc, F >> M	[´əwei]

An advantage of OT is that the formal devices for expressing phonological generalizations include a set of markedness constraints. Most researchers have proposed that learners begin acquisition with a ranking wherein markedness constraints dominate faithfulness (which favor identity between inputs [stored representations] and outputs) (e.g., Demuth 1995; Gnanadesikan [1995] 2004; Smolensky 1996; Pater 1997; Ota 2003; cf. Hale and Reiss 1998). Throughout development, constraints are reranked to yield more marked outputs. However, many paths can be followed, as there are many options for what to rerank. Thus, the idea that grammars are initially unmarked is not inconsistent with their being self-organizing.

Perception Versus Production

Most work in phonological acquisition has focused on production; indeed, researchers typically assume that children accurately perceive the ambient input. This is due, in part, to the observation that prelinguistic infants can perceptually discriminate perhaps all contrasts exploited by the world's languages (Eimas et al. 1971; Werker et al. 1981). This ability largely declines by age one (cf. Best, McRoberts, and Sithole 1988), coinciding with a reorganization of perceptual categories according to what is contrastive in the target language (Werker and Tees 1984). As children start to speak around age one, it would appear that perception is complete by the onset of production.

Research on phonemic perception, which requires the ability to form sound–meaning pairings, has challenged this view (Shvachkin [1948] 1973; Edwards 1974; Brown and Matthews 1997). Although experiments examining minimal contrasts between native-language sounds have revealed that perceptual development is mostly complete by age two, some contrasts develop as late as three. Even age three is probably conservative because, for consonant perception, this research has focused almost exclusively on word-initial position. Since contrasts in other positions are harder to discriminate, many non-target patterns that children's productions display could reflect perceptual miscoding, rather than production constraints (Macken 1980).

If perception and production both reflect aspects of children's COMPETENCE, both must be included in the grammar (cf. Hale and Reiss 1998). However, the time lag observed (production trails perception) has suggested to some researchers that they form independent (interacting) grammatical modules (see Menn and Matthei 1992). This approach, though, cannot predict that perception and production abilities develop in a similar order. The latter favors the postulation of a single grammar *if* the time lag can be built in. In Pater (2004), this is accomplished by introducing perception-specific faithfulness constraints into OT.

As shown in Table 1, at Stage 1, both perception-specific faithfulness (F-perc) and general faithfulness (F) are outranked by markedness (M). The result is unmarked forms stored in perception and uttered in production. In the example provided, the ambient form [´wei] "away" undergoes truncation of the *pretonic* syllable (an unstressed syllable immediately preceding a stressed syllable) in both components of the child's grammar; accordingly, words of this shape are perceived and produced without this syllable. At Stage 2, the child's perceptual abilities become more target-like (i.e., he/she learns to correctly identify information in the ambient language); this indicates that the relevant markedness constraints have been demoted below perception-specific faithfulness. General faithfulness is still outranked, yielding a mismatch between what the child perceives and what he/she produces. At Stage 3, markedness is demoted below general faithfulness, and the form is correctly produced. The perception-production time lag results because forms that are correctly perceived at Stage 2 are not correctly produced until Stage 3.

Phonological Theory and Phonological Acquisition

As the preceding discussions reveal, research in phonological acquisition has been directly impacted by the thinking in generative phonology. Modern generative phonology began with Chomsky and Halle's (1968) *Sound Pattern of English* (SPE). Although more recent work has situated the shapes of developing grammars within the typological range manifested by adult systems, this was less the case in the SPE-based literature. Much of this work used SPE as a tool only, in part because, with the formal apparatus employed by the theory, it was difficult to constrain what a possible grammar is: developing or end state. And although the theory contained an evaluation metric to guide learners in selecting the most highly valued among descriptively adequate grammars, rules for unattested processes were as easy to formalize as rules for commonly attested processes. Finally, SPE contained no workable theory of markedness and, thus, children's grammars could not be considered relative to some notion of optimal.

To facilitate a comparison between SPE and later theories, we draw on truncation, further exemplified in (1) from Amahl, age 2.60 (Smith 1973; [ɪ,G] are voiceless unaspirated lenis stops). (The discussion focuses on the stage when perception is target-like and truncation is restricted to production.)

(1) [Ge:p] "escape"
[ʙa:nə] "banana"

In SPE, every deviation from adult forms required one or more rules, and so there was little in common between the rule sets

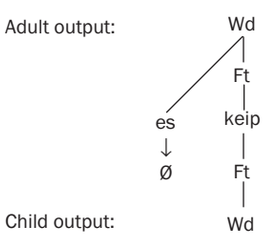
for developing and target systems. To capture truncation, Neil Smith (1973) provides the rules below, neither of which operates in the adult grammar:

(2) R14: V → Ø / # (C) _____ C V
[-stress] [+stress]
R16: [+sonorant] → Ø / [+consonantal]

R14 deletes initial vowels in words like *escape.* For consonant-initial forms like *banana*, the result is [bna:nə], which then undergoes R16, yielding [ba:nə].

Since SPE employed linear representations, the theory did not offer any insight into why pretonic rather than posttonic syllables delete ("escape" → [Ge:p], but "tiger" → [gaigə], *[gai(g)]). The development of nonlinear phonology (see Goldsmith 1985 for an overview), notably the move to highly articulated prosodic representations, led to significant breakthroughs in understanding this asymmetry. In trochaic languages, where the foot (the rhythmic unit in which stress is assigned) is left-headed (stress-initial), *escape* cannot form a single foot, [əs(kéip)$_{Ft}$]$_{Wd}$, whereas *tiger* can, [(táigə)$_{Ft}$]$_{Wd}$.

Much work in nonlinear phonology has explored the idea that prosodically defined templates constrain output shape (McCarthy and Prince 1995). Paula Fikkert (1994) proposes that templates, which at early developmental stages reflect what is unmarked, are responsible for truncation. If the child's productions are limited to one foot, circumscribed from the adult output, this template will determine which material is preserved from the adult form and which is deleted:w



In contrast to SPE, nonlinear phonology reveals the relationship between target and truncated forms, and the role that markedness plays in shaping outputs. The material inside the foot survives, as syllables organized by feet ([keip]) are less marked than those linking directly to the word ([əs]). One problem with the templatic approach, however, is that it is too rigid: If the segments predicted to survive are precisely those delimited by the constituent that serves to organize them in the adult form, it becomes difficult to capture the observation that material from the truncated syllable can also survive. For example, in Amahl's pronunciation of *banana* in (1), onset selection favors [b], replacing [n] from the stressed syllable; that is, his production is [ba:nə] not *[na:nə] as expected from adult [bə(na:nə)$_{Ft}$]$_{Wd}$ (see Kehoe and Stoel-Gammon 1997 for other problems with the templatic approach).

This problem is rectified in OT. First, there are no templates; templatic effects arise from the interaction of markedness constraints. Second, segmental content (e.g., labial preservation) is the responsibility of faithfulness constraints. Finally, all constraints are interranked; thus, the co-occurrence of truncation and onset selection is not unexpected (see Pater 1997).

Table 2.

	ParseSyll	Max[lab]-IO	Max-IO	I-Contig
a. [bə(na:nə)$_{Ft}$]$_{Wd}$	*!			
b. [(na:nə)$_{Ft}$]$_{Wd}$		*!	**	
c. [(ba:nə)$_{Ft}$]$_{Wd}$			**	*

To illustrate concerning truncation in Table 2, the constraint ParseSyllable (syllables are parsed into feet), along with other markedness constraints, must be satisfied at the expense of the lower-ranked faithfulness constraint Max-IO (every segment in the input has a correspondent in the output). Fully faithful (a) is thus eliminated because the initial syllable is unfooted. Concerning onset selection, Max[labial]-IO (every [labial] in the input has a correspondent in the output) must be ranked over I-Contiguity (the portion of the input standing in correspondence forms a contiguous string). Preservation of [labial] in *banana* will thus be favored, (c), even though the result violates I-Contig through morpheme-internal deletion.

OT has had a major impact on acquisition research. Phonological processes are now generally expressed through constraints, rather than rules, as this provides a better conceptualization of the observation that markedness shapes early grammars. As discussed, children's productions become more target-like when markedness constraints are demoted below faithfulness. A similar idea, that development is best viewed as the gradual relaxing of constraints, had been proposed earlier (Stampe 1969; Menn 1980), but it was difficult to formally implement it in the rule-based frameworks of the time.

OT seems to provide an appealing view of the initial state and of development; researchers can address important questions, such as how the theory may restrict what a possible developing grammar is, and how, in turn, data from development may inform the theory. However, this is not to say that OT has solved all problems in phonological acquisition. One understudied problem is rogue behavior. We have been assuming that children's grammars are possible grammars, thereby ignoring the fact that some commonly attested processes, notably consonant harmony (CH), have no adult analogs (Drachman 1978). In CH, consonants share place over vowels of any quality (Vihman 1978), as seen in (3) for Amahl, age 2.60 (Smith 1973):

(3) [gaigə] "tiger"
[go:k] "stroke"

Some recent accounts of CH (Goad 1997; Rose 2000) incorrectly predict that the process should be attested in adult grammars; others (Pater 1997) appeal to child-specific constraints, thereby challenging the notion that children's grammars are possible grammars. Neither of these approaches questions whether CH is truly grammar-driven nor addresses, more generally, the criteria that should factor into the determination concerning what is grammar-driven and what is not. I leave these questions to future work.

– Heather Goad

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PHONOLOGY, EVOLUTION OF

True Phonology: How Did It Evolve?

PHONOLOGY is the study of how languages use segmental and prosodic categories to build spoken words and signal their differences in meaning. Many animals that communicate vocally use distinct sound patterns to signal different "meanings," but their repertoires are typically small and closed sets. By contrast, humans have large vocabularies and learn new words all of their lives. From infancy to adolescence, children acquire lexical entries at a remarkably fast rate. The vocabulary size of high school students has been conservatively estimated at 60,000 root forms – a number that implies an average acquisition rate of more than 10 words per day (Miller 1991).

This difference is linked to the uniquely human method of coding information: the combinatorial use of discrete entities. Combinatorial structure, the hallmark of true language, creates the conditions for open-ended lexical and syntactic systems that provide the foundation for the singular expressive power of human languages. How did it evolve?

We focus on two areas of empirical research. One is the study of *human cognition*. The other is the investigation of the *phonetic signal space* from which all phonological patterns are drawn. The first theme highlights man's rich semantic abilities. The second looks for phenomena that presage combinatorial sound structure.

Cognitive Growth

The virtually infinite set of meanings encodable by language raises the question of how man's cognitive capacity evolved from skills not unlike those of present-day apes. How do we picture the transition from a nonhuman to a human primate mind? What was the role of language?

According to Merlin Donald's synthesis of neurobiological, psychological, archeological, and anthropological evidence (1991), our ancestors broke away from the stimulus-driven behavior of apes in two steps. First, during the period of *Homo erectus* (from 1.5 million years ago), an adaptation called *mimesis* occurred, a communicative culture allowing individuals to share mental states and begin to represent reality in new and expanding ways.

Mimetic behavior is an ability to voluntarily access and retrieve motor memories and to rehearse and model them for **COMMUNICATION** with others. The whole body is used as a representational device, as in imitating vocal, manual, and postural movements for a communicative purpose. Mimesis involved major changes of motor and memory mechanisms based on existing capacities.

Communication during this period was based on **GESTURES**. Spoken language emerged in the second transition. In Donald's scenario, it takes until the end of the period associated with archaic *Homo sapiens* (45,000 years ago) for spoken language to appear.

If mimesis was a basically gestural mode of communication, would it not imply a proto-language that was signed, rather than spoken (cf. Arbib 2005)? Donald assumes that as mimetic messages grew more elaborate, they eventually reached a complexity that favored faster and more precise ways of communicating. The vocal/auditory modality offered an independent, omnidirectional channel useful at a distance and in the dark. It did not impede locomotion, gestures, or manual work. The vocal system came to be exploited more and more and further adaptations occurred: first *lexical invention* and *high-speed phonological speech*, **SYNTAX** later.

Specializations of the Vocal/Auditory Modality

A number of comparative studies have been undertaken in attempts to evaluate the adaptive significance of novel features of human anatomy (see SPEECH ANATOMY, EVOLUTION OF): for example, disappearance of air sacs (Hewitt, MacLarnon, and Jones 2002), bigger hypoglossal and vertebral canals, smaller masticatory muscle mass, genetic changes, and uniqueness of craniofacial sensorimotor system (Fitch 2000; Kent 2004).

Perhaps the most conclusive example of a speech-related adaptation is the *descent of the larynx*, which makes swallowing more hazardous but expands the space of possible sound qualities (Lieberman 1991; Carré, Lindblom, and MacNeilage 1995).

A human ability, central to language but curiously absent in primates, is *vocal imitation*. A beginning of a neural account of imitation was suggested by the discovery of *mirror neurons*. First identified in the macaque's premotor cortex, these neurons discharge when the monkey manipulates objects and when it observes other monkeys or humans do the same. Neurons that respond to sound and to communicative or ingestive actions have also been identified. Although there is no direct evidence for a human mirror system, brain stimulation and imaging studies indicate increased activity in speech muscles when subjects listen to speech (Hurley and Chater 2005; see MIRROR SYSTEMS, IMITATION, AND LANGUAGE).

Signals for Speaker, Listener, and Learner

In technical jargon, phonology has been characterized as providing an *impedance match* between **SEMANTICS** and **PHONETICS** in the sense that it succeeds in coding a large number of meanings despite its use of only a small set of phonetic dimensions (Bellugi and Studdert-Kennedy 1980). How was this match achieved?

GESTURES AS BASIC UNITS. One answer is that the building blocks of speech are *phonetic gestures*, units corresponding to the discrete articulators. The argument is that, evolutionarily, as holistic utterances were processed by the mirror system, they came to be parsed into the basic articulators of the vocal tract and their preferred, natural motions. Data from early speech have been used to argue that these units, when properly timed and modulated in amplitude, produce the vowels and consonants of the ambient adult input (Studdert-Kennedy 2005).

PHYLOGENY OF THE SYLLABLE. The *frame/content theory* (MacNeilage 2008) offers an evolutionary account of the syllable. Syllables are universally associated with open–close alternations of the mandible, vowels being open and consonants closed articulations. This movement has a parallel in children's babbles, which resemble consonant-vowel sequences such as [bababa], but are in no way organized in terms of discrete segments. Rather, their *syllabic* and *segmental* character arises fortuitously from adding phonation to the open–close jaw motion. This rhythmically repeated up-and-down movement is also found in so-called lipsmacks, a facio-visual behavior in primates often combined with phonation during **GROOMING**.

Accordingly, the evolutionary path to the syllable began in deep prehistoric time when mammal biomechanics evolved for feeding. A second stage was the use of this machinery in primate communication. In a third step, this primate mechanism was coopted for speech by scaffolding early phonology on its pseudo-syllables and pseudo-segments.

QUANTAL THEORY. The **ACOUSTIC** consequences of a continuous **ARTICULATORY** movement are often noncontinuous, as illustrated by the pseudo-segmental character of babbling. In the babble example, the jaw moves continuously but the acoustics shows an abrupt change from a vowel-like to a stoplike pattern. This *quantal* jump illustrates a general fact about the phonetic space. The mapping of articulation onto acoustic parameters creates a set of acoustic patterns that forms a number of disjoint subspaces, rather than a single continuous, coherent space. Within each such subregion, sound quality is homogeneous. Voiced and voiceless sounds, as well as different manners of articulation (e.g., stops, nasals, fricatives, trills), exemplify such distinct subspaces (Stevens 1989).

USER-BASED CONSTRAINTS: ON-LINE SPEECH. The human voice is an expressive instrument that undergoes moment-to-moment retuning by many nonlinguistic factors. Consequently, the phonetic patterns conveying linguistically the "same utterance" exhibit great variability. However, the need for messages to be both intelligible and pronounceable imposes a systematic distribution on phonetic variations, placing them between clear *hyper*forms and reduced *hypo*forms. This view portrays speaker–listener interactions as a tug-of-war between the listener's need for comprehension and the speaker's tendency to simplify. There is a great deal of experimental evidence for this view of speech (Lindblom 1990).

USER-BASED CONSTRAINTS: PHONOLOGY. These user-based constraints also leave their mark on phonology, as is evident from typological data on strengthening and weakening processes in phonological rules and sound changes (Kiparsky 1988) and from attempts to simulate segment inventories. These studies indicate that systemic selections have been favored that simultaneously optimize *distinctiveness* and *articulatory ease*. An example of the effect of these conditions is the *size principle*: The larger the system, the greater the proportion of articulatorily complex segments (Lindblom and Maddieson 1988)

SELF-ORGANIZATION. These user-based constraints – in conjunction with the quantal nature of the signal space – help explain why phonologies do not recruit more of a human's total sound-making capabilities (e.g., mouth sounds and other non-speech vocalizations; Catford 1982) but prefer practically the same small set of phonetic properties. However, the study of these constraints only partially illuminates the roots of combinatorial coding. This topic has been explicitly addressed in computer modeling experiments. One such study shows how discrete phonetic targets and reuse can emerge from a dynamic systems network of agents (speaker/listener models) whose vocalizations – initially randomly distributed in phonetic space – tend to converge (driven by a magnet-like dominance of the patterns heard most often) on a few targets (Oudeyer 2006).

TARGETS AND MOTOR EQUIVALENCE. Traditionally, the basic units of speech have been assumed to be *targets*, the intertarget transitions being primarily determined by the response characteristics of the production system. Speech, like other movements, exhibits *motor equivalence*: the ability of motor systems to compensate and reach a given goal irrespective of initial conditions. This view implies that the end state of phonetic learning is a set of context-independent targets and a system capable of motor equivalence. It moreover suggests that once a target has been learned in one context, it can immediately be reused in other contexts, since the motor equivalence capability handles the new trajectory. Also, it means that, developmentally, discrete segments derive from the emergent targets and recombination from motor equivalence.

A further relevant observation on the target hypothesis is that linguistic systems with phonemically coded vocabularies would be learned faster, more easily, and in an open-ended manner than repertoires based on holistic forms (Lindblom 2007).

Conclusion

Where does combinatorial structure come from? From prespecifications in our genetic endowment? Or from a modality-independent principle shared by sign and speech and perhaps also operating in genetics and chemistry (cf. the *particulate principle* [Abler 1989])? Or from a mutually reinforcing interplay between cognitive growth and a suite of conditions entailed by communicating by vocal sounds?

In view of the materials reviewed here, a positive treatment of the last possibility appears within reach. More lexical inventions imply an increasing number of sound–meaning pairs. The linking of phonetic shapes with distinct meanings would be subject to numerous user-based constraints and processes shaping the instrinsic content of lexical entries, fractionating them into discrete units and facilitating unit recombination. Sound structure could, thus, plausibly have evolved in response to the expressive needs associated with growing semantic abilities and as a process of phonetically biased scaling, **SELF-ORGANIZING** without any formal a priori or modality-independent blueprint.

– Björn Lindblom

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PHONOLOGY, UNIVERSALS OF

Phonological universals are those aspects of languages' sound system that are found either in every or most human languages or in diverse languages where their presence cannot be accounted for by inheritance from a common parent language, geographical proximity, or borrowing. They are often referred to as *unmarked* or *default* conditions in languages' phonologies when these terms imply reference to common cross-language patterns. There are universal patterns in languages' 1) sound inventories, including their prosodies, 2) sequential constraints (how sounds are sequenced), and 3) sound changes and the phonological alternations they create within a given language. They are of interest because they give insight into the physical factors that shape human speech, help to elucidate mechanisms of sound change, and, perhaps, suggest something about the supposed human innate capacity for language. There is a sizable literature on phonological universals (e.g., Greenberg, Ferguson, and Moravcsik 1978; Maddieson 1984), and it will not be possible in this limited space to discuss and exemplify more than a few of those that have been discovered. What is more important and what will be emphasized here is a consideration of the explanation for phonological universals. The best evidence presented so far points to their phonetic origin.

A caveat: Phonological universals – as with any other phonological generalization – are inevitably stated in terms of a traditional pretheoretic taxonomy. One should always be alert to the possibility that the taxonomic terms devised for purely practical and descriptive purposes may not conform to the true essence of speech, just as, for example, a pretheoretic category for living animals of "those that fly" would result in a heterogeneous class that included birds, bats, flying fish, and winged insects to the exclusion of penguins, ostriches, emus, and kiwis.

Universals Deriving from Speech Aerodynamics

All languages have consonants and vowels. Among consonants, all languages employ stops. Among stops, voiceless stops are the default; that is, if a language employs voiced stops it will also have voiceless stops, but not the reverse. This can be explained by the *aerodynamic voicing constraint* (AVC) (Ohala 1983): Voicing requires air flow through the approximated vocal cords, and this requires a positive pressure differential between the subglottal and the oral air pressures. During obstruents, the flowing air is blocked by the consonantal closure so that air accumulates in the oral cavity, thus increasing the oral air pressure above the glottis such that eventually the required pressure differential diminishes, thereby reducing transglottal airflow below the level needed for vocal cord vibration. Another universal pattern explained in part by the AVC is that among languages that do have voiced stops, it is often the case that the back-articulated stop is missing, for example, as in Dutch and Thai. This is because insofar as the AVC can be ameliorated, it is due to the compliance of the surfaces of the vocal tract to the impinging oral air pressure. The magnitude of this compliance is greatest for labial obstruents (due to expandability of the cheeks), less for apicals, and least for velars, which have the least surface area exposed to the oral pressure. These factors also help to explain the kind of sound change that occurred in Nubian, now manifested as a morphophonemic alternation, whereby geminated voiced stops become voiceless at all places of articulation except labial (Table 1; data from Bell 1971).

Among languages that have both voiced and voiceless stops, there are many that have only voiceless fricatives (e.g., Thai, Galician, Taba). Again, the AVC is part of the explanation: As

Table 1

Noun stem	Stem + "and"	English gloss
/fab/	/fab:ɔn/	Father
/sɛgɛd/	/sɛgɛt:ɔn/	Scorpion
/kadʒ/	/kaʧ: ɔn/	Donkey
/mɔg/	/mɔk:ɔn/	Dog

Table 2.

Language	Voiceless and voiced	Voiced only
Awadi	i, u, e	a, o
Campa	i	o, e, a
Chatino	i, u	o, e, a
Dagur	i, u, e	o, a
Huichol	i, ɨ, e	u, a
Serbo-Croatian	i, u	e, o, a
Tadjik	i, u, a	e, o, u
Tunica	u	i, e, ɛ, a, ɔ, o
Uzbek	i, u	e, ɔ, o, a

mentioned, optimal conditions for voicing require oral pressure as low as possible (with respect to subglottal pressure), but optimal conditions for generating frication (turbulence) at an oral constriction requires the oral pressure as high as possible (with respect to atmospheric pressure). These conditions are contradictory. Thus, voiced fricatives are less common than voiceless ones. Phonetically, in languages that have both voiced and voiceless fricatives (e.g., English, French, Italian, etc.), the frication noise of voiced fricatives is always less than that for voiceless fricatives.

Although all languages have voiced vowels, some languages feature voiceless vowels as well, though often these are contextually determined, for example, word finally or in the environment of voiceless consonants. In any case, it seems to be always the case that a voiceless vowel has a voiced counterpart. J. H. Greenberg (1969) provided a survey of the incidence of voiceless vowels in several languages. He found a virtually uniform pattern: Voiceless vowels appear as the counterparts to vowels higher in the vowel space. (See Table 2.) The explanation for this also requires reference to the AVC. Among vowels, high, close vowels like [i] and [u] are *almost obstruents*. If articulated sufficiently close, they impede the exiting airflow almost as much as fricatives. This, in combination with other factors that could create a slightly open glottis via coarticulation, such as appearing in word- (and thus utterance-) final position or near voiceless obstruents, can lead to the vowel being voiceless. The same factors apply to glides (approximants) that are high, close like [j], [w], and [ɻ] and account for the frequent devoicing and fricativization that gives rise through sound change to cases like the dialectal alternations in English as *Tuesday* [tʰjuzdi] ~ [tʃʱuzdi], and *lieutenant* [lɪwtɛnənt] ~ [lɛftɛnənt] and *truck* [tʰɻʌk]~[tʃʱɻʌk] (and similar patterns in many other languages). The same factors frequently lead to the affrication of stops before high close vowels or glides as in Japanese, for example, or the sound change that converted Benjamin Franklin's *natural* [nætjuɻəl] to the modern pronunciation [næ t͡ʃ əɻəl].

Aerodynamic factors also explain patterns of nasal prosody in languages as diverse as Sundanese (spoken in the Indonesian archipelago) and Tereno (spoken in the Mato Grosso, Brazil). As shown in Table 3, in these (and other) languages, the presence of a nasal consonant induces nasalization on all vowels and

Table 3.

a. Sundanese:

ɲãĩãn	"to wet"	
bɤŋñãr	"to be rich"	
ɲãñõkɤn	"to inform"	
mĩʔãsih	"to love"	

b. Tereno:

1st person	3rd person	
piho	ᵐbiho	"I/he went"
ahajaʔaʃo	aⁿʒaʔaʃo	"I/he desire(s)"
iso	ĩnzo	"I/he hoed"
owoku	õw̃õⁿgu	"my/his house"
ajo	ãjõ	"my/his brother"
emoʔu	ẽmõʔũ	"my/his word"
iha	ĩⁿza	"my/his name"

Sources: For Sudanese: Robins 1957; for Tereno: Bendor-Samuel 1960, 1966.

glides following, unless blocked by a buccal obstruent (that is, one made in the oral cavity from the uvular-velar region to the lips). Nonbuccal obstruents such as the glottal fricative [h] or the glottal stop [ʔ] do not block it. This follows from a straightforward physiological constraint: Buccal obstruents, insofar as they require the buildup of oral pressure, cannot tolerate venting of this pressure via an open velic port. The nonbuccal obstruents require a pressure buildup in a cavity that does not access the velic port, and so whether the velic port is open or closed is irrelevant to their production.

Among fricatives, the most common are the apical *s*-like fricatives (Maddieson 1984). This stems from a combination of aerodynamic and anatomical factors. Apical fricatives have relatively long and intense noise in the high frequencies (3 to 8 kHz) and are thus easily detected and are distinct from all other speech sounds. This is due to the fact that the approximation of the tongue apex at or near the alveolar ridge enables the generation of a relatively focused high-velocity air jet, which itself generates noise, but the air jet is also directed at the incisors, which act as a baffle and cause the generation of more high-frequency noise as the air hits the teeth surface (this is why "s" sounds are impaired in the speech of juveniles when they lose their primary teeth and before the growth of their permanent teeth). Additionally the small space between the tongue apex and the lips constitutes a resonator that reinforces high frequencies.

The existence and properties of a resonator downstream of the point where turbulent noise is generated underlies another marked asymmetry in the incidence of stop types. We saw previously that in languages that have both voiced and voiceless stops, the voiced velar stop [g] is often missing. Among voiceless stops, the bilabial [p] is often missing (Sherman 1975), for example, in Arabic and in Aleut (except for loanwords) and in Proto-Celtic. Noise generated by the air turbulence at the lips have no downstream resonator to amplify the noise.

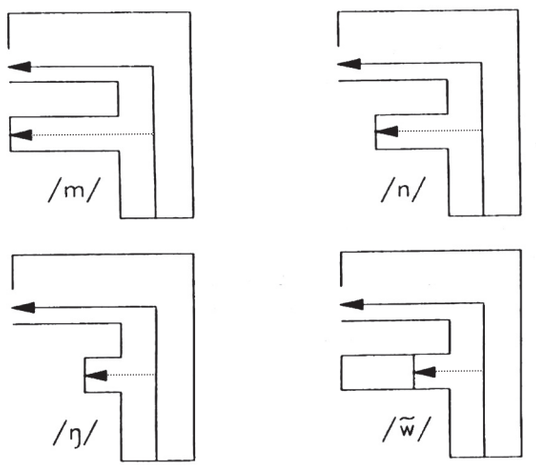

Figure 1. A schematic representation of the resonating cavities during the production of different nasal consonants. The solid line demarcates the main pharyngeal-nasal cavity, which is the same for all such nasals. What differentiates one nasal from another is the effect produced by the oral resonator, which branches off this main cavity. Even though a labial velar consonant has two main constrictions, it is only the rearmost, the velar constriction, that matters and thus sounds similar to the velar nasal [ŋ].

Table 4.

Kpelle: [w] patterns with velars in nasal assimilation:

Indefinte	Definite	
ɓɔ́ɔ	ˋmɔ́ɔi	"wax"
lúu	ˋnúui	"fog, mist"
γîla	ˋŋìlaī	"dog"
wée	ˋŋwéei	"white clay"

Notes: Melanesian: m > ŋ / __w:
Common Melanesian /limwa/ 'hand' ~ Fijian /linga/ (= phonetic [liŋʷa])
/mala/ ~ /mwala/ ~ /ŋwala/ (name of the Mala Island in different dialects of the island)

Sources: For Kpelle: Welmers 1962; for Melanesian: Ivens 1931.

Virtually all languages employ nasal consonants (Ferguson 1963). However, there are never more place distinctions among nasals than there are obstruents, and there are often fewer. The acoustics of nasals probably account for this. All nasal consonants have in common the pharynx-plus-nasal air space. What differentiates one nasal consonant from another is the effect of the oral cavity, which branches off the nasal-pharyngeal cavity (see Figure 1). Thus, although nasals are highly distinct as a class from non-nasals, they are auditorily very similar to one another. This also partly accounts for the frequent pattern whereby nasals assimilate in place to a following stop, for example, English *incredible* [iŋˈkʰɻɛɾəbl]< *in* (neg. prefix) + *credible*; Latin *quīnctus* > *quīntus* (where original *n* = [ŋ] > [n] / __t).

An interesting cross-language pattern is the character of nasal assimilation to labial velar consonants such as [k͡p], [g͡p] and [w], that is, segments that have equal constrictions in the labial and velar region. The nasal that appears before such segments in invariably a velar [ŋ] not the labial [m], for example, Kpelle and Melanesian (Table 4). The explanation for this pattern can be seen in Figure 1. What matters for the place of articulation of a nasal consonant is the first buccal constriction encountered from the nasal pharyngeal cavity. In a labial velar, this is the velar constriction; the labial constriction, being beyond that, is acoustically largely irrelevant (Ohala and Ohala 1993).

Phonotactics

The conventional view of common cross-language sound sequencing or *phonotactics* is couched in terms of what's called the *sonority hierarchy*' (attributed to E. Sievers and O. Jespersen), whereby the favored pattern at syllable onset shows sounds sequenced in the following order (where omissions are possible): *stop* + *fricative* + *nasal* + *liquid* (i.e., non-nasal continuant) + *glide* + *vowel* and at syllable offset, the reverse. The English words *swamp* and *tryst*, the French words *plume* [plym] and *soir* [swaʁ], and the Czech *Psov* "name of a city" [psɔf] would thus adhere to this generalization. But there are reasons to be skeptical of the sonority hierarchy. First, there is no empirical content to the term *sonority*; it has never been adequately defined. Second, it ignores such very common clusters as /sp/, /st/, and so on in syllable initial position and /ps/, /ts/, and so on in syllable final position. Third, it ignores cross-language prohibitions of onset sequences like /tl/, /dl/, /ji/, /wu/, /tʷu/, and /bʲi/, that is, sequences that have similar elements. John Ohala and H. Kawasaki-Fukumori (1997) suggest replacing a) the one-dimensional concept of sonority with a multidimensional measure, where similarity of sounds is a function of acoustic amplitude, formant frequencies and spectral shape in general, degree of periodicity (whether from fricatives or stop bursts), and even fundamental frequency; and b) the notion of the fixed hierarchy with a measure of the degree of similarity of sounds according to (a). The more two sounds are similar, the less common would such sequences be found; the greater the difference in sounds, the more common. By this criterion, initial sequences like /sp/and final sequences like /-kst/ (in English *text*), and so forth are normal, and initials /tl/, /ji/, /wu/, and so forth are less preferred.

Sound Changes

Of the thousands of regular sound changes that have been identified using the comparative method in historical phonology, certain ones are recognized as showing independent cross-language incidence. One such is *velar palatalization*, k > t, t͡ʃ, s, ʃ /__i (j), (and similar changes involving the voiced velar /g/), for example, English *cheese* [tʃʰiz]] from Latin *caseus* (cf. Dutch *kaas*); Ikalanga [t͡ʃi-ledu] "chin" < Proto-Bantu **ki-de'du*. Traditionally, the causes of sound change were attributed to two opposite tendencies: speakers striving for "ease of articulation," which would lead to assimilations and reductions, and speakers striving to speak more clearly, which would lead to exaggeration of articulation and augmentation of pronunciation. There is no doubt that speakers do alter their pronunciation in these manners, but it may be seriously questioned whether

these changed forms replace previous norms of pronunciation. There is no evidence for this. There is, however, an alternative scenario of sound change that does have empirical support: listeners' errors. There have been numerous speech-perception experiments, some involving natural speech, which revealed errors that mirrored sound change; for example, in a study in Winitz Scheib, and Reeds (1972) where listeners heard a fragment of consonant/vowel (CV) syllables, [k^hi] was misidentified as [t^hi] 47 percent of the time, paralleling the change in place found in velar palatalization. Ohala (1981) has elaborated a theory of sound change based on listeners' misperception or misparsing of the speech signal. Such common sound change includes VN > $\tilde{V}$, for example, Sanskrit *dant* "tooth" > Hindi /dāt/, Latin *bon-* "good" > French /bõ/, and the assimilation of place in C_1C_2 consonant clusters, Latin *scriptu* > Italian *scritto*, English *congress* [$k^haŋgrɛs$] < (ultimately) Latin *com-* "together" + *gradi* "to walk."

Phonological Universals and Universal Grammar

It has also been proposed that phonological universals arise from humans' genetic endowment in the form of what's called *universal grammar* (Pertz and Bever 1975). Such claims have been disputed by those who find phonological universals rooted in the physical and physiological attributes of all human speakers and hearers. The dust has not settled on this issue as yet.

– John Ohala

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PHRASE STRUCTURE

It is an ancient observation that natural language **SYNTAX** is hierarchically organized. As can be seen from a variety of diagnostics, the **WORDS** comprising a **SENTENCE** do not behave as beads on a string but group into successively larger units, or constituents. Phrase structure (PS) is a formal representation of this **CONSTITUENT STRUCTURE**. PS is typically depicted as a tree-structured graph (Figure 1), which encodes three sorts of structural information: i) *dominance*, specifying the words and constituents that a constituent contains within it (e.g., as shown by vertical placement in the figure, *prepositional phrase* (PP) dominates *on* and *television*); ii) *precedence*, specifying the temporal orderings among the words and constituents (e.g., as shown by horizontal position, the constituent *most fans* precedes the constituent *watched the game on television*); and iii) *labeling*, specifying the grammatical category of each word and constituent (e.g., the constituent *the game* is a *noun phrase* [NP]). In PS-based approaches, this structural information plays an important role in defining the conditions under which grammatical dependencies may obtain (see AGREEMENT, ANAPHORA, BINDING, and CASE), and PS is often taken to be the input to transformational operations (see MOVEMENT and TRANSFORMATIONAL GRAMMAR). Further, PS representations serve as the interface between syntax and *semantics*, as they provide the structural information necessary for interpretation (see COMPOSITIONALITY, THEMATIC ROLES, and LOGICAL FORM).

A fundamental question concerns how the range of possible PS is specified in a grammar. The earliest answer comes from Noam Chomsky (1957), who suggests that PS is generated by a set of phrase structure rules, like the following:

1. S → NP VP

2. NP → N

3. NP → Det N

4. VP → V NP

5. → VP PP

6. PP → P NP

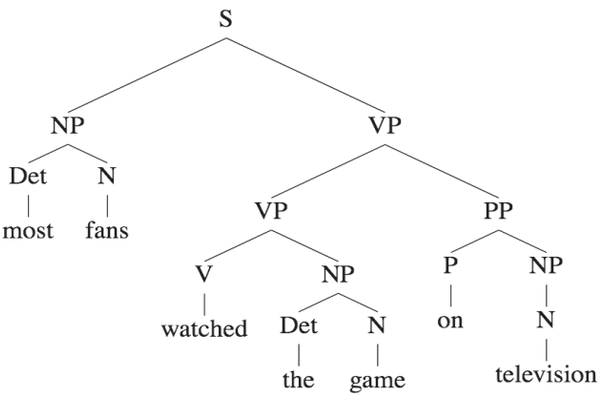

Figure 1. Phrase structure representation for Most fans watched the game on television.

In these rules, a symbol appearing to the left of the arrow can be rewritten as the sequence of symbols to the right of the arrow. The process of PS generation begins with a distinguished start symbol *S* and successively rewrites the symbols in the string using the rules of the grammar until no rewritable symbols remain. An example of this process follows, with the number above each arrow indicating the rewriting rule used:

$$S \overset{1}{\Rightarrow} NP\ VP \overset{3}{\Rightarrow} Det\ N\ VP \overset{5}{\Rightarrow} Det\ N\ VP\ PP \overset{4}{\Rightarrow} Det\ N\ V\ NP\ PP \overset{3}{\Rightarrow}$$

$$Det\ N\ V\ Det\ N\ PP \overset{6}{\Rightarrow} Det\ N\ V\ Det\ N\ P\ NP \overset{2}{\Rightarrow} Det\ N\ V\ Det\ N\ P\ N$$

The PS in Figure 1 can be understood as a history of this derivation: The children of a node correspond to the sequence of symbols into which that node is rewritten. Some recent approaches have maintained rewriting as part of the grammar but have questioned the nature of the rewrite rules employed in this system, generalizing and modifying them in a variety of respects (see X-BAR THEORY and MINIMALISM). Other approaches have abandoned rewriting, taking well-formed PS representations to be those that best satisfy a set of grammatical constraints (see HEAD-DRIVEN PHRASE STRUCTURE GRAMMAR, LEXICAL-FUNCTIONAL GRAMMAR, and OPTIMALITY THEORY).

– Robert Frank

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PIDGINS

Pidgins are the world's only non-native languages. They are typically acquired by adults, after the *critical period* for language acquisition has passed. They normally arise wherever sufficient speakers of mutually incomprehensible languages must interact with one another. Some pidgins arose through and for trade; the most plausible derivation offered for the origin of the name *pidgin* attributes it to the Chinese pronunciation of "business" (Baker and Muhlhausler 1990). Pidgins used widely for trading purposes (but not limited to such functions) include Russenorsk, Chinese Pidgin English, and Chinook Jargon, once widely used in the American Northwest. Other pidgins arose where large numbers of slaves and/or indentured laborers had to work together on colonial plantations. Such pidgins were usually short-lived, evolving into creole languages; contrary to some claims, careful examination reveals manifold signs of their pidgin ancestry, and the earliest attestations of some (Baker and Corne 1982; van den Berg 2000) show pidgin-like structures Although the reality of this "pidgin-to-creole" cycle has been denied (see entry on CREOLES), massive empirical evidence exists in Hawaii, as described by S. J. Roberts (1995, 1998); there is also evidence of prior pidginization in other creoles, such as fossilized sequence markers and marked vocabulary mixture (see the following examples).

As compared with natural languages (including creoles), all pidgins are severely impoverished, with sharply reduced vocabularies, few structural consistencies, and few if any inflectional affixes; complex sentences very seldom occur. Function words are rare, if not completely absent; categories normally expressed via auxiliary verbs of tense, mood and aspect are indicated, if at all, by two adverbial forms meaning roughly "soon" or "finish" that are attached, not adjacent to the verb as in natural languages generally, but clause-finally or clause-initially. We find, for example, *baimbai* (English "by-and-by") and *pau* (Hawaian "finished"), *baimbai* and *pinis* in Tokpisin; also a number of similar pidgin fossils in creoles (sometimes inside, sometimes still outside the verb phrase), such as *fin(i),* "finish" in French-relasted creoles, "done" in English-related creoles, or (*ka)ba* (Portuguese *acabar* "finish") in Portuguese-related creoles.

If a pidgin persists in a relatively stable population (one not subject to the rapid expansion and turnover that typically characterize creole societies) and is widely used over a long enough period, it may acquire a more stable (although still limited) structure. However, pidgins still suffer from widespread misunderstanding of the linguistic mechanisms through which they arise. According to many writers (e.g. Bakker 1995; Manessy 1995) they are "reduced" or "simplified" versions of preexisting languages, or failed attempts by speakers with inadequate access to acquire the locally dominant language – a view reinforced by standard usage of expressions such as "Pidgin English," "Pidgin French," and so on.

Pidgins do not derive from processes applied to any preexisting natural language, however, but (as is clear both from historical data in Hawaii and reminiscences of older residents; see, e.g., Bickerton 1981, 11) arise naturally from strategies employed by individuals of any ethnic background in a multilingual situation where no single existing language is both viable and accessible. Speakers seek to communicate by any means possible, using isolated words from their own language, from their interlocutor's language (if they know any), and from any third or fourth language that they may happen to have picked up.

These words are seldom assembled in the way words are assembled in modern human languages, that is, hierarchically. Except for occasional rote-learned phrases, words are attached sequentially, like beads on a string. Consequently, no true grammatical relations exist, limiting utterances to brief strings of a few words without embedding.

The degree to which pidgins (and subsequent creoles) show lexical mixture has been underestimated in the literature. Noteworthy are Russenorsk (with roughly equal quantities of Norwegian and Russian words, but also 14% of its vocabulary drawn from other languages; Broch and Jahr 1984) and Chinook Jargon (only 41% from Chinook, with at least 11 other languages, European and non-European, contributing to the remainder; Gibbs 1863). The *baragouin* that preceded the formation of the Lesser Antillean French Creoles showed a similar mixture (Wylie 1995).

Evidence from creoles suggests that the pidgins they evolved from had equally mixed vocabularies. Berbice Dutch draws 27 percent of its vocabulary from one African language, Ijaw (Smith, Robertson, and Williamson 1987). Saramaccan may have as many as 50 percent African words (Price 1976). Comparison of Saramaccan and Sranan vocabularies shows that these creoles, both derived from the same pidgin, differ in perhaps as many as 75 percent of their vocabulary items; contra most sources, relatively few of these differences involve a Portuguese/English contrast, strongly suggesting an antecedent macaronic pidgin that drew on English, Dutch, and Portuguese, as well as a variety of African and Amerindian languages, and from which Sranan and Saramaccan each made a different selection.

Why pidgins have so often been regarded as simplifications of particular (almost invariably, European) languages is revealed by the massive database of contemporary citations gathered by Roberts (summarized in Roberts 1995, 1998. 2005, but not yet published in its entirety). From this data, it is clear that pidgin descriptions have been shaped by observer bias. Most citations from English-language sources contain a preponderance of English words, showing why J. E. Reinecke (1969) and others characterized the lingua franca of early Hawaii as a predominantly English pidgin with a sprinkling of Hawaiian words. However, the abundant Hawaiian-language sources reverse this picture, presenting a predominantly Hawaiian vocabulary with a sprinkling of English words, while the much sparser Japanese-, Chinese-, and Portuguese-language sources each contain a higher admixture of their own languages (brief sentences containing words from three different languages are by no means uncommon). Clearly, in a pidgin situation, observers record what they best understand and downplay or ignore the rest.

The well-attested existence of a pidgin phase in the life cycle of creoles also helps to explain the strong structural similarities that hold between creoles of widely different provenance. For such similarities to arise, input had first to be reduced to an abnormally low level of structure, forcing children to draw on their innate language faculty for the systematic structures that a pidgin can manage without, but that are essential for any natural language.

– Derek Bickerton

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PITCH

When an object vibrates, its movement produces changes in air pressure that radiate like waves from the source. If the frequencies of the vibrations are roughly between 20 and 20,000 cycles per second, or Hertz (Hz), ideally they can be heard by a young, healthy human listener. The range of hearing frequencies declines with age. The physical characteristic of the vibrating body, *frequency*, produces a psychological experience called pitch. In general, a low frequency produces the sensation of a low pitch (for example, the 60 Hz hum produced by electrical power in a poorly grounded radio), with the pitch increasing as the frequency increases (a male voice at 100 Hz, a female voice at 200 Hz, a child's voice at 300 Hz). Because there is a close correspondence between frequency and pitch, people frequently use the terms interchangeably. However, in addition to frequency, the sensation of pitch is influenced by an interaction between the amplitude of the vibration and the range of the frequency. Pitch is also influenced by the complexity of the vibration and its corresponding wave form.

A vibrating body oscillates as a single entity, producing a frequency referred to as the *fundamental frequency*. So, when the key for A above middle C is played on a piano, a string vibrates at 440 Hz. Vibrating bodies are not perfectly rigid, though, and the string also vibrates in parts as if it is two strings (producing a frequency of 880 Hz), and three strings (1320 Hz), etc. Thus, a vibrating body produces a series of frequencies beginning with the fundamental frequency (f0) and including its harmonics, which are multiples of the f0. The distribution of acoustic energy

across the harmonic series contributes to the quality or timbre of the sound. In addition to sound quality, the harmonics contribute significantly to the perception of pitch. The fundamental frequency of a harmonic series can be artificially removed without changing the pitch, a demonstration referred to as the *missing fundamental*. In speech, the harmonic series is a function of the complex wave produced by the glottal source. *Formants* are bands of resonance that concentrate the acoustic energy produced by the glottal source as a function of the vocal tract configuration and have center frequencies that reflect the vocal tract, rather than the harmonic series.

Pitch can be experienced from pure tones (f0 alone), which do not occur naturally, as well as from complex tones (f0 + harmonic series), but the pitch of complex tones is a stronger percept, allowing finer discriminations of f0 frequency differences. The processing of pitch from a determination of the f0 versus the pattern recognition of a harmonic series relies on different neurological systems. Simple frequency determination can occur at multiple levels of the nervous system, but complex pitch processing occurs in auditory areas in the right cerebral hemisphere that complement speech and language areas in the left cerebral hemisphere (Sidtis 1980; see also RIGHT HEMISPHERE LANGUAGE PROCESSING and LEFT HEMISPHERE LANGUAGE PROCESSING).

For practical purposes, pitch in language can be viewed as a direct function of f0. Unlike the pitch distinctions made in music, linguistic pitch distinctions are comparatively coarse. Whereas a musical octave can be divided into 12 semitones, and vibrato in experienced singers can be consistently less than a semitone, most linguistic communicative situations only require distinctions of three semitones or more. Further, the pitch distinctions in language are relative, allowing men, women, and children to make the same linguistic and paralinguistic distinctions despite different vocal f0s (see PARALANGUAGE), whereas pitch distinctions in music reference specific frequencies (e.g., a musical scale tuned to 440 Hz).

A number of linguistic and paralinguistic phenomena are provided by pitch. At the suprasegmental level, pitch produces the melodic line of an utterance to convey linguistic **INTONATION** (e.g., declination effect: falling pitch anticipating the end of a statement, rising pitch indicating a question), **SOCIOLINGUISTIC** information (e.g., uptalk, rising pitch at the end of a statement, falling pitch as a cue for turn-taking), and paralinguistic information (e.g., emotion, attitude). Pitch can also be used with loudness to provide **SYLLABLE** accent at the segmental level.

Pitch also has a lexical role in **TONE** and pitch accent languages. Tone languages may have many tone patterns (estimates vary, but the numbers are fewer than the 12 notes in the musical octave), and they tend to fall in relative categories like high, medium, and low, further distinguished by rising and falling patterns. Because such distinctions are relative, the listener is required to perform a tone normalization to identify a speaker's lexical tones. Just as simple and complex pitch perception rely on different brain mechanisms, the processing of pitch for linguistic and nonlinguistic purposes engage different neurological systems, principally the **TEMPORAL LOBES** in the left and right cerebral hemispheres (Van Lancker and Fromkin 1973).

In sum, the perception of pitch can play linguistic and paralinguistic roles at the suprasegmental and segmental levels of utterances. Pitch is closely related to the physical stimulus frequency, but as a psychological event, it is influenced by the complexity, frequency range, and loudness of the tone. Pitch can be processed in a low-resolution mode at many levels in the nervous system or at high-resolution mode in specialized areas of the cerebral cortex of the brain in the right temporal lobe. Pitch can also be processed in linguistic and nonlinguistic modes by the left and right temporal lobes of the brain, respectively. The variation of pitch during fluent speech can be considered a truly integrative process that conveys both linguistic and paralinguistic information.

– John Sidtis

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POETIC FORM, UNIVERSALS OF

A poetic universal is manifested by a feature that is found very widely (for example, rhyme; see RHYME AND ASSONANCE) or by a relation between features that is found very widely (for example, rhyme is generally found in verse, not in prose). Like linguistic universals, poetic universals might be studied by comparative work (often depending on fairly salient features) or by focused work on the abstract forms (hypothesized abstract universals) underlying the surface poetic forms in a particular language. A theory of universals can be formulated in terms of universal *parameters* (sets of related formal options) from which a specific poetic tradition makes specific choices. Unlike a language, where only one choice can be made, a literary tradition can divide into subtraditions, each making a different choice (thus, for example, classical Sanskrit literature includes quite different kinds of metrical verse). There is no presupposition that different modalities will throw up significantly different universals; thus, the general assumption is that written, oral, and signed literatures will have similar characteristics (see ORAL COMPOSITION and **SIGN LANGUAGES**. The term *literature* is here used interchangeably with *verbal art* and should not be used to imply a special status for written literature.

With the exception of folklore studies (which, however, tend to have a narrow areal range), no discipline or subdiscipline takes as its responsibility the investigation of poetic universals. Some researchers are actively hostile to universals in favor of an alternative emphasis on the special characteristics of each tradition, and some fieldworkers ignore verbal arts when they

gather information about a language; some missionary linguists have even been known to displace indigenous verbal arts with hymns or Bible stories, with the odd result that it is these, rather than indigenous texts, that are gathered in grammars and other reports. Thus, there has been relatively little work, either descriptive or theoretical, on poetic universals.

The universal of poetic form that is most widely manifested, and may indeed be found everywhere, is the possibility of verse, as a way of organizing language. A text that is "in verse" is a text cut into a sequence of lines (= **VERSE LINES**). A line is a section of text that supports two or more generalizations, and the investigation of universals of poetic form is largely an investigation of the generalizations formulated in terms of the line.

For example, Milton's poem *Paradise Lost* is in lines, and so is verse. (This example is chosen [see Fabb 2002] because in the eighteenth century some critics claimed that it was *not* verse.) Here are five generalizations that are supported by the line in this poem: 1) There are 10 syllables in each line; 2) the end of the line coincides with the end of a word; 3) while there is a tendency for stressed **SYLLABLES** to be in even-numbered positions, the line-initial position is often also occupied by a stressed syllable; 4) the word *of* is found with greater than expected frequency as the first word in a line, as seen, for example, in the first two lines of the poem; and 5) the printed form of the text arrays lines in a vertical sequence. The study of poetic universals seeks to establish the distribution of each of these kinds of form (i.e., each of these generalizations) and then to understand whether these distributions imply anything about poetic universals.

What would the study of poetic universals make of these generalizations? Generalization 1 can be understood more abstractly as "the line contains a specific number of syllables," and this is definitely a universal, in the sense that it is true of many verse traditions; however, we might also ask whether the fact that there are specifically 10 syllables in the line also constitutes a (more narrowly manifested) universal. Generalization 2 is also very widespread; while lineation does not necessarily respect phrase or **SENTENCE** boundaries, **WORD** boundaries are usually respected (and this connects with the fact discussed later that metrical rules control for word boundaries but not for phrase or sentence boundaries); hence, there is an interesting potentially universal relation between the line that is a nonlinguistic section of text and the word that is a linguistic constituent. Generalization 3 in its specific formulation is generally true of English, but more abstractly the possibility of relaxing a rule at the beginning of a line is found widely; for example, Greek verse lines often begin with a syllable whose weight is uncontrolled (*anceps*). Generalization 4 holds true also of eighteenth- and nineteenth-century verse after Milton; is it telling us something significant about *of* or about the naturalness of beginning a line with a preposition phrase? On the one hand, we might say that post-Miltonic verse is just imitating a kind of form that Milton may have invented, but we might also note that much twentieth-century free verse also favors preposition-initial lines. It is worth noting that the Greek early elegiac poets tended to begin and end lines mainly with words used previously by Homer, suggesting again that choice of particular words at line edges has the potential to be a universal. This generalization also draws attention to the fact that literary practices can have features in common because of imitation of an admired writer or foreign tradition. Finally, generalization 5 is not true of all ways of writing verse, but we might ask whether the wide acceptance of this practice tells us something about the cognitive status of lines (e.g., that we cognize each line as a separate, isolated unit). These are the kinds of questions we might ask in exploring the possibility of universals of poetic form.

Relative to the line, six categories of poetic form might be identified, which follow; there may be others (such as the tendency to use specific words at line edges), and the grouping in this list depends on theoretical assumptions and is not simply given to us by the data. For each of the categories, we might explore its status as a universal. None of these kinds of form is required in a verse tradition. Most verse traditions are either metrical (i.e., they involve the counting of syllables) or parallelistic, which is itself an interesting universal. Either metrical or parallelistic verse can also have rhyme and **ALLITERATION**, though **RHYTHM** and word boundary rules are usually found only in metrical verse. There are some verse traditions, such as modern free verse, that do not consistently manifest any of these categories of poetic form (but, as noted, they may manifest other categories of poetic form, such as the tendency to use particular words or particular **SYNTACTIC** structures at line edges).

1. The counting of syllables: In all metrical verse, the line has a specific number of syllables (Irish *deibhidhe* has 7, Icelandic *dróttkvaett* has 6) or a defined range of possible numbers of syllables (English iambic pentameter is normatively 10 but permits 9–11, French *alexandrin* 12–13, Homeric dactylic hexameter 13–17, Japanese haiku 3–5 or 4–7 in different lines, etc.). Some theories of meter suggest that units other than syllables can also be counted, such as *morae* (subsyllabic units) or larger groupings of syllables. Across literary traditions, we find that not all syllables in the line are counted for metrical purposes; in particular, when a vowel-final syllable precedes a vowel-initial syllable, many traditions permit or require these to count as a single metrical syllable. Various other generalizations can be made about the counting of syllables, which may be the source of universals (this is the basic claim of Fabb and Halle 2008).

2. The patterning of syllables, requiring a division of syllables into two classes for metrical purposes: Accentual rhythms manifest this type of patterning, where syllables are distinguished into two classes as stressed versus unstressed and patterned on this basis, for example, into triplets where every third syllable is stressed. More generally, most kinds of metrical verse divide syllables into two classes, on the basis of stress, syllable weight, lexical tone, or whether they alliterate and on possibly other characteristics yet undiscovered); the class membership of a syllable then admits it to specific positions within the verse line. In some cases, the distribution of the two types of syllable is periodic (e.g., a regular recurrence as in an iambic rhythm) and in other cases partially periodic or apparently nonperiodic (as in the superficially aperiodic sequences of heavy and light syllables required in Classical Sanskrit verse). An interesting rhythmic universal is that syllables are divided into just two classes for metrical purposes, even when there would be a basis in the

language for more than two classes. For example, Vietnamese has six types of lexical **TONE,** which are grouped into just two tonal classes for the purposes of metrical regulation. It has been claimed that another rhythmic universal is based on the (**OPTIMALITY-THEORETIC**) **PHONOLOGICAL** notion of the *moraic trochee* as a basic rhythmic unit (see, for example, Golston and Riad 2005). Robbins Burling (1966) claimed that a certain combination of meter and rhythm is found universally in children's verse.

3. Word-boundary rules: In the metrical line, two adjacent syllables can be required to be in separate words – that is, a word boundary must intervene (by a caesura rule); or they can be required to be in the same word – that is, a word boundary must not intervene (by a bridge rule). Thus, for example, the sixth syllable in a French 12-syllable *alexandrin* must be word-final. Word-boundary rules are widespread, and this suggests an underlying universal. In particular, the word seems to have a special status in meter: Metrical rules do not control for phrase or sentence boundaries, and this also points to a universal.

4. Rhyme – understood as the repetition of the end of the syllable (usually including its nucleus): Rhyme is very widespread, including in nonmetrical verse: Parallelistic verse can have rhyme, and we may even find rhyme of a kind in prose. Rhyme would seem to manifest a universal. Furthermore, it is cross-linguistically true that sound sequences can be counted as rhyme that are phonetically dissimilar but share underlying similarities; this possibility, and perhaps the way in which dissimilar phonetic sequences are admitted as equivalent, may manifest universals.

5. Alliteration: Understood as the repetition of the beginning of the syllable (sometimes including its nucleus), alliteration is much rarer than rhyme, which may itself tell us something about poetic universals. The fact that words beginning with dissimilar vowels are considered to alliterate in separate traditions (e.g., Old English and Somali) may suggest a universal. Alliteration also appears to be subject to locality constraints that do not hold for rhyme; thus, alliteration tends to be line-internal or between adjacent lines and does not "interlace" as rhyme does in ABAB structures (Fabb 1999).

6. Parallelism: This formal property is very widespread in the literatures of the world, and Roman Jakobson (1960) thought of it as a defining formal characteristic of poetry because it draws attention to form by repeating it (he included meter, rhythm, rhyme, and alliteration as types of parallelism). There are different kinds of parallelism, all quite widely distributed, including parallelism of sound sequences, parallelism of words, and parallelism of syntactic structures. Universals have yet to be established.

Lines may be organized into larger units, such as stanzas. The possibility of organizing lines into stanzas is sufficiently widespread as to count as a universal. Stanzas have characteristics, such as having a specific number of lines, lines of the same or varying lengths, or rhyme. While there is clearly much variety, universals may be discovered, perhaps involving the way lines are counted in a stanza, or the possible ways in which rhyme patterns can be structured. For example, there may be locality effects, such as limits on the possible distance (e.g., number of intervening lines) between related elements in different lines. (Bruce Hayes and Margaret MacEachern 1998 discuss universals in stanza structure.)

Are there any kinds of poetic form that are unrelated to the line? In part, this is a matter of definition (i.e., of whether we intend *poetic* to mean "verse"). Clearly, various types of figure and trope are widely found in the world's literatures, and not only in verse (though these may be better understood as linguistic or pragmatic universals, rather than poetic universals; see PRAGMATICS, UNIVERSALS IN). And there are possible universals of narrative form (see NARRATIVE UNIVERSALS) that might also be thought of as "poetic," some of which may in fact be related to universals of verse form. It is possible that there are universals that relate verbal art to counting (perhaps via "the aesthetic," and perhaps extending beyond verbal art). Metricality is based on counting, as are the kinds of form closely related to metricality, such as rhythm and word-boundary placement. Parallelism may be based on counting of a different kind (a tally or one-to-one alignment). Narratives seem to involve counting at various levels, including Dell Hymes's (1992) suggestion that narratives are structured around pattern numbers, with narrative units organized in two and four or in three and five in a particular tradition.

What is the relation between poetic form and linguistic form? One widely held view (associated, for example, with Jakobson) is that the forms of poetry in a particular language are dependent on the linguistic form of that language; the fixing of a choice from a poetic parameter is thus dependent on the fixing of a choice from a linguistic parameter. Thus, for example, the claim might be that some languages are better suited to quantitative meters (where the distinction between heavy and light syllables is criterial) and others better suited to accentual meters (where the distinction is instead between stressed and unstressed syllables); English, for one, has successful accentual verse, but neither nonaccentual syllable counting nor quantitative meters have taken hold in the poetic tradition, despite attempts to introduce them. Kristin Hanson and Paul Kiparsky (1996) propose a theory of poetic universals that has a parameter offering a range of differently sized phonological units that can match metrical positions; in a specific tradition, a specific size of phonological unit matches the metrical position. Thus, for example, Chinese and Japanese verse both have five- and seven-unit lines, whose positions are filled by syllables in the former and subsyllabic morae in the latter. An alternative position is taken by Nigel Fabb and Morris Halle (2008), who argue that poetic form and linguistic form have systemic subcomponents in common, including some parameters (and indeed share subcomponents also with music); however, there is no necessary relation between the poetic form and the linguistic form of a particular language.

Is verbal art itself a universal? That is, is there any single way in which it can be characterized, and distinguished from general verbal behavior? The most commonly given answer to this question is "yes": that verbal art is distinguished from verbal behavior because it draws attention to its own form. This is the basis of Jakobson's (1960) "projection principle," of Nelson's Goodman's (1978) notion of style as exemplified by a text, or of Richard Bauman's (1984) notion of verbal art as a text that is

fully performed. All of these answers assume that the question is not about the work itself, which cannot categorically be said to be either verbal art (literature) or not verbal art (not literature); instead, works are more or less verbal art to the extent that they carry the distinguishing characteristics of verbal art (or as Goodman would say, works may carry "symptoms of verbal art"). Being verbal art is thus a matter of degree. All of these answers also imply that verbal art should be universal and that all users of language should be able to have a literature because literature is just a particular and always-possible way of using language.

– Nigel Fabb

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POETIC LANGUAGE, NEUROBIOLOGY OF

Not unlike the elephant approached by a delegation of blind men, each of whom investigated a body part seemingly unrelated to the others, the neurobiology of poetic language has been approached from such widely varying perspectives that the results hardly seem to share tusks and a tail. One can peer into ancient poetry in search of evidence that consciousness has changed over time, or explore cross-cultural **POETICS** for clues to common neural processing mechanisms. One can map the regions of the brain involved in the processing of poetic devices, or pursue the question of how poets and nonpoets may differ in their neural functioning.

In *The Origins of Consciousness in the Breakdown of the Bicameral Mind* ([1978] 1990), psychologist Julian Jaynes claimed that Homer's *Iliad* and the oldest books of the Hebrew Old Testament portrayed human beings in a twilight state of awareness. According to Jaynes, the characters in the world's most ancient poetry take action not as the result of personal thought and conscious decision but because they hear the voice of a god ordering them to do so. He hypothesized that the voices of the gods were actually auditory hallucinations produced in the brain's right **TEMPORAL LOBE**. Transmitted to the left temporal lobe, seat of **LEFT HEMISPHERE LANGUAGE PROCESSING**, they were perceived as coming from outside the self. Pointing to the metered verse spoken by Greek oracles, the language of Hebrew prophets, and the god-dictated Vedas of India as evidence of the link between poetry and god-speech, Jaynes asserted that the god-voices spoke in verse. Beginning around 1000 B.C.E., he believed, the discovery and spread of writing brought about a "breakdown" in the functioning of the bicameral mind, although the auditory hallucinations of modern-day schizophrenics furnish evidence that contemporary consciousness can revert to its earlier state. While the book was a finalist for the National Book Award, his theory has generated controversy.

Homer's dactylic hexameter **VERSE LINE** is among those surveyed by literary scholar Frederick Turner and psychophysicist Ernst Pöppel in their essay, "The neural lyre: Poetic meter, the brain, and time" (1989). Comparing the metrical verse line lengths of various language cultures, Turner and Pöppel found that almost all of the lines took two to four seconds to recite, with distribution peaking in the range of 2.5 to 3.5 seconds. The authors suggested that their findings might reflect a constant in human neural processing: a "human present moment" or "information buffer" averaging about three seconds in length, subject to variation due to cultural factors. Literary critics have targeted the essay's biological reductionism and its underlying politics, as the authors view free verse as an historical anomaly compatible with bureaucratic or even totalitarian modes of cognition. To date, their thesis has not been subjected to empirical scientific testing.

Initial data on the neurobiology of poetic language came from studies of subjects who had sustained brain damage or undergone *commissurotomy*, surgical severing of the **CORPUS CALLOSUM**. Those findings suggested that comprehension of many poetic devices involved **RIGHT HEMISPHERE LANGUAGE PROCESSING**, even though the left hemisphere was known to control language in most persons: Verbal intelligence tests of the isolated left hemispheres of commissurotomy subjects fell in the normal range, while subjects experienced **APHASIA** after left (but rarely right) hemisphere damage. However, over time, tests of right-hemisphere-damaged (RHD) subjects revealed subtle linguistic deficits in comprehending poetic devices such as **METAPHOR** or connotation, while other studies showed that the isolated right hemisphere recognized certain concrete nouns (i.e., images), vowel sounds (i.e., assonance), and emotional prosody in spoken or written language – all important for understanding poetry (Kane 2004).

For example, Ellen Winner and Howard Gardner (1977) had left-hemisphere-damaged (LHD), RHD, and control subjects match a spoken expression such as "He has a heavy heart" to one

of four pictures, with the correct response being metaphoric. To their surprise, RHD patients performed poorly, often selecting the literal match – for example, an illustration of someone carrying a giant heart. Similar results were obtained from metaphoric word-matching studies. Then G. Bottini and colleagues (1994) used PET (positron emission tomography; see NEUROIMAGING) to scan normal brains processing literal and metaphoric sentences; blood flow (signaling brain activation) increased in six regions of the RH when metaphoric but not literal sentences were being processed. The right hemisphere's role in controlling metaphor seemed obvious – or was it?

As advances in technology have made fMRI (functional magnetic resonance imaging) studies of normal linguistic processing possible, the results have raised as well as answered questions. It is now known that conventional or "frozen" metaphors are processed much like ordinary denotative language, primarily in the left hemisphere, whereas novel metaphors – as well as ironies and the literal meanings of idioms – light up additional regions of the right hemisphere (Giora et al. 2000; Mashal, Faust, and Hendler 2005; Sotillo et al. 2005; Eviatar and Just 2006, Faust and Mashal 2007). Thanks to fMRI, the precise brain regions involved in novel metaphoric processing can be pinpointed: the right homologue of **WERNICKE'S AREA**, right and left premotor areas, right and left insula, and **BROCA'S AREA** (Mashal, Faust, and Hendler 2005). Of course, novel and not conventional metaphors are the stuff of poetic language, unless one's definition of "poetry" extends to greeting card verse, and so the role of the right hemisphere remains significant. It was at first assumed that the right hemisphere's increased involvement in novel metaphoric processing corresponded to visuospatial processing of evoked imagery, whereas conventional metaphors were unlikely to evoke pictures in the mind. However, Rachel Giora's "graded salience hypothesis" (1997; Giora et al. 2000), which assumes that the most common or "salient" meaning of an expression is processed first, regardless of whether it is literal or metaphoric, and that right hemisphere language processing regions get recruited only when secondary meanings must be accessed, provides an alternate explanation.

Concrete nouns are the building blocks of poetic images, and preliminary studies of commissurotomy patients led by Michael Gazzaniga showed that the isolated right hemisphere was capable of recognizing simple nouns. Subsequent tests of normal subjects, isolating either the right or left visual field, suggested that the left hemisphere excelled at processing abstract nouns and low-imagery nouns, adjectives, and verbs, while the right performed as well as the left in processing high-imagery nouns and adjectives. Once again, neural-imaging studies have revealed a more nuanced model than the simple association of "left" with words and "right" with pictures (Kiehl et al. 1999). Marcel Just and his colleagues (1996) and Jean François Demonet, Guillaume Thierry, and Dominique Cardebat (2005) suggest that as cognitive processing increases in complexity, right-hemispheric regions get recruited to handle the additional demand. That hypothesis does not necessarily conflict with behavioral data showing the right hemisphere to be poor at processing abstractions but good at processing concrete nouns on its own.

Studies of connotation, another essential element of poetic language, have followed a similar trajectory from brain-damaged to normal subjects, and from behavioral tests to technology-assisted observations. In the 1970s and 1980s, RHD subjects performed poorly on connotative word meaning tests, while LHD subjects experienced problems with denotation (Gardner and Denes 1973; Brownell, Potter, and Michelow 1984; Drews 1987). One might have assumed that the left hemisphere processed denotation and the right, connotation, but over time, a more complex picture emerged. Christine Chiarello and others established, using visual-field testing, that primary and subordinate word meanings are initially activated in both hemispheres, but that subordinate meanings are quickly suppressed in the left hemisphere, resulting in a more efficient processing time for the dominant meaning – not unlike Giora's graded salience model, where the most salient meaning of an expression, metaphoric or not, gets processed first and faster than a less commonly occurring meaning (Chiarello and Maxfield 1995).

Finally, the neurobiology of poets may play a significant role in the neurobiology of poetic language. Poets are known to suffer from affective disorders – in particular, hypomania and bipolar illness – at rates far exceeding those of the general population or other categories of writers (Andreasen 1987; Jamison 1989; Ludwig 1994; Post 1996). Feeling negative emotion strongly, being introspective, and spending time alone are traits associated with expressive writing as well as mental dysfunction, and mentally ill persons may feel drawn to express their anguish in writing; James Kaufman and John Baer (2002) propose these and other behavioral explanations for the poetry/affective disorder connection. Taking a neurobiological approach, Felix Post (1996) suggests that the intensive intellectual and emotional effort involved in writing poetry may trigger overactivation of neural networks and, thus, cause mental illness. Julie Kane (2004) suggests the opposite, that overactivation may precede poetic output: Pointing to substantial evidence that handedness and dominance for language can shift temporarily from the left to right hemisphere during manic episodes, she proposes that abnormal mood elevation may activate right-brain regions involved in processing poetic language. Recently, too, Dawn Blasko and Victoria Kazmerski (2006) have shown that poets and nonpoets differ in the brain regions that they activate while reading poems.

There is a vast amount of territory yet to be covered in exploring the "elephant" of poetic language, complicated by the fact that new research findings often seem to challenge the old. But as neuroimaging techniques become more precise and less invasive, illuminating features that could only be guessed at before, one thing becomes increasingly clear: The neurobiology of poetic language is not the same animal as the neurobiology of ordinary language.

– Julie Kane

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POETIC METAPHOR

Since Aristotle's first articulation of a comparative theory of **METAPHOR**, metaphor studies in literary and ordinary language have proceeded without interruption in philosophy, **RHETORIC**, linguistics, and literary criticism. Two traditions have emerged in metaphor theory: conceptual and linguistic traditions. The conceptual view emphasizes metaphor's fundamental role in everyday thought and language; the linguistic tradition limits the range of metaphor to local **PRAGMATIC** and aesthetic functions (Ortony 1993). The range of accounts within both traditions is variegated and well beyond the scope of this entry. Nonetheless, for the language sciences, it seems that the conceptualist tradition has dominated in recent years. The present discussion assumes a conceptual view of metaphor as understood through the frameworks of **CONCEPTUAL METAPHOR THEORY** (CMT) and **CONCEPTUAL BLENDING** theory (CBT), where poetic metaphor is regarded as a special case of these underlying conceptual operations. At present, poetic or literary metaphor cannot be easily extracted from the central questions of metaphor theory in general, namely: What is metaphor, and what is metaphor for? The present discussion merely touches on the first question, in favor of a more elaborate treatment of the second question.

The question of what metaphor is and how poetic metaphor can help language sciences understand the everyday mind and language is addressed in the first section, where I compare and contrast the two models of metaphor. The question of what metaphor is for is addressed in the second section.

What Is Metaphor?

CMT purports to unearth the systematic correlations of experience and meaning. Meaning arises from everyday experience. Abstract notions such as time, causation, states, change, and purposes depend on a rich system of metaphors. Metaphor is the name given to the process of conceptual **MAPPINGS** from source to target domains (see SOURCE AND TARGET). The latest incarnation of CMT (Lakoff and Johnson 1999) builds on Joseph Grady's (1997) theory of *primary metaphor*, in which the ontogenetically basic process of domain correlation constitutes the experiential basis of conceptual metaphors. A primary metaphor is a correlation of subjective experience with a more abstract concept. For instance, MORE IS UP is a primary metaphor, based on the tight ontological correlation between the accumulation of the same entities and vertical height.

CBT, while not a theory of metaphor, accounts for metaphor as a species of conceptual blending that often involves the integration of concepts that do not normally go together. CBT takes a decidedly **USAGE-BASED** perspective to metaphor and other phenomena, in which systematic correlations arise from conceptual blending itself, the process of constructing new scenes and scenarios with specific **EMERGENT** properties from multiple **MENTAL MODELS**. The aim is to see how metaphors arise "on the fly" as we think and talk. CMT has as its basic unit of cognitive structure the conceptual domain. CBT has as its basic unit of organization a **MENTAL SPACE,** or scenes and scenarios set up as we think, talk, and otherwise interact. CBT models the dynamic unfolding of a language user's representations. In this respect, CBT has developed analytic routines and modeling techniques that capture constitutive principles and governing constraints of blending. (See Fauconnier and Turner 2002, 309–52.)

What Is Metaphor For?

This question has no straightforward answer, but Samuel Levin provides an initial approximation by suggesting that these "ontologically bizarre" notions are constructed for the purpose of "conceiving what a world would have to be like were it in fact to comprise such states of affairs" (1993, 121). Levin suggests that we construct worlds in which the metaphor is literally true, but only in order to tease out inferences that guide reasoning about the real world. Consider the opening line of John Milton's poem, "On Time," in which the poet commands:

> Fly envious Time, till thou run out thy race,

This conceit depends on the conventional metaphoric mapping TIME IS A MOVER, creating a world in which time is literally an intentional being running a race, the purpose of which is to focus attention on the theological implications of speeding up the pace at which the known world ends. In the poet's world, the notion of time as running a race can be considered preternatural, but the theological implication of the end of days is the great truth to be disclosed. In a similar vein, consider now the conventional metaphor STATES ARE SHIPS.

The text in question is the sermon, "The Negro Element in American Life: An Oration." Delivered by Reverend A. L. DeMond on January 1, 1900, this oration illustrates the degree to which a conventional metaphor can be extended and elaborated. The reverend ends with a poem that makes elaborate use of the Ship-of-State metaphor, a potentially disastrous rhetorical maneuver, given the history of the forced importation of Africans. The sermon ends thus:

> As the old ship of State sails out into the ocean of the 20th century, the Negro is on board, and he can say:
>
> **(1)** Sail on, O ship of State,
> **(2)** Sail on, O Union, strong and great;
> **(3)** Humanity, with all its fears,
> **(4)** With all the hope of future years
> **(5)** Is hanging breathless on thy fate.
> **(6)** We know what master laid thy keel,
> **(7)** What workman wrought thy ribs of steel;
> **(8)** Who made each mast, and sail and rope;
> **(9)** What anvils rang, what hammers beat;
> **(10)** In what a forge and what a heat
> **(11)** Were shaped the anchors of thy hope.
> **(12)** Fear not each sudden sound and shock,
> **(13)** 'Tis of the wave, and not the rock;
> **(14)** 'Tis but the flapping of a sail,
> **(15)** And not a rent made by the gale.
> **(16)** In spite of rock and tempests roar,
> **(17)** In spite of false lights on the shore,
> **(18)** Sail on, nor fear to breast the sea,
> **(19)** Our hearts, our hopes are all with thee;
> **(20)** Our hearts, our hopes, our prayers, our tears,
> **(21)** Our faith triumphant o'er our fears
> **(22)** Are all with thee, are all with thee.

A CMT analysis begins by positing cross-domain mappings between the source domain of ships and the target domain of states or nation-states. The conventional mappings between source and target domains include the following correspondences offered in Grady, Oakley, and Coulson (1999, 109):

Nation-State	=	Ship
Leader	=	Ship's captain
National policies/actions	=	Ship's course
National success/improvement	=	Forward motion of the ship
National failures/problems	=	Sailing mishaps
Circumstances affecting the nation	=	Sea conditions

All these metaphoric mappings derive from the basic primary metaphoric couplings of ACTION-AS-SELF-MOTION, COURSES-OF-ACTION-AS-PATHS, SOCIAL-RELATIONSHIPS-AS-DEGREES-OF-PHYSICAL-PROXIMITY,andCIRCUMSTANCES-AS-WEATHER. These experiential correlations (and perhaps others) interact in a way that motivates the framing of a nation and its history as a ship gliding through water.

As George Lakoff and Mark Turner (1989, 67–72) argue, the power of poetic metaphor, in particular, issues from the extension of these mappings for local expressive purposes. A conventionalized metaphor never gives you all you need, and poetic thought is marked by its ability to stretch or extend conventional metaphors. Notice that with lines 6–7, DeMond extends the typical range of mappings to include "ship building" and the role "shipwright."

Poems also employ expressions in which the **SCHEMAS** and domains underlying the metaphor can be elaborated in unusual or novel ways. Lines 6 and 7, when understood against the context of the whole speech, take on unusual significance. The implication of line 6 is that the "master shipwright" is God, while the "workman" is identified with the Negro, echoing a consistent theme of the speech – the hard labor of the Negro race in building America.

A blending analysis helps account for ways in which the NATION-AS-SHIP metaphor is not a simple and obvious mapping between two conceptual domains. While conceptual domains name large depositories of knowledge about the physical and social world, mental spaces comprise on-line scenes and scenarios; they are specific and sensitive to pressures from local context.

Levin's (1993) account of poetic metaphor is more completely captured in CBT, a theoretical framework in which preternatural scenes are constructed to reveal how to reason and draw inferences about something else. Conceptual blends are often richly **COUNTERFACTUAL,** but rarely do they exist for their own ends. In this case, the blended scenario extends and elaborates the conventional metaphor for local rhetorical purposes. A basic blending analysis of DeMond's introductory sentence and the first five lines of the poem proper would include a discourse ground specifying the participants, the situation, and setting, a mental space for Seafaring, a mental space for Nation, and the initial blended space for Nation-as-Ship, each of which is set up in the very first line of the poem.

Let us assume the analysis from the perspective of a worshiper sitting in the Dexter Avenue Baptist Church in 1900. Under these conditions, the ground includes the identities of the churchgoers, the speaker, and the setting. Let us further assume that the discourse participants are African Americans and that the poetic persona represents them. Initially, the Seafaring and Nation spaces project conceptual structure into the blend under the influence of the cross-space mappings as specified here. In the blend, America is a ship, Negro citizens are among its passengers, the ocean is time, and the twentieth century is an unspecified landmark on open water. The blend allows the audience to imagine temporally, causally, and spatially diffuse political events as attaining, for the moment, the look and feel of primary experience.

Once composed, the blend and the network of mental spaces permit the addition of new information and relations. A noteworthy contribution of the blending framework here is that it offers precise ways of accounting for the elements of the Nation-as-Ship image that have no specific counterparts in the target space of nations and politics. Once the network is up and running, readers can combine concepts fluidly. For instance, line 2 commands, "Sail on, O Union, strong and great," wherein the poet fuses elements from different mental spaces into tight syntactic units. Thus, in the blend it is perfectly natural and logical for a union to sail. What is more, it is perfectly natural for the ship to plot a straight course. Once the image is created, many other elements of ships become mentally accessible. For instance, ships must be made of particular materials in order to be seaworthy. The phrase, "ribs of steel," in line 6 satisfies local formal and conceptual imperatives in 1) providing completion for the couplet with line 5, and 2) suggesting that the nation is made of sturdy material and (opportunistically) made from the very material that the Negro worker has been responsible for manufacturing. Importantly, the mapping between Shipwright and Creator is responsible for all aspects of the nation.

The goal of using this conventional metaphor is to construct a view of social reality for the Negro race, focusing on communal activities and on achieving collective goals. The ship of state has been conventionalized for just that purpose because the image potential associated with building, operating, and navigating is of richly social activities. In the blended space, however, the choice to sail on is framed as an all-or-nothing proposition. If the ship of state does not sail, it ceases to exist. In the sailing space, however, the ship, once built, exists whether or not the crew sails; in the sailing space, a captain and crew can choose when and when not to sail, and the crew can still be referred to as sailors whether on land or on sea. In the blend, a refusal to board and sail is tantamount to renouncing one's citizenship. By exploiting elements of the shipwright (a collective activity) and by attributing that activity to a divine creator, DeMond's version of the ship of state takes on the voice of a divine decree.

As suggested, DeMond takes considerable risk in quoting a poem that makes extensive use of this metaphor, for members of the congregation may generate a metaphoric mapping in which the cross-domain counterpart of American Negro is not passenger but cargo, destroying the political legitimacy of the image. DeMond, however, assiduously avoids focusing any attention on the circumstances that brought them to America. Instead, he picks up the story at their arrival and tells of the Negro race as those who built the nation.

The present analysis presents CMT and CBT as complementary analytic frameworks, wherein the first focuses solely on conventionalized mappings, while the latter is much more interested in how these mappings operate in local rhetorical contexts, and thus can point scholars in the direction of a usage-based theory of poetic metaphor.

– Todd Oakley

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POETICS

In ancient Greece, as Aristotle pointed out, there was "no common name" for all the different poetic genres (*Poetics*, 47b), including epic, tragic drama, dialogue, elegy, and poems written in various meters. Poetry in the sense of making or creation became the general name for literary expressions in diverse

forms, and *Poetics*, the term used by Aristotle for his treatise on tragedy and epic, thus represented the kind of critical and analytical treatment of poetry that would be called in later times literary criticism or literary theory.

Aristotle's *Poetics* offers an important model in Western literary criticism, but it was not widely known in Europe in antiquity or in medieval times, and it did not become a classic until the latter half of the sixteenth century. During the time that it was lost in medieval Europe, however, the *Poetics*, along with some other works by Aristotle, was being studied by Arabic scholars, notably Ibn Rushd, known in the West as Averroës. But once it was rediscovered and commented on by such influential Renaissance critics as Lodovico Castelvetro (1505–71) and Francesco Robertello (1516–67), the *Poetics* quickly became one of the most influential works in Western literary criticism. Epic and tragedy discussed therein became the two major classical genres before the rise of the modern novel and, after Dante, poets of every European nation tried to create an epic in the vernacular to mark the maturity of a modern language and the establishment of a national literary tradition. Aristotle's philosophical treatment of plot, language, and rhetoric of the tragic drama provides a model of critical analysis, and many basic concepts used in the *Poetics*, such as imitation, recognition, the reversal of fortune, tragic hubris, and the catharsis of pity and fear, have all had a tremendous influence on later criticism. In our own time, Aristotle's *Poetics* remains a major classic and continues to be discussed and commented on by important critics and theoreticians from various perspectives.

As the aforementioned Arabic commentaries suggest, the systematic study of the literary art is by no means confined to the European tradition. There are, for example, well-established traditions of sophisticated literary criticism or poetics in South and East Asia. The earliest treatise on dance and dramatic art in ancient India, Bharatamuni's *Nātyaśāstra* (ca. second cent. B.C.), offers a comprehensive discussion of Sanskrit drama in terms of taste and emotions (*rasa*) and of language and bodily gestures that give expression to various emotions. In the seventh century, Sanskrit poetics was fully established by such important theorists as Bhāmaha and Dandin. In the ninth century, Ānandavardhana made significant contributions to its further development with discussions of the theoretical notions of *rasa* and *dhvani*, while Abhinavagupta and Kuntaka in the tenth century explored new areas by debating on the issue of indirect and suggestive expressions (*vakrokti*) in poetic language. Indeed, as an Indian scholar remarks, "A study of Sanskrit poetics from Bharata (5th century B.C.) to Panditarāja Jagannātha (17th century A.D.) will bear witness to the existence of a highly developed poetics in ancient India, with a rigorous scientific method for description and analysis of literature" (Pathak 1998, 34–5).

In China, the *Great Preface* to the Mao edition of the *Book of Poetry* (second century B.C.) articulated the Confucian ideas about poetry and its functions, and laid the foundation of a poetics that both acknowledges the release of emotions as the origin of poetry and the efficacy of moral teaching as its ultimate justification. Lu Ji (261–303), with his *Rhyme-Prose on Literature* added to the critical tradition a more focused attention on the importance of emotions (*qing*), and he argued for the necessity to learn both from nature and from the ancients. Liu Xie's (465?–520?) *Literary Mind and the Carving of Dragons* is deservedly famous as the most systematic study of the literary art in the Chinese critical tradition. This substantial work of Chinese poetics relates literature to the cosmic *tao* and the exemplary classics of ancient sages, thereby elevating literature to a position of high social and moral values. Its focus, however, is on the art of literature. The *Literary Mind* first formulates some basic principles of the idea of *wen* or literature, gives a survey of all the literary genres in classical Chinese literature, commenting on their origin and development, and then presents a highly developed theory of literary creation, making contributions to the important issues of the relationship between poetry and reality, the style and characteristics of a literary work, the effect of imagery and poetic imagination, and the regulations of metric composition. Since the eighth century in Tang China, and particularly the eleventh century in the Song Dynasty, there have been numerous works in a critical genre known as remarks on poetry (*shihua*), which often contain valuable insights into the nature of poetry, the techniques of the literary art, and the principles of aesthetic appreciation. Like the aforementioned Indian example, the Chinese critical tradition also offers an alternative form of poetics outside the Aristotelian and European tradition.

In a broad sense, then, "poetics" can be understood as a critical, theoretical, and more or less systematic treatment of poetry or literature in general. In such an expanded usage, what the term signals is a theoretical discourse on a subject in arts or literature, covering a considerable range of oeuvre, and offering some philosophical insights into the nature of the subject under discussion. Poetics, therefore, becomes a general term for a sustained argument or a long essay in literary and art criticism.

– Zhang Longxi

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POINT OF VIEW

In narrative studies (see NARRATOLOGY), this term, also *perspective* or *focalization*, refers to textual strategies that provide the reader with the illusion of seeing things "through the eyes of a character." These strategies are mostly linguistic in nature, ranging from deictic positioning in the character's mental here and now (see DEIXIS) to lexical choices linking up with the

character's worldview and ways of thinking and perceiving the world. Point of view, from a linguistic perspective, is therefore an important aspect of linguistic **PRAGMATICS**.

Origins and History

The strategies of point of view narration are of fairly recent date. They came into existence as part of the shift toward increasingly subjective literary narratives near the end of the nineteenth century, and document authors' attempts to portray characters' individuality not merely in the rendering of idiosyncratic dialogue (for instance, in **DIALECT**) but also in the extensive depiction of characters' minds or consciousness. Already in the 1790s, the Gothic novel figured the female protagonists' anxious meditations, and Ann Radcliffe and Charles Maturin also portrayed the impact that the contemplation of sublime scenery had on their heroines. Gothic novels are, therefore, important anticipations of the point of view technique which, in English literature, came into its own in the work of George Eliot, Elizabeth Gaskell, Thomas Hardy, Joseph Conrad, and Henry James and in the stream of consciousness novels of literary modernism (James Joyce, Virginia Woolf, Katherine Mansfield, D. H. Lawrence, Aldous Huxley, E. M. Forster). Since then, the point of view technique has been standard in fictional narrative, especially so in the short story, even though postmodernist texts of the radical experimental sort do not employ them as often.

The term *point of view* (interchangeably with *center of vision*) was first used by Percy Lubbock in *The Craft of Fiction* (1921), although Henry James in his prefaces had already analyzed the phenomenon under the heading of "center of consciousness" and the image of the "house of fiction" having many windows (James [1880–1/1908] 1975, 7). Point of view in James refers to the presentation of the story from the perspective, hence point of view, of a character, for instance, Strether in *The Ambassadors*: "It affected Strether: horrors were so little – superficially at least – in this robust and reasoning image. But he was none the less there to be veracious" (James [1903] 1994, 99). However, even in James, the point of view technique, in the meaning of limited perspective (seeing the world through the naive, obsessed, or puzzled perspective of a character), is extended from the new narrative form of the (third person) stream of consciousness novel (following the protagonists' associations in the depiction of their consciousness) to experiments with unreliable or otherwise limited first person narrators, as in James's "The Real Thing" or "Daisy Miller." In these texts, the narrator is very naive, and has a clearly reduced intellectual capacity. For Lubbock (1921), Jean Pouillon (1946), and Norman Friedman (1955), the term, by contrast, comprises not *one* technique of focusing the narrative through a central character's mind but a variety of three (Pouillon) to eight (Friedman) alternative points of view that authors can choose.

Not only was point of view a vague term because it included so many different aspects of narrative; it, moreover, was very limiting since it focused on the visual **METAPHOR.** As a consequence, the term *point of view*, though still used as a general label, became displaced in narratology by more inclusive or more specific terms: *narrative situation*, *perspective*, and *focalization*.

Franz Karl Stanzel's ([1979] 1984) three *narrative situations* ([1] authorial – roughly: omniscient; [2] first person; and [3] figural – the presentation through a character's mind) follows Friedman in looking at *types* of narrative. Boris Uspensky ([1973] 1983), too, extends the meaning of point of view under his term *perspective* to include a) vision (spatio-temporal perspective); b) language (phraseological perspective); c) knowledge and feelings (psychological perspective); and d) **IDEOLOGY**. Although these four types of perspective are all determinable from the language of the text (the spatio-temporal perspective through deictics; the ideological through tell-tale phrases like *tovarish* ["comrade"] for "fellow man"; the psychological through the **SYNTAX** and lexis of emotion), it is the phraseological level of perspective that is most "linguistic" in its deployment of **REGISTER** and **STYLE** to signal narrators' or characters' perspectives, for instance, in the citing of dialect words, hints at pronunciation typical of certain social groups, or the contrast between high and low register in heteroglossic texts (Bakhtin 1981; see DIALOGISM AND HETEROGLOSSIA). For instance, Uspensky cites Tolstoy's sentence "Anna Pavlova had been coughing for the last few days: she had an attack of *la grippe*, as she said" (1983, 33) as an example of phraseological point of view, where *la grippe* registers Anna Pavlova's class and social snobbery. Psychological perspective can be exemplified by a sentence from Toni Morrison: "He examined *the bushes, the branches, the ground for a berry, a nut, anything*" (1977, 255; emphasis added). The sentence traces the order of Milkman's order of perception and the urgency of his quest for food. Uspensky devotes a whole chapter to the interrelation of the four types of perspective in texts.

Gérard Genette's reconceptualization of point of view as focalization (zero; external; internal) abides by the visual metaphor, with focalization opposed to **VOICE** (who sees? vs. who speaks? [1972] 1980, 186). Genette's typology of focalization is one of limited perspective – either no limitation of point of view (zero focalization) or limitation to a view on characters from outside (external focalization) or a subjective view from inside (internal focalization). The narrator and narrative voice are excluded from the discussion, in contrast to Friedman's or Stanzel's analyses. More recent models of focalization are discussed by Manfred Jahn (2005), who has himself proposed the distinction among strict, ambient, weak, and zero focalization based on an optical analogy.

Linguistic Signals of Point of View

The textual inscription of point of view depends on the insertion of signals of subjectivity and individual knowledge, opinion, or worldview in the text such that they can be aligned with a character. The same signals can also be employed to relate the subjectivity or individual stance of the speaker/narrator of a text/utterance, and this alignment is usually discussed under the heading of *voice* and *not* point of view. Voice and point of view can get into conflict or overlap as in *free indirect discourse*, a technique for rendering speech or thought in which the language of the reported speaker/thinker (his/her point of view) is to some extent preserved in the report: *She had **never, ever** told fibs, not for worlds*. (Here, the syntax and vocabulary of the reported speaker are integrated into the report.)

Free indirect discourse (thought representation) is one of the most common signals of point of view in literary texts since it introduces a character's perspective (feelings, intentions, worldview) to the reader. Moreover, the narrative can be studded with

stylistic and lexical markers relating to the character's social position, age, gender, and so on. For instance, when in Charles Dickens's *Our Mutual Friend* Mrs. Veneering "remarks that these social mysteries make one afraid of leaving *Baby*" ([1864–5] 1952, 414; emphasis added), the word *Baby* relates to the mother–child relationship of the reported speaker and represents her point of view. At the same time, the phrase *these mysteries* and the pronoun *one* underline Mrs. Veneering's upper-class status. Addressee-oriented expressions like forms of address (*Ma'am*, *Sir*, *Your Excellency*, etc.) also invoke social position by linguistic means (cf. Fillmore 1983, 1997).

Most basically, deictics serve the function of positioning speakers and, hence, creating point of view. For example, in *Bleak House* "Mr. Bucket (still grave) inquires if *to-morrow* morning, now, would suit" ([1852–3] 1962, 720; emphasis added), in which "to-morrow" relates to Mr. Bucket's moment of utterance. Among linguists, Charles Fillmore's work on deixis (1983, 1997) needs to be credited with incisive insights into the generation of point of view by means of deixis. From a linguistic perspective, these signals are expressivity markers, implying a speaking or thinking consciousness, a deictic center (Bühler's [1934] *origo*) from which the world is being viewed. In the widest possible sense, such expressivity markers are indicative of ideation and emotion, the latter capable of being textually suggested by syntactic means, such as intensifying repetitions besides merely lexical intensifiers and emphatic vocabulary. Evaluative point of view can be illustrated in sentences like *Do talk to* ***the poor dear***. Incomplete sentences (indicating hesitation or derangement), sentence modifiers (*in any case*, *sure enough*), clause-initial adjuncts (*oh*, *well*), interjections (*good grief*), negative inversion (*Never will he forget*) or left and right dislocation are among the most common strategies used (cp. Fludernik 1993, 227–79). In oral discourse, moreover, expressivity shows up in INTONATION and the echoing of idiosyncratic pronunciation (imitated in writing: *she sho was happy*).

In medieval literature, point of view is often signaled by interjections like *alas* or by means of repetition. Such signals of point of view occur intermittently in medieval literature and early modern English prose but do not constitute a continuous representation of a character's perspective as in the Gothic novel and the later stream of consciousness novel.

Like the study of narrative discourse markers, the focus on expressivity signals can help to emphasize the specifically narrative uses of point of view for the linguist. Point of view markers not only establish free indirect discourse; they are, moreover, crucial to text beginnings, where they help distinguish between narratives with a prominent speaker (= narrator) function and others in which the reader is eased into the story by means of a protagonist's perspective. (Roland Harweg [1968] has contrasted these as emic and etic text beginnings, respectively.) Peculiarities of thought and worldview are also constitutive of M. A. K. Halliday's *mind-style* (1971) as the "distinctive linguistic representation of individual self" (Shen 2005, 312). Ultimately, an analysis of point of view as expressivity links up with the linguistic enquiry into individual style.

It should be noted that all of these signals of expressivity are clichés and cannot directly claim mimetic relevance (Fludernik 1993, 434–64). On the contrary, they depend on typical recurrent models of speech that are employed to create an illusion of authenticity. Moreover, the attribution of expressivity markers to the primary frame speaker (narrator) or reported speaker (character) is frequently problematic. The mere presence of expressivity markers does not convey a clear point of view; point of view needs to be constructed interpretatively by the listener or reader in the overall context of the utterance or text. Thus, though point of view can be fruitfully *analyzed* by linguistic means, it cannot be exhaustively described within a purely formal framework. Point of view, therefore, is a pragmatic phenomenon located on the threshold between narrative pragmatics and literary narratology (see also LITERARY CHARACTER AND CHARACTER TYPES).

– Monika Fludernik

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POLITENESS

Politeness is essentially a matter of taking into account the feelings of others as to how they should be interactionally treated, including behaving in a way that demonstrates appropriate concern for interactors' social status and their social relationship. In this broad sense of speech oriented to an interactor's social persona or *face*, politeness is ubiquitous in language use. Since taking account of people's feelings generally involves saying things in a less straightforward or more elaborate manner than when one is not considering such feelings, ways of being polite provide a major source of *indirectness,* reasons for not saying exactly what one means, in how people frame their utterances.

There are many folk notions for these kinds of attention to feelings, captured in terms like *courtesy*, *tact*, *deference*, *sensibility*, *poise*, *rapport*, and *urbanity*, as well as terms for the contrasting behaviors – *rudeness*, *gaucheness*, *social gaffes* – and their consequences, embarrassment or humiliation. Such terms attest both to the pervasiveness of notions of politeness and to their cultural framing.

People's face is invested in their social status and in their relationships with one another, and so indexing this relationship appropriately is necessary for maintaining face expectations. In addition, one often has interactional goals that potentially contravene face, and the expression of such communicative intentions (e.g., requests, offers, disagreements, complaints) tends to be mitigated by attention to face.

Politeness is crucial to the construction and maintenance of social relationships; indeed, it is probably a precondition for human cooperation in general. Politeness phenomena have, therefore, attracted interest in a wide range of social sciences, particularly linguistics, anthropology, psychology, sociology, and communication. Work in these disparate fields can be characterized in terms of three main classes of theoretical approach.

Politeness as Social Rules

To the layperson, politeness is a concept designating "proper" social conduct, rules for speech and behavior stemming generally from high-status individuals or groups (cf. **STANDARDIZATION**). These notions range from polite formulae like *please* and *thank you*, codified forms of greetings and farewells, honorific address forms, and so on, to more elaborate routines, for example, for table manners or the protocol for formal events. Politeness in this view is conventionally attached to certain linguistic forms and formulaic expressions, which may be very different in different languages and cultures.

Some analytical approaches to politeness are formulated in terms of the same sorts of culture-specific rules for doing what is socially acceptable, for example, the work by Sachiko Ide (1989) and others on Japanese politeness as social indexing or "discernment." In these approaches, politeness inheres in particular linguistic forms when used appropriately as markers of pregiven social categories.

Politeness as Conversational Maxims

A different approach understands politeness as a set of social conventions coordinate with Paul Grice's (1975) **COOPERATIVE PRINCIPLE** for maximally efficient information transmission ("Make your contribution such as required by the purposes of the conversation at the moment"), with its four "maxims" of *quality*, *quantity*, *relevance*, and *manner* (see CONVERSATIONAL IMPLICATURE). Robin Lakoff (1973) argued that three "rules of rapport" underlie choices of linguistic expression, rules that can account for how speakers deviate from directly expressing meanings. Choice among the three **PRAGMATIC** rules gives rise to three distinct communicative styles: Rule 1, "Don't impose," produces a distant style; Rule 2, "Give options," gives rise to a deferent style; and Rule 3, "Be friendly," results in a style of camaraderie. Geoffrey Leech's (1983) proposal is in the same vein. Complementary to Grice's cooperative principle, Leech postulated a *politeness principle*, "Minimize the expression of impolite beliefs," with six maxims of *tact*, *generosity*, *approbation*, *modesty*, *agreement*, and *sympathy*. As with Grice's maxims, deviations from what is expected give rise to inferences. Cross-cultural differences derive from the different importance attached to particular maxims.

The conversational maxim view shares with the social norm view the emphasis on codified social rules for minimizing friction between interactors and the idea that deviations from expected levels or forms of politeness carry a message.

Politeness as Face Management

A more sociological perspective places *face work* at the core of politeness. Erving Goffman (1967) considered politeness as an aspect of interpersonal rituals, central to public order. He defined face as an individual's publicly manifest self-esteem and proposed that social members have two kinds of face requirements: positive face, or the want of approval from others, and negative face, or the want not to offend others. Attention to these face requirements is a matter of orientation to Goffman's "diplomatic fiction of the virtual offense, or worst possible reading" (1971, 138 ff), the working assumption that face is always potentially at risk, so that any interactional act with a social-relational dimension is inherently face threatening and needs to be modified by appropriate forms of politeness. Deference (attention owed to the other's face) can be distinguished from demeanor (attention owed to oneself).

Building on Gricean and Goffmanian approaches, Penelope Brown and Stephen C. Levinson ([1978] 1987) introduced a comparative perspective by drawing attention to the detailed parallels in the construction of polite utterances across widely differing languages and cultures, arguing that universal principles underlie the construction of polite utterances. The parallels they noted are of two sorts: how the polite expression of utterances is modified in relation to social characteristics of the interloculors and the situation, and how polite utterances are linguistically formulated. At least three social factors are involved in deciding how to be polite: 1) One tends to be more polite to social superiors; 2) one tends to be more polite to people one doesn't know. In the first case, politeness tends to be asymmetrical (the superior is less polite to an inferior); in the second, politeness tends to be symmetrically exchanged. In addition,

3) in any culture there are norms and values affecting the degree of imposition or unwelcomeness of an utterance, and one tends to be more polite for more serious impositions. The linguistic structures for conveying particular kinds of politeness are also underlyingly similar across languages, with the politeness of solidarity ("positive politeness") characterized by expressions of interest in the addressee, exaggerated expressions of approval, use of in-group **IDENTITY** markers and address forms, seeking of agreement, and avoidance of disagreement, whereas avoidance-based politeness ("negative politeness") is characterized by self-effacement, formality, restraint, deference, hedges, and impersonalizing mechanisms like nominalization or passive constructions.

To explain these kinds of detailed parallels across languages and cultures in the minutiae of linguistic expression in socially analogous contexts, Brown and Levinson proposed an abstract model of politeness as strategic attention to face, deriving strategies for constructing polite utterances in different contexts on the basis of assessments of three social factors: the relative power (P) of speaker and addressee, their social distance (D), and the intrinsic ranking (R) of the face-threateningness of an imposition. In contrast with rule-based approaches, Brown and Levinson argued that politeness inheres not in words or sentences per se; politeness is an *implicature* that may be conveyed by utterances spoken in context, by virtue of successful communication of a polite attitude or intention.

Politeness continues to be a major focus for research in many disciplines concerned with social interaction, and the topic now has its own professional journal, the *Journal of Politeness Research*. Over the past 30 years, empirical descriptions of particular politeness phenomena from many different parts of the world have accumulated, with the research emphasis largely on cross-cultural differences. There has been much theoretical controversy over whether, indeed, there are any universal principles of politeness and if so, what form they take. The recent trend seems to be toward emphasizing emic rather than etic approaches (cf. Watts 2003; Eelen 2005). But the importance of politeness goes far beyond the p's and q's of appropriate behavior and speech in a particular cultural setting. Its wider significance is in the interactional, communicative, day-to-day basis of social life and the conduct of social relationships. Recent developments in the theory of social interaction that take account of our common human nature (e.g., Goody 1995; Enfield and Levinson 2005; see also UNIVERSAL PRAGMATICS) offer hope for theoretical progress in this field.

– Penelope Brown

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POLITICS OF LANGUAGE

Politics of language is not a domain or subdiscipline. It is an idea that puts the study of language in a perspective: the idea that language is a politically invested object and that people, consequently, act politically in, through, and on language. In that sense, the term covers an enormous range of phenomena and cuts across numerous disciplinarily organized practices. The issue is one of function, and the politics of language suggests that political meanings and effects are among the functions of language. In fact, some would emphasize that there are no nonpolitical meanings.

Such political functions are metapragmatic: They operate through meta-discourses on language, on things people say about language in language. Thus, the politics of language is a language-ideological phenomenon. Clear instances of it are widespread utterances such as "English is the language of business" or "Xhosa is a language for community interaction." In both instances, a particular language is defined as a language that operates with a specific "load," a specific set of social, cultural, economic – political – attributes, all of them implicitly articulated: Whenever I use English, my language use will be framed as "business," and I will speak *like* a businessman. The politics of language has to do with the way in which we associate particular varieties of language (forms) with particular normative complexes, genres and topical domains, and identities (functions). The relationship between forms and functions, thus defined and seen as relatively stable (stable enough to generate shared meanings), is usually defined as **IDEOLOGY**, and authors explicitly addressing the politics of language often focus on ideology, hegemony, and ideological naturalization.

In what follows, I first give a brief overview of some key notions and authors, then engage in a brief survey of some recent work and focus on language ideologies as a frame for understanding such political functions. I conclude with an appraisal of this work.

Key Notions and Authors

Language has been defined as politically invested since Aristotle and the Sophists; it is therefore futile to attempt a historical survey.

Rather, I would suggest we read history backwards, starting from the current approaches to the politics of language and looking into those authors who are seen as formative now. From that vantage point, two groups of authors stand out: authors who developed a political view of language and authors whose political-analytic work provides tools for scholars in the field of language. The first category is dominated by such scholars as M. M. Bakhtin, V. N. Voloshinov, Roland Barthes, Michel Foucault, and Pierre Bourdieu; in the latter, Karl Marx and Antonio Gramsci stand out.

This collection of authors and insights, it must be realized, can only be discussed in a more or less coherent way when a number of conditions are met. In particular, two presuppositions are required:

(i) It is clear that reflections of this kind are predicated on a view of language as a social object (not a mental object); such reflections belong to the realm of a social theory of language.

(ii) They also are predicated on a view in which language displays intricate connections with social structure: Either language mirrors social structure (especially structures of inequality) or it can become an instrument for changing social structure.

These presuppositions ensure that the authors mentioned can become interlocutors for current practitioners in the field, and such practitioners would then be clustered in "applied" fields, such as **DISCOURSE ANALYSIS** (both **LINGUISTIC** and **FOUCAULTIAN**), **SOCIOLINGUISTICS**, and linguistic anthropology.

The work of Bakhtin and Voloshinov has been influential in its emphasis on the social and political dimensions of a key feature of real language: its heteroglossic nature (see DIALOGISM AND HETEROGLOSSIA). Heteroglossia stands for the presence of multiple "voices" in an act of **COMMUNICATION**, and such voices are intricately related to social formations and interests. Whenever we communicate, thus, we engage with existing complexes of social (and cultural) meaning, we insert ourselves in an **INTERTEXTUAL** tradition in which such complexes make sense, and we articulate interests, not only (neutral, self-contained) meanings. In addition, the articulation of such interests is not a unilateral and linear event. Bakhtin (1981) emphasizes the importance of evaluative uptake in interaction – his "dialogical principle" – in which every act of communication requires ratification by the other in order to be valid, that is, in order to be meaningful. This process of ratification is *evaluative*: It is done from within ordered complexes of forms-and-meanings in which appropriateness, social roles, fluency, and other quality attributes are specified. Thus, even if I think I produce a cogent story, my interlocutor may judge it to be off the mark because what I say and how I say it do not qualify as "good enough" in his/her evaluative framework. And evidently, such evaluative frameworks are reflections and instruments of the social and political order (Voloshinov 1973).

This social and political order penetrates language at a fundamental level: It shapes discourses. Discourses are complexes of communicative forms (genres, styles) mapped onto thematic and social domains, and what the social and political order does is to create spaces in which particular discourses operate while it eliminates other such spaces. This idea is central to the work of Barthes (1957), who emphasizes the discursive routines and the silences that are generated by the consumer-capitalist society. It also underlies Foucault's (1984) notion of "order of discourse," and it is reflected in Bourdieu's (1991) notion of "legitimate language." In each case, macrosocial order manifests itself in discourse patterns, structures, both positively and negatively. The fact that some things can only be said in some ways is an effect of the social and political order; the fact that some things cannot be said at all is an effect of the same thing (Blommaert 2005).

The fact is, however, that people rarely experience this shaping of discourses as an effect of social and political forces. Mostly, we perceive these discourse routines and absences as "normal," as "just the way things are." It is at this point that we see scholars refer to the Marxian notion of ideology – an agentive notion in which ideational complexes such as discourses have real material effects – as well as to the Gramscian notion of hegemony. Hegemony is ideological dominance, that is, dominance that is not perceived as dominance but as a neutral, normal state of affairs. Social and political forces operate in language through hegemony, that is, through naturalized, neutralized, and normalized perceptions and forms of behavior.

These authors all provide frequently used key notions and insights, all of which revolve around the same central node: that language is not a neutral phenomenon but one that bears deep traces of social and political structures and processes in society. The use of language, consequently, is always an activity that has social and political dimensions: It can reproduce existing structures or challenge them, it can empower or disempower people, and it can enfranchise and disenfranchise them.

State of Affairs

The political "load" of language is one of the central concerns for **CRITICAL DISCOURSE ANALYSIS** (CDA), an approach to discourse analysis that, especially since the 1990s, explicitly focuses on the ways in which discourse reflects power and social structure and constructs it (Fairclough 1989, 1992; Blommaert 2005). It is CDA's stated goal to analyze "opaque as well as transparent structural relationships of dominance, discrimination, power and control as manifested in language" (Wodak 1995, 204) – a paradigmatic choice that is reflected in numerous studies on racism, sexism, media, and political discourse and advertisements. In all of these, linguistic and textual patterns are analyzed as conduits for hegemony and power abuse, and CDA has been influential in identifying **REGISTERS** and genres of power and control. CDA clearly subscribes to a view of language as "loaded" (cf. Bolinger 1980) and as invested with social and political interests that steer discourse into particular, structural (i.e., nonarbitrary) patterns of use and abuse. The influence of Foucault, Gramsci, Bourdieu, and other critical theorists is explicitly acknowledged in much CDA work.

The same paradigmatic choice underlies work in what could be called critical sociolinguistics: an approach in which the distribution of language in society is also seen as a reflection of power processes, often crystallized in normative ("standards") discourses and invariably entailing judgments of users through judgments of language use (e.g., Milroy and Milroy 1985; Cameron 1995; see STANDARDIZATION). Variation in language speaks to variation in society, and such forms of variation

are evaluated – given different value. Institutionalization, such as, for example, in the education system (Rampton 1995) or in bureaucracy (Sarangi and Slembrouck 1996) can stabilize and reify such evaluative patterns and use them as normative, exclusive, and excluding instruments of power and control. Sensitive social identities, such as gender and immigrant identities, can be especially vulnerable to exclusion or marginalization in such reified normative structures.

Both CDA and critical sociolinguistics seek an integration of the linguistic or discourse-analytic method with social theory, thus reversing the tendency toward autonomy and disciplinary recognizability that characterized earlier phases in the development of these disciplines (e.g., Cameron 1992; Chouliaraki and Fairclough 1999). This move is aimed at strengthening the fundamental theoretical assumption: that language and social structure stand in an intricate relationship to each other and that one cannot be understood without an understanding of the other.

From another theoretical angle, linguistic anthropology has significantly contributed to the study of the politics of language. In contrast to the previous schools, linguistic anthropology has its roots in an integrated science of human behavior. The anthropological notion of language, consequently, appears easier to integrate into a mature social-theoretical framework than notions of language that have their feet in twentieth-century linguistic traditions. The fact that language forms and structures need to be seen as reflective and constructive of sociocultural and political realities was central to Edward Sapir's work (1921), and the post–World War II reemergence of the ethnography of communication (Gumperz and Hymes 1972; Gumperz 1982; Hymes 1996) started from the assumption that there is no occurrence of language that is not drenched in social, cultural, historical, and political contexts and that, consequently, can be understood without attention to these contexts (Duranti 1997). It is from within linguistic anthropology that the paradigm of language ideologies developed (Schieffelin, Woolard, and Kroskrity 1998; Blommaert 1999; Kroskrity 2000; Bauman and Briggs 2003).

Language Ideologies

Language ideologies are beliefs, ideas, views, and perceptions about language and communication. Such ideational complexes pertain to every aspect of communication: about linguistic forms and functions, as well as about the wider behavioral frames (often called "nonlinguistic") in which they occur. Thus, in the field of language ideologies, people are seen to *perform* meanings, and *language* in the narrow sense of the term is seen as just one mode of meaning production. People produce *semiosis* (meaningful symbolic behavior) as **PERFORMANCE**, and they do so within a *regimented* field in which language ideologies produce stability and recognizability. Seen from that perspective, language ideologies are of course not just ideational; they are *practical* in the sense of Bourdieu, referring to the Marxian *praxis*, rather than to the Mannheimian or Durkheimian notion of ideology.

The study of language ideologies emerged out of the Whorfian concern with connections between language form and "world view" (Hill and Mannheim 1992). To recap Benjamin Whorf's basic idea, he argued that grammatical categories **ENCODED** and thus revealed aspects of collective perceptions of reality; as such, grammatical organization was not random, logical, or autonomous but cultural and social, and it displayed coherence with other aspects of social and cultural patterning. In that sense, grammatical form responded to collective patterns that organized social and cultural behavior, including linguistic behavior. The full richness of Whorf's approach was established by people like Michael Silverstein (1979). Silverstein suggested that we read Whorf's argument as follows: Linguistic form is *indexical*; it indexes aspects of context through *ideological* inferences: A particular form "stands for" a particular social and cultural meaning (also Silverstein 2003). Thus, in French, *tu* and *vous* share a great deal of linguistic meaning but are differentiated by *indexical* meanings; *tu* indexes a "low" second **PERSON** singular addressee, while *vous* indexes a "high" second person singular addressee. The one who uses *tu* or *vous* would express *indexically* his/her degree of respect and social distance toward the interlocutor, and the interlocutor would attribute conventional identity features, such as "polite," "proper," "well educated," "middle class," and so on to the one using these forms. Thus, we select linguistic (and wider **SEMIOTIC**) forms in relation to socially and culturally shared ideas about what would be appropriate, good, useful, and salient communicative behavior in a specific context, and our use of semiotic means creates, supports, and manipulates contexts.

This reconstruction of Whorf's foundational insight has significant implications. One effect is that it creates a new, but essentially inseparable, layer to language structure: a metapragmatic layer. Accepting that layer means that the analyst must accept that whenever we communicate, we not only communicate *in* our communication but also communicate *about* our communication: We always flag socially and culturally shared (ideological) indexical meanings while we talk, and these indexicals make others perceive our talk as "serious," "arrogant," "funny," or "knowledgeable." The metapragmatics of language organizes its **PRAGMATICS** – its meaning in society. And this, then, means that approaches solely focused on a pragmatics of language risk buying into commonly shared metapragmatic frames; in other words, a "normal" linguistics always risks dragging along the widespread language ideologies that dominate its object.

Another effect is that the range of variability in language is vastly expanded, for the metapragmatic layer also provides an enormous potential for social and cultural differentiation (*distinction*, to borrow Bourdieu's term). In a nutshell, we can say that every possible difference in language can become a socially and culturally salient and important difference and that linguistic differences need not be "big" in order to generate important social and cultural differences.

Evaluation

The idea that language is a politically invested object and that people act politically in, through, and on language is by now a well-established theoretical frame, the legitimacy of which no longer requires debate. One reason is the fact that the different approaches discussed here all have very strong empirical inclinations and that studies documenting the politics of language often manage to transcend the slogans of a committed social science and bring theoretical and methodological innovation to the field. CDA has done much to sensitize discourse analysts at large about the fact that discourse matters to people because it

is invested with power and social capital; critical sociolinguistics has likewise drawn attention to the fact that sociolinguistic distribution is not just a horizontal phenomenon but also a vertical one: Sociolinguistic difference is complemented by sociolinguistic inequality. And from within linguistic anthropology, we have witnessed the emergence of a powerful ethnographic paradigm that recovers the holistic and rich agenda developed earlier by the likes of Sapir and Whorf and applies these insights to an expanding field of fundamental and applied topics of language in society. The language-ideological approach appears to be the most promising one because of its compelling theoretical coherence and empirical applicability, and it would benefit adjacent disciplines if the central insight – that every pragmatics of language is accompanied by a metapragmatics – would be adopted.

– Jan Blommaert

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POSSIBLE WORLDS SEMANTICS

Possible worlds semantics is a family of semantic theories in which the truth conditions of modal concepts and other intensional locutions are expressed with the help of the concept of possible world (scenario, possible state of affairs, possible course of events). (See MODALITY, INTENSION AND EXTENSION.)

Human beings constantly find themselves concerned with what could happen or might have happened. The modal notions of possibility and necessity are used to cope with such situations. Less directly, notions like knowledge, belief, obligation, permission, and so on serve the same purpose. Concepts behaving in essentially the same way as necessity, knowledge, and so on are known as intensional concepts. Modal notions have several varieties, among them logical, conceptual, metaphysical, natural, nomic, and physical modalities. When the different possibilities can be weighted, one can also evoke the concept of probability.

It is nevertheless only relatively late that philosophers and logicians came to think that in order to understand modal notions (and other related notions), we have to consider unrealized courses of events or states of affairs and, hence, merely possible worlds. Earlier philosophers usually did not think in such terms. For one thinker, Aristotle, the only reality is the succession of present moments outside of which there are no other possible courses of events. The idea of *many worlds* began its development in the Middle Ages, encouraged by the famous condemnation of 1277 of the view that God could not create other worlds. The notion of possible world was put to major metaphysical uses by G. W. Leibniz for whom metaphysical truths are truths holding in all possible worlds.

In twentieth-century philosophical logic, the notion of possible world became prominent when modal logic was approached from a model-theoretical or semantic point of view. The use of the notion of possible world in the study of modalities is analogous to the measure-theoretical approach to probability theory, with probability theorists' sample-space points playing the same role as logicians' possible worlds. One of the pioneers of the semantic study of modalities was Rudolf Carnap (1947), who explicitly acknowledged the inspiration he received from Leibniz. The early treatments of the logic and semantics of modalities nevertheless relied heavily on syntactical concepts and arguments. For instance, Carnap represented possible worlds by sets of sentences he called state-descriptions. A state-description is a complete list of atomic sentences and the negations of atomic sentences that are true in some model.

In such semisyntactical theorizing, interpretational questions were neglected, relatively speaking. Fortunately, this neglect did not initially matter. For what is the cash value of assuming that

possible worlds exist? According to Van Quine, such existence means that we can quantify over them (see QUANTIFICATION). The starting point of possible worlds semantics is the insight that many modal and other intensional concepts can be construed as quantifiers over suitable classes of possible worlds. If NS means "it is necessary that S," it is true if and only if S is true in all possible worlds. "It is possible that S," briefly PS, is true just in case S is true in some possible world. If K_aS means "a knows that S," it is true if and only if S is true in all the possible worlds not ruled out by what a knows, and so on. Thus, the idea of possible worlds was involved right from the beginning in the development of the semantics of modal logic, following the work of Alfred Tarski and his associates. (Cf. Copeland 2002; Kanger 1957; Hintikka 1957a, 1957b; Kripke 1959.) The first to emphasize the role of possible worlds semantics as the basis of general semantics seems to have been Richard Montague (cf. Montague 1974).

Even though this is, for most purposes, an adequate explanation of the meaning of K_aS, the characterizations of necessity and possibility need further specification, namely, an indication of what kind of modality we are dealing with. For instance, not all logically possible worlds are nomically (physically, naturally) possible.

We thus seem to obtain a semantically interpreted language by adding to a first-order language the operator or those operators we are interested in. On the basis of this idea, we can develop much of a viable modal logic, epistemic logic, and so on, as well as the required methods of proof.

This procedure is not sufficient alone, however. For one thing, the possible worlds that figure in these explanations are relative to the world w in which NS, PS, K_aS, and so on are evaluated semantically. They will be called alternatives to w. To deal with iterated or multiple modalities, we have to consider alternatives to alternative worlds, and so on. The alternativeness relation involved here is sometimes called the *accessibility relation*.

This does not yet completely determine the possible worlds semantics. To see what is missing, consider how the references of linguistic expressions are determined. The guiding principle of possible worlds semantics is that the application of a language, including the reference of any expression e, in a given world w must depend only on that world. The way in which the reference of e in w is determined is, therefore, codified in the function f that determines the reference of e as a function $f(w, e)$ only. We could call the totality of these functions the **REFERENCE** system of the language. For instance, the reference of "the 44th president of the United States" is whoever wins the 2008 election.

These ideas of reference and meaning are, in fact, the cornerstone of the version of possible worlds semantics most extensively used in linguistics, known as Montague semantics (see MONTAGUE GRAMMAR). It was developed by Montague (1974) and applied in linguistics most vigorously by Barbara Partee (1976, 1989).

There are further problems in the development of possible worlds semantics, however. When we use a quantifier, we consider each of its values as being the same individual in different possible worlds. But how can such identities be recognized? They cannot be established by examining the different possible worlds in question independently of one another. For instance, a name-conferring ("dubbing") ceremony in one world does not automatically help the identification of the same individual in another world. Nor does the rest of the reference system help us here. There must exist principles defining what counts as a single individual across possible worlds. Their totality can be called an *identification system*.

The nature of such identification has given rise to extensive discussion and controversies. The identification system codified in our language is largely independent of the reference system. Indeed, there are two different kinds of identification actually used in our conceptual system. An identification system can be visualized as a kind of "map" shared by the possible worlds between which the identification is to take place. In the most common cases of identification, the map can be thought of as a kind of universal registry of the relevant population. For instance, if the files of the Social Security System were to serve as such a system, I would know who someone is if and only if I knew his or her social security number. Such identification could be called public. An idea of how the criteria of public identification could work can be obtained by considering how we reidentify objects over time. Continuity considerations obviously play a major role, but questions as to how objects behave over time also come into play.

An individual's position in someone's perceptual space or remembered role in someone's past experiences can also serve as a framework of identification. The simplest framework of this kind is someone's visual space. Such forms of identification are called *perspectival*. Among other expressions of our language, demonstratives rely on perspectival identification. Their operation is illustrated by Bertrand Russell's onetime view that the only "logically proper names" of English are "this," "that," and "I." The explanation is that Russell tacitly presupposed only perspectival identification.

The distinction between perspectival and public identification gains further interest and robustness from the fact that these two systems are, in the case of visual cognition, implemented by different parts of the human brain (Vaina 1990; Hintikka and Symons 2003). Since quantifiers depend on identification, they acquire a different meaning according to the kind of identification presupposed.

These observations open the doors to extensive applications of logical languages with a possible worlds semantics. For instance, a simple wh-statement "Alonzo knows who (call him or her x) is such that F[x]" can be expressed by a sentence of the form $(\exists x)K_{Alonzo}F[x]$ where x ranges over persons. This shows how to formalize simple *knows who* statements in general. For example, $(\exists x)K_{Alonzo}(\text{Barbara} = x)$ says that Alonzo knows of some particular individual x that Barbara is that x. This unmistakably means that Alonzo knows who Barbara is. Such statements may be contrasted to $K_a(\exists x)(b = x)$, which merely says that a knows that b exists.

This kind of variation of operator ordering – K versus $(\exists x)$ – cannot do the whole job, at least if we want to stay on the first-order level. In order to do so, we have to resort to a recently introduced idea of operator independence (Hintikka 2003). Since modalities are characterized by quantification over possible worlds, the same kind of independence can obtain between modal operators and quantifiers as between quantifiers. This independence can be expressed by a slash. Thus, we can express

$(\exists x)K_a(b = x)$ equivalently as $K_a(\exists x/K_a)(b = x)$, where "$\exists x/K_a$" means that $\exists$ is independent of K_a. (Notice that by so doing, we can stay closer to the structure [word order] of the corresponding English knowledge statements.) In more complicated cases, we can, for instance, express "a knows which function g(x) is" by

$$K_a(\forall x)(\exists y/K_a)(g(x) = y).$$

We cannot stay on the first-order level here without the independence indicator.

This does not clear up all interpretational problems, however. We can still ask: What are the relevant possible worlds in different applications? This question is connected with the question as to what kinds of modalities and other intensional notions there are.

The characterization of possible worlds as represented by maximal consistent classes of sentences of a given language has encouraged the idea that what is intended by possible worlds are indeed worlds in the sense of entire universes. However, a comparison with probability theory shows that such grandiose interpretations are neither unavoidable nor even preferable. In most applications of probability theory, the "possible worlds" (sample space points) are not worlds in any ordinary sense of the word. They usually are what might be called *scenarios*, namely, courses of events involving a small region of space-time, for example, tosses of a die. Some probability theorists speak of *small worlds*, and practically all realistic applications of possible worlds semantics are to such small worlds. In some of his work, Montague, in fact, operates with "contexts of use," rather than "possible worlds."

There remains the question of different modalities. Are they all viable in the light of possible world semantics? There are no major unsolved conceptual problems about epistemic or doxastic modalities or other similar intensional concepts. The class of alternative epistemic worlds has a clear meaning – or at least as clear a meaning as our language has. Logical (conceptual) modalities are interpretable only if we look at the structure of the possible worlds that they involve. If we begin to speak of all possibilities of individual existence, the alternatives to a given world do not form a viable class anymore than the set of all sets in set theory. The idea of natural possibility has a clear sense if it is taken to mean conformity with natural laws (nomic necessity). But when it is claimed that there exists a metaphysical necessity separate from nomic (physical) and conceptual (logical) necessities, it is hard to see what is being meant. It is not enough to claim that we have "intuitions" about them, for the very notion of intuition in its current philosophical use is highly suspect.

– Jaakko Hintikka and Risto Hilpinen

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POSSIBLE WORLDS SEMANTICS AND FICTION

The applications of the philosophical concept of possible world to narrative and to fiction were first developed in the late 1970s and early 1980s as a reaction to **STRUCTURALIST** poetics, a movement that adhered to Ferdinand de Saussure's conception of language as a self-enclosed system of signs. As Thomas Pavel has argued, this theoretical position led to a "moratorium on representational topics" (1986, 6) and on the notion of reference to a world external to language. In its literary applications, possible worlds (hence, PW) **SEMANTICS** is an attempt to restore the relevance of mimesis, reference, and the question of truth without reducing the fictional text to an image of reality.

The logician Jaakko Hintikka (1989) describes the conception of language to which PW semantics seeks an alternative as "language as the universal medium." According to this view, "all that language is good for is to enable us to talk about this world" (Hintikka 1989, 54). The primary target of his description is positivist philosophies that limit reference to an objectively existing external reality, such as those of Gottlob Frege, Bertrand Russell, and the early Ludwig Wittgenstein. For the positivist, a statement concerning a nonexisting entity, such as Santa Claus or Emma Bovary, is either false or indeterminate. It is, therefore, impossible to differentiate the validity of statements made about imaginary beings. Structuralism and **DECONSTRUCTION** go even further in their interpretation of language as universal medium by regarding it as the unique reality to which it is capable of referring.

To the conception of language as universal medium, Hintikka opposes what he calls "language as calculus." In this framework, "you can so to speak stop your language and step off. In less metaphoric terms, you can discuss the semantics of your language and even vary systematically its interpretation.... The operative word highlights the thesis that language is freely interpretable like a calculus" (1989, 54). By virtue of this reinterpretability, language can be directed toward different domains of reference and the truth value of **PROPOSITIONS** established separately for each

of these domains. A statement can consequently be false in one domain and true in another, and it becomes possible to assign a positive truth value to the statement "Emma Bovary committed suicide by swallowing arsenic" for the world of Gustave Flaubert's novel, even though the sentence is false in the real world (unless we prefix it with "in Flaubert's novel").

Hintikka's conception of language as calculus relies on an ontological model made of a plurality of worlds. A common justification for the postulation of multiple worlds is the intuitive notion that "things could have been different from what they are." Saul Kripke formalized this intuition through a model that describes reality – the sum of the thinkable – as a set of elements hierarchically structured by the opposition of one element, which can be interpreted as the actual or real world, to all the other members of the system. Kripke envisions a relation of accessibility that links the actual world to those worlds that are possible but not actual. Worlds not linked to the central element of the system are considered "impossible worlds," but when the relation of accessibility is interpreted as respect for the laws of logic (noncontradiction and excluded middle), one may debate whether they are worlds at all, rather than incoherent collections of propositions. There are, however, other interpretations of accessibility that preserve the world status of the inaccessible elements: for instance, nomological (respect of the laws of nature), epistemic (distinguishing what is known, believed, and ignored), and deontic (based on what is allowed, obligatory, and forbidden).

A question raised by Kripke's model is what distinguishes the actual world from all the other members of the system. According to a widespread view that may be called absolutist, the actual world differs in ontological status from merely possible ones in that this world alone presents an autonomous existence; all the other worlds are the product of a mental activity, such as dreaming, imagining, foretelling, promising, or storytelling. David Lewis (1986, 84–91) proposes an alternative to the absolutist view known as modal realism. For Lewis, all possible worlds are equally real, and all possibilities are realized in some world, independently of whether somebody thinks of them or not. But if all possible words are real, how does one pick one of these worlds as actual? Lewis answers this question through an indexical conception of actuality. The reference of the expression *the actual world* varies with the speaker, like the reference of the deictics *I*, *you*, *here*, and *now* (see DEIXIS). All possible worlds are consequently actual from the point of view of their inhabitants.

The indexical conception of actuality is very important for the description of the reader's experience of fiction. We normally think of fictional worlds as imaginary and as nonexisting. We know that in contrast to our world, they are produced by a human mind, the mind of the author. But this does not explain how we relate to them. In contrast to hypothetical and counterfactual statements, whose reference to an imaginary world is stressed by the conditional mode or by an *if … then* construct, fictions are narrated in the indicative mode and, therefore, hide the nonactual status of their reference world. Lewis accounts for the formal similarity between fiction and statements of facts by characterizing fiction as a story told as true about a world other than the one we regard as actual by a narrator situated within that other world. A nonfictional story, by contrast, is told as true about our world by one of its members, and a counterfactual or hypothetical statement describes another world from the point of view of the actual world.

For the duration of our immersion in a work of fiction, we regard – or, rather, pretend to regard – its world as actual. This pseudoactuality is produced by a gesture of imaginative recentering of the reader, spectator, or player into the fictional world (Ryan 1991, 21–2). The experience of fiction has been compared by Kendall Walton (1990) to a game of make-believe, but what exactly is it that we pretend to believe when we immerse ourselves in a work of fiction? PW theory, and more specifically the indexical theory of actuality, spells out the rules of this game as pretending to believe that fiction describes a world that is both real and actual. Pretending that this world is real means pretending that it exists independently of the text, while pretending that it is actual means transporting oneself in imagination into this world and adopting the point of view of one of its members.

Another of Lewis's contributions to the theory of fiction is the elaboration of an algorithm for determining the truth or falsity of interpretive statements made by the reader about fictional worlds (1978). This algorithm is adapted from his famous analysis of the **TRUTH CONDITIONS** of counterfactual statements (1973). Lewis's criterion for establishing the truth value of statements about fiction, such as "Emma Bovary was a devoted mother," can be paraphrased as follows: "A sentence of the form 'in the fiction f, p' is true when some world where f is told as known fact differs less, on balance, from the actual world than does any world where f is told as known fact and p is false." This formula tells us that Emma was not a model mother because, in order to accept this interpretation, we would have to assume that the fictional world adheres to a set of standards of good motherhood vastly different from the values of our cultural corner of the actual world, though nothing in the text authorizes such an assumption.

Lewis's algorithm entails a fundamental principle for the phenomenology of reading. This principle, called by Marie-Laure Ryan the "principle of minimal departure," states that when readers construct fictional worlds, they fill in the gaps in the text on the basis of their experience of the actual world, and they will not make gratuitous changes. The principle of minimal departure can only be overruled by the text itself. For instance, if a work of fiction mentions an elephant, the reader will imagine the elephant as huge and gray unless the text describes it as a polka-dotted pet the size of a chihuahua. Even then, the reader will imagine that the elephant has thick skin, big ears, and tusks.

The assimilation of fictional worlds – a concept often used by critics informally – to the more technical notion of possible worlds can claim Aristotle as its forefather: As he writes in the *Poetics*, "the function of the poet is not to say what *has* happened, but to say the kind of thing that *would* happen, i.e. what is possible in accordance with probability and necessity" (1996, 16, par. 5.5). But even if one extends the notion of possibility beyond what could happen in our world so as to include the logically coherent but nomologically impossible worlds of science fiction and fantasy, the straightforward assimilation of fictional worlds to possible worlds encounters difficulties.

Logicians consider possible worlds to be "maximal states of affairs," meaning by this formula that every proposition is either true or false in a given world. But fictions are created by texts, and texts can only assert a limited number of propositions. To

take a famous example, the tragedy of Shakespeare implies that Lady Macbeth had children, but it does not specify the number of these children. Should one regard fictional worlds as radically incomplete, as does Lubomír Doležel (1998, 22–3), a view implying that Lady Macbeth is a creature who lacks the feature "having a determinate number of children"? Or should one apply minimal departure and assume that by presenting her as a human being, the text invites the reader to regard the number of her children as unavailable information – as would be the case for a flesh-and-blood woman – rather than as an ontological lack? Walton's concept of make-believe offers a compromise between these two interpretations: While readers *know* that fictional worlds are the product of a finite number of textual assertions, they *imagine* these worlds and their inhabitants as ontologically complete.

Another problem with regarding fictional worlds as possible worlds is the existence of fictions that do not respect the laws of logic and consequently fail to satisfy the broadest notion of possibility. In **LOGIC**, a single contradiction in a group of propositions renders the system radically inconsistent because this contradiction allows everything (and its opposite) to be inferred. This makes it impossible to imagine a world. But in a fictional text, transgressions of logic are not totally incompatible with the mental construction of worlds. Logically impossible objects or events can be limited to certain areas, comparable to the holes in a Swiss cheese, and the reader remains capable of drawing inferences for the solid parts of the cheese. We can still imagine the world of a time-travel story that presents impossible causal loops or of a fantastic tale situated in an inconsistent space. But some fictions generalize contradiction by systematically negating what they assert or by presenting dreamlike situations that continually morph into other situations. The reader of these texts can only construe fragments of worlds that do not fit together. All fictions project a set of meanings, but if we conceive worlds as relatively stable totalities populated by individuals whose evolution maintains some continuity, the extent to which these meanings form a world is variable. A fiction made of incompatible world fragments blocks the experience of immersion because it does not offer a target for the recentering of the imagination.

– Marie-Laure Ryan

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PRAGMATIC COMPETENCE, ACQUISITION OF

The acquisition of pragmatic competence involves the development by the first or second language learner of a wide range of skills and capacities in using language to interact. Together with linguistic competence, it forms the core of communicative competence, as defined by D. Hymes (1967, 1992; Foster-Cohen 2001) and includes how learners develop the ability to convey and interpret linguistic (and nonlinguistic) messages; how they expand their repertoire of communicative acts; how they come to modulate those acts for such features as directness, **POLITENESS**, and informativeness; and how they design their messages so that they conform to the social norms of their community. It also includes the developing ability to construct linguistic units larger than an utterance, including extended conversational exchanges, stories, descriptions, explanations of procedures, and so on, as well as the very basic capacity to enter into interactions with other people and the turn-taking, topic initiation, topic maintenance, and exchange opening and closing behaviors upon which any interaction depends.

Work in the acquisition of pragmatics has often resulted in extended taxonomies of the **SPEECH-ACTS** and types of talk that learners acquire. A. Ninio and P. Wheeler (1984), for example, developed a taxonomy of 70 distinct types of "talk interchanges" acquired by children, categorized at an exchange level as *negotiations*, *discussions*, *performances*, and so on and at the utterance level in terms of communicative acts, such as directives, declarations, statements, questions, and the responses to each of these. The taxonomy represents a "hypothesis about the organization of the mental representation of communicative intents in the mind" (Ninio and Snow 1996, 39) and has its roots in speech-act theory, pioneered by Austin and Searle (see Searle 1969).

Other work has attempted to explore what is needed for children to be able to behave in ways that others accept as natural and effective language use in a given community. E. Andersen (1990), for example, examined children's growing knowledge of the language appropriate to roles with significant power differentials, such as doctor versus patient or teacher versus pupil; others have explored issues such as how children develop gender-differentiated ways of speaking (see **GENDER AND LANGUAGE**). Other studies have explored what kinds of social, cognitive, and

linguistic developments are needed before children can engage in particular acts. J. Bernicot and V. Laval (2004), for example, have explored how children learn to make a promise or understand one. This kind of work addresses children's growing understanding of how the interpretation of linguistic expressions depends crucially on inferencing by correctly processing both the language that is spoken and a wide range of contextual characteristics that go well beyond the words actually uttered. In fact, the exploration of children's capacity for drawing inferences in communication is a healthy area of research in its own right. I. Noveck (2001), for example, has explored children's interpretations of scalar implicatures (see CONVERSATIONAL IMPLICATURE) and suggested that in certain ways, children are more "logical" in their interpretations of words, such as "some," than are adults.

Pragmatic Acquisition from Birth to Adolescence

Infants are surprisingly communicative, even from birth. Perhaps because of **MIRROR** neurons (Bråten 2007), newborns respond in kind to the social advances of adults and are soon able to initiate social exchanges with others through eye gaze, movement, and vocalization (see COMMUNICATION, PRELINGUISTIC), as well as to engage in elementary turn-taking. This is the beginning of the development of pragmatic competence.

Elizabeth Bates and colleagues (Bates, Camaioni, and Volterra 1975) suggested that Austin's tripartite distinction between **PERLOCUTION**, **ILLOCUTION**, and *locution* might be harnessed to describe what happens in the first year of life. They suggested that when an infant communicates a message (such as "I'm hungry") through a cry but without the intention to communicate, it can be seen as a sort of perlocutionary event (albeit without either illocution or locution). Then, as the emergence of **GESTURES** and specific patterns of eye gaze emerge, illocutionary forces, such as requests (perhaps achieved via a reaching hand coupled with a glance at the interlocutor and a glance at the desired object) or making an observation (perhaps through a similar eye gaze pattern, but this time coupled with a pointing hand shape), can be observed while still in the prelinguistic phase and therefore prelocutionary. Finally, the emergence of recognizable words adds the capacity for locution. Other researchers, such as John Dore (1975) and Michael Halliday (1975), have also added to our understanding of just how rich very young children's capacity for pragmatic competence is before the emergence of significant expressive language.

As productive expressive language emerges, from around the first birthday, the communicative resources of the child expand and go on expanding over the next two decades and, for some, throughout life. Some communicative acts are easily accomplished with quite simple linguistic resources (greetings, leave-takings, agreements, and labeling of objects, for example). Others, such as giving explanations, asking questions, providing definitions, or making hypotheses, are dependent on a more sophisticated level of language development. So, while yes/no questions can be asked with only a rise of **INTONATION** ("Out?," for example), open-ended questions require at least some control of the wh-questions forms, for example, "What Daddy do?" and "How you go there?" Interestingly (and often irritatingly for the parent), the ubiquitous "Why?" seems to be used in the first instance for its ability to elicit a response from the interlocutor, rather than for its ability to seek reasons and motivations, which at that stage are beyond the child's level of cognitive development.

Not long after children acquire the ability to produce individual communicative acts, they begin to combine them into larger language acts and events, such as stories, explanations, and complex observations. Narratives range from the simple statement of a problematic event in the past followed by a solution ("The baby cried; the mummy picked it up") to heavily scaffolded productions such as the following:

> Ross (aged 2;6) and his mother are sitting together eating a snack.
>
> R: Sometimes Ross come out bed bed come out night.
> M: What are you talking about? What about that bed at night? Sometimes you what the bed at night?
> R: Mmm.
> M: What did you say?
> R: In the dark.
> M: In the dark!
> R: Ross, erm, Ross runs in the dark.
> M: Run in the dark?!
> R: Ross runs.
> M: You get out of the bed in the night did you and ran around in the dark. That sounds a daft thing to do! (Foster-Cohen 1990)

Here, Ross's mother helps him get his story out piece by piece and puts it together for him.

As children develop their story skills, we start seeing complex depictions with recognizable phases and characteristic packaging of information (Labov and Walestsky 1967). The literature on children's narratives has been enhanced by several large-scale studies, such as that by Ruth Berman and Dan Slobin, whose collection of stories told in response to a wordless book about a small boy and a frog (known, naturally enough, as The Frog Stories) has provided a cross-linguistic, cross-cultural view of how children develop the ability to tell a story (Berman and Slobin 1994; Strömqvist and Verhoeven 2004).

Stories and other large discourse units are held together via the **COHERENCE** of their informational structure and by the markers of cohesion than link individual utterances to each other. The presentation of new information in relation to assumed or known information is one key aspect of coherence, and requires children to be able to infer what their interlocutor knows and to structure the information provided accordingly. As such, the development of coherence in children's narratives, and in their language use generally, is dependent on the evolving understanding of other minds (see THEORY OF MIND AND LANGUAGE ACQUISITION). When there is different and conflicting information held by the child narrator and by a protagonist in the story, it places considerable strain on the young child's pragmatic competence. An example occurs in the "Frog, where are you?" story. At one point, the boy in the story grabs what be believes to be branches but the narrator knows to be the antlers of a deer. Children struggle with how to represent this conflicting information, as the following representative samples from Berman and Slobin's (1994) work suggest:

- *He hops on the deer.* (4.7; no understanding of the boy's misjudgment of the "branches")
- *Then he got on a reindeer, because the reindeer was hiding there.* (5.2; understanding that the reindeer was not initially visible to the boy, but no attention to the boy's state of mind)
- *He got picked up by a reindeer.* (5.8; use of get-passive suggests the narrator is aware that the boy was not an intentional agent)
- *He's holding on to some sticks. But they aren't really sticks. When – uh – something came up, and the little boy was on it. Um – it was … a father deer, I'd call it.* (5.10; explicit recognition of the boy's misperception, though from the point of view of the narrator, rather than the boy)
- *He – thought it was sticks and – he got on that and – the deer came and – carried him.* (5.11; explicit attribution of misperception to the boy; groping for means of encoding the unintentionality of the consequences)
- *And then he stands up on the rock and hangs onto some branches. Then it turns out they're a deer's antlers. So – and he gets – he lands on his head.* (9.11; the "turns-out" construction provides a means of encoding the switch in perspective, and the interrupted "he gets" suggests a groping for a passive construction)
- And finally, here is an adult version: *When he gets to the top of the rock, he holds onto something that he app – thinks are branches, and calls to the frog.… And what the boy took to be branches were really antlers of a deer on which he gets caught.*

These samples can also be used to illustrate cohesion markers. In particular, we can see how the deer is introduced by the youngest child with a definite article, as if its presence were already known. Almost all the other older children use the indefinite article appropriate to a first mention. All the children use "he" to refer to the boy, which works in these examples. However, in another example, taken from elsewhere in the database – "And he [the deer] starts running. And he [the deer] tips him off over a cliff into the water. And he [the boy] lands" – we can see how the use of pronouns undergoes development in order for the hearer to keep track of the protagonists reliably. If the simple story referred to had been "The baby cried; the Mummy picked Johnny up," we would be forgiven for wondering whether Johnny is the baby or someone else.

As they develop, children are able to rely more and more on their own skills in pragmatics and depend less and less on a cooperative "other" to make sense of what they are trying to say. As a result, their interactions with their peers can begin to mature, and they can develop the skills for working and learning cooperatively with children their own age. These conversations are often much more combative than any conversation between nurturing parent and child, and children need to, and do, develop important skills for repairing the misunderstandings that inevitably arise. However, unlike grammatical development, which is largely complete by the age of five, pragmatic competence keeps on developing. Teenagers continue to develop their skills of staying on topic, interrupting appropriately, showing empathy, and entertaining others by telling jokes and acting out stories and events (Nippold 2000). Moreover, as professional orators, stand-up comics, negotiators seeking the release of hostages and those clinching business deals know, they may hone their pragmatic skills for the rest of their lives.

Developing Pragmatic Competence in a Second Language

Most of the work on the acquisition of pragmatics has been carried out within first language research circles. However, there is now a thriving research stream in second language pragmatics, pioneered most notably by Gabriele Kasper (Kasper and Rose 2002). The significance of this work for those working in developmental pragmatics with children lies in the help it provides for teasing apart those aspects of pragmatics that are pancultural and part of the human makeup and those that are specific to particular language and cultural groups.

Research suggests that second language pragmatics is notoriously difficult to learn. There are a number of possible reasons. One is that, unlike grammar, inappropriate pragmatics is generally perceived by the other party as another pragmatic message. So, inability to respond to a compliment as a native speaker might is perceived as ungratefulness or rudeness. Overlapping another person's speech in a way that is not native can be perceived as interrupting. As a result, learners may not receive the kind of feedback they actually need to adjust their pragmatics toward the native-speaker norms. Another reason is that while learning the grammar of a second language can be perceived by the learner as simply the learning of a code (another way of saying something), learning the pragmatics of another language group is learning that group's culture and, as such, is felt more deeply and more personally. As a French learner of English once said when I was trying to teach the pragmatics of English, "I want to learn English; I don't want to *be* English." Finally, and relatedly, the reason second language pragmatics is so hard to acquire is because researchers and pedagogues are not very good at describing it in such a way that learners can, in fact, learn it.

Disorders of Pragmatic Competence

Because the development of pragmatic competence depends on a number of intersecting developments, there are multiple ways in which it can be derailed or curtailed. Difficulties with understanding the nature of social engagement, of inferring the knowledge and intentions of another person, or of processing the subtle cues of verbal and nonverbal communication can all impact on a learner's capacity to become pragmatically competent. The most well known disorder of pragmatic competence is *autistic* spectrum disorder, a condition which comes in a variety of forms and degrees of severity. It can impact all of the aforementioned prerequisites for pragmatic competence. A variety of other developmental conditions (including Down syndrome, Williams syndrome, and global developmental delay) also impact on pragmatic development. More avoidable are those disruptions to pragmatic development that come about as a result of neglect or abuse and the consequent failure to attach effectively to one or more key people. It is now quite clear that the development of social relationships, and with it pragmatic competence, is dependent on experience in responsive and pragmatically appropriate relationships. Even an intact child can have his or her pragmatic competence derailed by poor experiences.

How Pragmatics Is/Are Acquired

As with any human development, pragmatic competence is acquired as a result of both biological design and social experience. As already indicated, the acquisition of pragmatic competence depends crucially on nonlinguistic factors, such as innate social responsiveness, the development of real-world knowledge, and general problem-solving ability. It has also been claimed to depend more heavily on overt instruction. Children are observed being taught to be polite, to follow the rules for "trick or treat" at Halloween, or to adjust their messages to take account of the other person's knowledge and seem more able to learn from correction and overt modeling than they are when their grammatical "errors" are corrected. However, given the complexity of pragmatic development, the huge amount of unconscious inferencing it requires, and the difficulty understanding what has gone wrong when pragmatic rules and expectations have been violated, it is unlikely that more than the most codified of pragmatic skills (politeness formulae, terms of address, "fixed" events such as trick or treat) are acquired in this manner. Rather, pragmatic skills are "caught" through cultural **CONTACT** and spread by epidemiological principles (Sperber 1996).

– Susan Foster-Cohen

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PRAGMATICS

Pragmatics refers to the study of meaning in context. Consider, for example, the following exchange between two close friends:

> Harvey: "Are you going to the big party tonight?"
>
> Molly: "Didn't you hear that Jason would be there?"

How does Harvey interpret Molly's response to his question? Although Molly's response is itself a question, it is considered an appropriate answer to Harvey's original question, at least in this context, given the assumption that Harvey knows what Molly feels about Jason. Of course, listeners who do not know how Molly feels about Jason would be unable to infer whether Molly implies "yes" or "no" by her response. But the information that Harvey and Molly share about Jason, and particularly Molly's thoughts about Jason, such as that he is an ex-boyfriend whom she wishes to avoid, should allow Harvey to easily infer what Molly means by what she says.

People's pragmatic understanding of speakers' utterances in context is assumed to rely on their general knowledge of the world, the specific discourse context, and what they know about their interlocutors. Pragmatics is seen as distinct from **SEMANTICS** in referring to contextual meaning, as opposed to context-invariant word meaning or **SENTENCE MEANING**, and is also viewed as being associated with what speakers imply, as opposed to what they literally say. Philosophers interested in **ORDINARY LANGUAGE** use, and not more narrowly semantic meaning, launched the study of pragmatics in the late 1950s. For instance, J. L. Austin (1962) described the ways in which people use words to accomplish different social actions, and he demonstrated that speakers typically intend to communicate different or additional meanings beyond what their words literally say (see PERFORMATIVE AND CONSTATIVE). Thus, when a speaker says, "I'll lend you five dollars," she communicates a promise to actually give the listener $5. The philosopher John Searle (1975) later argued that there were only five major types of **SPEECH-ACTS** by which speakers perform acts with different **ILLOCUTIONARY FORCE**, including:

> *Representative or Assertive*: The speaker becomes committed to the truth of the propositional content of an utterance; such as asserting "The sun is shining today."
>
> *Directive*: The speaker tries to get the hearer to fulfill what is represented by the propositional content of an utterance, such as "Please stop talking."
>
> *Commissive*: The speaker commits to act in the way represented by the propositional content of an utterance, such as "I'll lend you five dollars."

Expressive: The speaker expresses an attitude toward the propositional content of an utterance, such as "I'm sad your wallet was stolen."

Declarative: The speaker performs an action just representing himself or herself as performing that action, such as "We find the defendant guilty of murder in the first degree."

Philosophers have explored the various social and institutional facts that must hold for an utterance to be faithfully seen as an example of any of these speech-acts, such as whether an individual must be capable of fulfilling the act represented in an utterance for it to be seen as a sincere promise (i.e., that the speaker actually has $5 to loan and can give this money to the listener).

Pragmatic theory, however, has paid greater attention in the last 40 years to the process by which listeners infer what speakers mean by what they say. Recall the conversation between Harvey and Molly. Understanding that Molly's comment is meant as a particular answer to Harvey's question requires that Harvey go through a chain of reasoning regarding Molly's intentions because her answer does not logically follow from his question. The philosopher H. Paul Grice called the intended message behind Molly's utterance a **CONVERSATIONAL IMPLICATURE**, which is a natural outcome of speakers' and listeners' tacit adherence to the **COOPERATIVE PRINCIPLE**. This states that a speaker must "make your conversational contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged" (Grice, 1975: 45). The cooperative principle carries with it four maxims:

Maxim of Quantity: Make your contribution as informative as is required, but not more so, for the current purposes of the exchange.

Maxim of Quality: Do not say anything you believe to be false or for which you lack adequate evidence.

Maxim of Relation: Say only what is relevant for the current purposes of the conversation.

Maxim of Manner: Be brief, but avoid ambiguity and obscurity of expression.

Grice noted that speakers do not always uphold these maxims. So long as speakers generally adhere to the overall cooperative principle, they can "flout" any of these maxims to produce certain implicatures. For example, Molly's response to Harvey's question flouts the maxim of manner to implicate that she is not going to the party because of Jason. According to Grice's analysis, Harvey would not consider Molly's response to be uncooperative. Instead, Harvey would continue to assume that Molly's rhetorical response was cooperative and would seek an interpretation given what he assumes about Molly, and what he believes Molly assumes about him, in order to derive an acceptable and "authorized" interpretation.

One place where speakers flout conversational maxims is in their use of figurative language, such as **METAPHOR** (e.g.,"Lawyers are sharks") and **IRONY** (e.g., "A fine friend you are!"). Grice's theory assumes that figurative language is understood in a series of steps (1975). First, listeners analyze the literal meaning of the entire expression. Second, they assess whether this literal interpretation is appropriate for the specific context. Third, if the literal meaning is contextually inappropriate, as is the case for figurative language, listeners must then derive the intended figurative (e.g., metaphorical, ironic) meaning via the cooperative principle. This view suggests, then, that figurative language should be more difficult to comprehend than corresponding literal speech, because figurative speech requires an additional processing step in which the literal meanings are rejected and the intended figurative meanings are subsequently inferred.

Many pragmatic theories, especially in philosophy, embrace all or some of the Gricean view of conversational implicature and his specific proposals on understanding indirect and figurative language. Indeed, much of the focus in philosophical and linguistic studies on pragmatics is devoted to demonstrating how classic semantic phenomena, such as **REFERENCE, INDEXICALS**, and demonstratives, can be explained in terms of an understanding of the specific facts about the speaker, time, and location of an utterance (Kaplan 1989; Stalnaker 1999) But psychological experiments have raised important questions about Grice's theory. Although there is considerable evidence showing that speakers generally aim to be cooperative, with talk being primarily organized around the recovery of speakers' pragmatic intentions (Clark 1996; Gibbs 1999), it is less clear that meaning is processed in the serial manner that Grice and other pragmatists assume. For instance, numerous psycholinguistic studies indicate that many kinds of figurative language, including novel metaphors, can be understood as quickly as literal speech when these expressions are encountered in rich linguistic contexts (Gibbs 1994). Thus, pragmatic knowledge may be immediately accessed and applied in order to understand what speakers imply by what they say, without listeners first having to analyze the literal, semantic meaning of utterances.

A different proposal on the pragmatics of utterance interpretation assumes that speakers aim to be optimally relevant in saying what they do. Optimizing relevance is a fundamental tenet of **RELEVANCE THEORY** (Sperber and Wilson 1995). Under this "optimally relevant" view, every act of ostensive behavior communicates a presumption of its own optimal relevance, that is, a presumption that it will be relevant enough to warrant the addressee's attention and as relevant as compatible with the communicator's own goals and preferences (the *communicative principle of relevance*). Speakers design their utterances to maximize the number of cognitive effects that listeners infer, while minimizing the amount of cognitive effort to do so. Listeners understand speakers' communicative intentions via the "relevance-theoretic comprehension procedure" (Sperber and Wilson 2002), by following a path of least effort in computing cognitive effects. They do this by testing interpretive hypotheses (e.g., disambiguations, reference resolutions, implicatures) in order of accessibility, and then stopping when their expectations of relevance are satisfied.

For example, consider the following exchange between two university professors (Sperber and Wilson 2002, 19):

Peter: "Can we trust John to do as we tell him and defend the interests of the Linguistics Department in the University Council?"

Mary: "John is a soldier!"

How does Peter understand Mary's metaphorical assertion about John? Peter's mentally represented concept of a soldier includes many ideas that may be attributed to John. Among these are a) John is devoted to his duty, b) John willingly follows orders, c) John does not question authority, d) John identifies with the goals of his team, e) John is a patriot, f) John earns a soldier's pay, and g) John is a member of the military. Each of these ideas may possibly be activated to some degree by Mary's use of "soldier" in relation to John. However, certain of these attributes may be particularly accessible given Peter's preceding question where he alludes to trust, doing as one is told, and defending interests. Following the relevance-theoretic comprehension procedure, Peter considers these implications in order of accessibility, arrives at an interpretation that satisfies his expectations of relevance at d, and stops there. He does not even consider further possible implications, such as e–g, let alone evaluate and reject them. In particular, Peter does not consider g, the literal interpretation of Mary's utterance, contrary to what is advanced by the Gricean view, and consistent with the psychological evidence on inferring metaphorical meaning.

Relevance theory has also advanced the idea that significant aspects of what speakers say, and not just what they totally communicate, are deeply dependent upon enriched pragmatic knowledge. Essentially, the same sorts of inferential processes used to determine conversational implicatures also enter into determining what speakers say (Carston 2002; Recanati 2004; Sperber and Wilson 1995). Consider a case where a speaker says to you "I haven't eaten" in response to a question about whether she found time for breakfast that morning. Once the indexical references and the time of the utterance are fixed, the literal meaning of the sentence determines a definite proposition, with a definite truth condition, which can be expressed as "The speaker has not eaten prior to the time of the utterance." This paraphrase reflects the minimal proposition expressed by "I haven't eaten." However, a speaker of "I haven't eaten" is likely to be communicating not a minimal proposition but some pragmatic expansion of it, such as "I haven't eaten today." This possibility suggests that significant pragmatic knowledge plays a role in enabling listeners to expand upon the minimal proposition expressed in order to recover an enriched pragmatic understanding of what a speaker says. Several experimental studies indicate that pragmatics plays a major role in people's intuitions of what speakers say (Gibbs and Moise 1997). Thus, the distinction between what speakers say and imply may possibly be orthogonal to any distinction between semantics and pragmatics, contrary to the traditional Gricean view.

The vast number of studies on a wide assortment of linguistic and nonlinguistic phenomena conducted within the relevance theory framework makes it the most salient model of pragmatics and utterance interpretation available today. At the very least, part of relevance theory's significant appeal in interdisciplinary language studies is its explicit aim to situate pragmatics within broader concerns of human cognition and communication, through its embrace of the principles of relevance. Not surprisingly, relevance theory has its critics, ranging from scholars, primarily in linguistics, who assume that utterance meaning is determined by heuristics of default or preferred interpretations (Horn 2004; Levinson 2000) to psychologists who fault relevance theory for the circularity in its proposed trade-off between maximizing cognitive effects and minimizing cognitive effort (Giora 1997).

Psychological studies on pragmatics have primarily examined figurative language understanding and the degree to which speakers and listeners coordinate during conversational exchanges. Both the Gricean and relevance theory perspectives do not assume that speakers and listeners rely on some definitive common ground in order for conversation to proceed smoothly. Some psychologists, however, have demonstrated through various empirical means that speakers and listeners actively collaborate and coordinate their beliefs and knowledge to achieve mutual understandings in different contexts (Clark 1996; Gibbs 1999).

For example, research shows that speakers take the addressee's perspective into account when designing their utterances in naturalistic, task-oriented dialogue. One set of studies had two people, who could not see each other, collaborate over the arrangement of Tangram figures (geometric shapes that are vaguely suggestive of silhouettes of people and other objects) (Clark and Wilkes-Gibbs 1986). One person (the director) had an ordered array of these figures and had to explain their arrangement to the other (the matcher) so that the other person could reproduce the arrangement. Each director-matcher pair did this six times. The main hypothesis is that as common ground is established between the director and matcher during the conversation, it should be easier for them to mutually determine where each figure should go. As expected, the number of words used per Tangram figure fell from around 40 in the first trial to around 10 in the last. For instance, a speaker referred to one figure in Trial 1 by saying "All right, the next one looks like a person who's ice skating, except they're sticking two arms out in front," while in Trial 6 the speaker said "The ice skater." A similar decline was observed in the number of turns required to complete the arrangement task, showing that the interchange became more economical as common ground was established. Other studies using this experimental paradigm indicate that speakers and listeners can also coordinate to hide information from overhearers without damaging their own understanding of each other's communicative meanings (Clark and Schaeffer 1987).

These data demonstrated that the assessment of common ground has an integral part in determining what speakers specifically say and in facilitating listeners' recovery of speakers' intentions. One implication of these findings is that utterance interpretation is a *joint activity* of both speakers and listeners, and not solely the responsibility of listeners. Indeed, psychological studies also demonstrate that conversational participants typically try to reach the mutual belief that the addressees have understood what the speaker meant to a criterion sufficient for current purposes. Thus, when Molly speaks, she looks for evidence from Harvey that he has understood her. Harvey, in turn, tries to provide that evidence by saying, "oh right," nodding his head, or taking the relevant next turn. Of course, the collaboration and coordination between speakers and listeners reflects the operation of rapid, mostly unconscious, comprehension processes. Conversational participants are rarely aware of the

cognitive and linguistic processes that underlie their understanding of others' pragmatic intentions, unless the attempt to coordinate fails and leads to misunderstandings.

Not all psychologists agree that speakers and listeners always aim to be cooperative in conversation by taking the other person's perspective into account during speaking and listening. Some experiments show, for example, that speakers and listeners can each adopt an egocentric bias as they speak and comprehend, particularly when they experience additional cognitive load or stress (Horton and Keysar 1996). Speakers also sometimes overestimate how effective they are communicating their messages to listeners, with listeners also sometimes assuming that they correctly understood speakers when in fact they did not (Keysar and Henly 2002). These studies show how there are at least some systematic sources of misunderstanding attributable to what might be best characterized as an egocentric bias in communication effectiveness.

The study of pragmatics will undoubtedly continue to have a strong interdisciplinary flavor in the future. Scholarly intuitions about how knowledge of the world and context shape utterance interpretation must be supplemented by experimental studies that examine fast, unconscious cognitive and linguistic processes operating when speaker meaning is understood. We need to understand not only what pragmatic information shapes contextual meaning but also when that knowledge in recruited in the psychology of ordinary language interpretation.

– Raymond W. Gibbs, Jr. and Gregory A. Bryant

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PRAGMATICS, EVOLUTION AND

For at least 100,000 years, human beings have been talking the way we do. Language is universally used by most individuals in every culture several hours each day, primarily during conversational chatter (Dunbar 1998). How did our species come to adopt such a strange behavior in the course of its evolution? The question has been considered in turn as obvious and baffling. A proper approach to the reasons why we talk requires that the biological function of language be understood, and pragmatics is the right place to seek out that function.

If we adopt the perspective of an ethologist, then language appears as a distinctive feature of our species that, like any other finely designed characteristic, must have a definite function to have been selected through the repeated effect of differential reproduction (Pinker and Bloom 1990). For decades, language was thought to be essentially a means for organizing, responding to, and manipulating the behavior of others (Brown 1991, 130) or a tool for sharing knowledge (Pinker 1994, 367), and it was considered obvious that it had been selected for these purposes. This traditional view has now lost most of its obviousness for two reasons: 1) Its logic contradicts Darwinian principles, and 2) what people spontaneously do with language corresponds to a quite different picture. We examine these two issues in turn, before considering more plausible alternatives.

Any evolutionary account of the existence of language must make clear what biological advantage both speakers and listeners get out of speaking. In many traditional accounts, the fact that *listeners* take advantage from receiving information is taken as sufficient explanation for the existence of language, but language cannot evolve if there is no direct or indirect advantage on the speaker's side. If language is a way of influencing others' behavior, the speaker's advantage is now obvious, but Darwinian selection should have led to resistance on the listener's side: There is an advantage in ignoring signals aiming at bringing you to serve the interest of others.

One of the most striking and incomprehensible facts about human language is that it relies on a positive attitude from speakers. Speakers bear all the burden of designing appropriate (Grice 1975) or even optimal (Sperber and Wilson 1986) messages to convey intentional meaning. If they do so spontaneously and often quite profusely, it must be because they gain some benefit from it. Listeners, on the other hand, show much trust in what they hear. Knowing that language is "cheap," the fact that listeners give credence to most of what they hear is hard to explain

in a Darwinian world in which creatures are designed to favor their own success, not the success of others (Knight 2002). The absence of trust is what explains the repetitiveness, the cost, and the poverty of most animal communication (Zahavi and Zahavi 1997).

These concerns about the speakers' willingness to speak and the listeners' to trust have no known solution within frameworks in which language acts are supposed to provide immediate benefit to either party. It has been suggested that information exchange through language could be based on reciprocity (Pinker 2003, 28; Nowak and Sigmund 2005, 1293). The reciprocation model, however, functions under strict limits: good benefit-to-cost ratio and strict control of reciprocity. It is at odds with several observations about spontaneous language, such as the fact that many conversational utterances are about futile topics, or the fact that talkative behavior is far from being an exception: On average, individuals typically talk to two persons simultaneously (Dunbar, Duncan, and Nettle 1995).

The utilitarian conceptions of language that inspired most traditional ideas about its biological role are dictated mainly by theoretical considerations. Some theories emphasize the role of language in performing actions; it is thus natural to imagine language as having emerged from simple directives (Holdcroft 2004). Other theories see in language a process through which individuals actively try to influence the beliefs of others (Sperber and Origgi in press). A natural strategy, to decide which aspect of language use is most likely to have given a biological advantage both to speakers and listeners, is to observe how current human beings spontaneously talk.

Conversation constitutes by far and universally the main occasion in which language is used. Conversational activity, however, is not monolithic. When chatting, individuals show essentially two forms of behavior: They tell stories and they pursue argumentative discussions. Even if both are often intertwined, it is important to distinguish narration and argumentation, as they involve quite different cognitive processes and might have arisen successively during evolution. Conversational narrative analysis shows that narratives fill up to one-half of our speaking time (Eggins and Slade 1997, 265) and may represent some 10 percent of our awake time. Speakers take time, sometimes several minutes, to recount some past situation in minute detail (Norrick 2000). Not all situations are likely to be reported: Only those that can elicit specific *emotions*, especially *surprise*, are recounted (Dessalles 2007). The following example, adapted from (Norrick 2000, 55–6), is about an unexpected encounter:

Brianne: It was just about two weeks ago. And then we did some figure drawing. Everyone was kind of like, "oh my God, we can't believe it." We- y'know, Midwest College, y'know, …

Brianne: like a … nude models and stuff. And it was really weird, because then, like, just last week, we went downtown one night to see a movie, and we were sitting in [a restaurant], like downtown, waiting for our movie, and we saw her in the [restaurant], and it was like, "that's our model" (laughing) in clothes

Addie: (laughs) Oh my God.

Brianne: we were like "oh wow." It was really weird. But it was her. (laughs)

Addie: Oh no. Weird.

Brianne: I mean, that's weird when you run into somebody in Chicago.

Addie: yeah.

Stories come in chunks, the so-called story rounds (Tannen 1984, 100), which may last for tens of minutes. The biological significance of this systematic and universal tendency to report emotional and unexpected events lies quite far away from any immediate utilitarian effect, like behavioral influence or vital knowledge transfer.

During argumentation, in contrast with narration, individuals are not bound to mention fully instantiated states of affairs. They may even utter quite general statements to make a point. Argumentation can be described, at the cognitive level, as an oscillation between problems and tentative solutions (Dessalles 2007). During conversation, any inconsistency between beliefs or between beliefs and desires is likely to be signaled, and it triggers a collective search for solutions. In the following example (adapted from Tannen 1984, 62), two participants wonder how the third one came to know about the sociologist Erving Goffman.

Deborah: But anyway.… How do you happen to know his stuff?

Chad: Cause I read it.

Peter: What do you do?

Deborah: Are you in … sociology or anything?

…

Chad: No.

Deborah: You just heard about it, huh?

Chad: Yeah. No. I heard about it from a friend who was a sociologist, and he said read this book, it's a good book and I read that book 'n

Deborah: I had never heard about him before I started studying linguistics.

Chad: Really?

The argumentative process is the same, with its characteristic alternation between problems and solutions, regardless of the social situation in which it occurs: a discussion about a famous sociologist's work, the planning of some forthcoming travel, or a harsh dispute. The biological significance of this systematic and universal propensity to mention inconsistencies and then to make every attempt to solve them cannot be reduced to the pursuit of some immediate practical benefit. Quite often, casual discussions are about futile matters that are unlikely to change the interlocutors' fate.

Why do human beings devote most of their speaking time telling stories and dealing with apparent inconsistencies? What utilitarian models fall short of explaining is directly addressed by models, like the **GROOMING** hypothesis, that emphasize the role of language in the establishment of social bonds (Dunbar 1996; Dessalles 2007). Language acts would not be biologically motivated by their immediate benefit but because they are

reliable indicators of some speaker quality that is valued in the establishment of solidarity networks. In these models, *language is display*. In the political niche of our species, individuals who are aware of their physical and social environment make better coalition partners. Hence, individuals demonstrate that they are able to witness unusual situations by reporting facts that elicit surprise and emotion. By recounting the "weird" encounter with the nude model, Brianne obeys this urge to show her ability to surprise others.

From this perspective, *language is a competition for interest*. On the friendship marketplace, where solidarity bonds are established and dissolved, individuals who report the most interesting events are, all other things being equal, the most appreciated. Now, the biological role of argumentation becomes clear. Without the ability to detect inconsistencies, individuals would easily shine by reporting incredible events that never occurred. Argumentation presumably emerged as an anti-liar device, besides checking for oneself (Dessalles 1998). As it is preferable to have nongullible members in one's coalition, argumentation became a way to demonstrate this quality. Hence, Deborah's and Peter's reflexes show that they could spot an apparent inconsistency during their conversation with Chad.

Recently, there have been various attempts to account for the existence of language (Johansson 2005). The one emphasized here highlights the *political* importance of talking. Language performance is indirectly vital: Those who recount in boring fashion or who are unable to build sensible arguments are rapidly left aside. In the world of our hominine ancestors, lonely individuals were defenseless and likely to be exploited. Language emerged as a way for human beings to show to their conspecifics that they have the required qualities to be valuable friends.

– Jean-Louis Dessalles

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PRAGMATICS, NEUROSCIENCE OF

What Is Pragmatics and What Is the Neuroscience of Pragmatics?

The neuroscience of pragmatics has not been extensively studied. This is understandable, inasmuch as **PRAGMATICS** came into focus fairly late as an area of study in linguistics. The field is not dominated by one specific theoretical framework. There are controversies concerning its delimitation with respect to, for example, semantics and "nonlinguistic" behavior. Finally, since pragmatic phenomena are crucially related to connected discourse and communicative interaction, they do not lend themselves easily to investigation by established experimental approaches or to such methods as neuroimaging, electroencephalography (EEG), and so on that focus on limited, often decontextualized, linguistic units. This entry is an attempt to summarize some typical approaches in relating pragmatic phenomena to neural processing, and what they have found to date.

The term *pragmatics* is used here in accordance with C. W. Morris (1938), who posited a framework in which syntax deals with the formal relations among signs, semantics adds the relations of signs to objects, and pragmatics further adds the relations of signs to the interpreter. Pragmatics is about language use or communication, in a broad sense and in context. It is assumed here that there is no clear sense in which pragmatics can be separated from semantics. The focus here, however, is on phenomena that are typically considered to be part of pragmatics.

In terms of the relation of pragmatics to *neuroscience*, different types of approaches have to be considered, since this is far from a uniform field of study. One set of approaches constitutes *experimental studies* of phenomena that are considered to be

important in pragmatics. This may involve trying to isolate such phenomena in an experimental setting that allows for *neuroimaging* techniques, such as fMRI (functional magnetic resonance imaging), or EEG/ERP (event-related potentials) to be used to measure brain activity. *Lesion* data can be handled either by experimental group studies, comparing, for example, individuals with left hemisphere damage (LHD), right hemisphere damage (RHD) and no brain lesion, or by case studies comparing specific phenomena in one individual or a number of individuals with lesions and communication disorders. Lesion studies in the area of pragmatics often also include a focus on communicative interaction in context, involving persons with brain damage, and use such methods as videorecording of face-to-face interaction, transcription, and coding and microanalysis of sequences and patterns of interaction. These studies also include more social constructivist empirical approaches, such as *conversation analysis*. Lesion studies can also be done with brain activity measurements, but this is more difficult, especially when homogeneous groups and many "repeated events" are needed and when an interaction between two persons is being studied.

The field of pragmatics primarily needs models of connected speech, for example, of story structure and topic flow, and models of linguistic communicative interaction, that is, models involving two (or more) participants and the interactive flow, co-construction, activation, and so on between them, including different levels of conscious control. These models can vary considerably in degree of detail and specificity. Typically in studies of pragmatics, communicative, cognitive, and emotive factors are included. Multimodality, such as body communication and prosody in speech, is considered important. Data often consist of sequences longer than words and sentences – monologue and dialogue samples, for example. Overall structure and the course of communication are studied, and interactive phenomena are often in focus. Specific pragmatic phenomena that can be studied from a neuroscience perspective are listed in Table 1.

Main Topical Subdivisions of the Field

Table 1 illustrates typical actual (x) and potential combinations of phenomena in pragmatics with methods in neurocognitive studies. Some of the combinations have also been attempted but, in general, there is a dividing line between phenomena that can be studied both in monologue and dialogue conditions and those that can only be fruitfully studied in dialogue. Studies involving the measurement of brain activity have generally been limited to monologue situations. It is, of course, possible to combine more than one method and more than one pragmatic phenomenon in a given study. The neuroscience of pragmatics faces the challenge of unifying the fairly rich findings from naturalistic and experimental behavioral studies of monologue and dialogue/interaction with studies of brain activity, which so far have been related to monological and experimental tasks only. This requires i) extensive work on models and theories, and ii) continued development of techniques and methodologies.

A Brief History of Modern Developments in the Field

A number of important milestones can be mentioned in the development of the neuroscience of pragmatics. The first is the acceptance of pragmatics as a discipline within linguistics, anthropology, sociology, and communication sciences and its introduction into clinical linguistics and medical settings during the last 20 to 30 years. Some approaches have involved the extension of the classical model of aphasia syndromes and the application of *cognitive neuropsychology* models. But there is also a recognition that other theoretical frameworks must be applied in the study of pragmatics: the increasing use of connectionist modeling, the growing community applying pragmatic theories and methods of analysis to studies of communication involving persons with brain damage, and the increasing interest in embodied cognition and communication. The rapid development of neuroimaging techniques, also during the last 20 to 30 years, has coincided with the development of pragmatic approaches to neurolinguistics; until very recently, however, the two research streams have not joined forces. Neuroimaging studies focus on phenomena that are easily studied in an experimental context. But the rapid development of fMRI, PET (positron emission tomography), and MEG (magnetoencephalography) techniques, as well as EEG/ERP, has paved the way for recent and ongoing attempts to actually capture pragmatic phenomena as well in this type of research.

Current State of the Field

Following are descriptions and examples of some of the dominant types of studies in this area.

MEASUREMENT OF BRAIN ACTIVITY. Some of the recurring abilities or functions attributed to specific brain areas are

- inhibition
- selection and ordering of speech, behavior, and logic
- formation and execution of plans of action
- memory processes (working memory, episodic memory retrieval, emotional modulation of memory processes and executive processing, and cues for long-term memory)
- theory of mind (ToM), mental inferencing, attribution of mental states, simulation for comprehension, visuospatial imagery, abstraction

TYPICAL STUDIES I – EEG/ERP. Studies of brain activity using EEG/ERP involve the correlation of specific temporal components of brain activity with performance. It is not (yet?) possible to study conversation with ERP. One of the most frequently used components is the N400, a negative ERP response to semantic anomaly.

One of the findings from studies of the N400 is that there is rapid incremental processing all the way through; in other words, listeners start early to respond to unfolding words as influenced by topic, how the speech is produced, and by whom. Listeners also use discourse information to automatically make predictions about semantics, syntax, phonology, and referents; discourse information can overrule local constraints. No evidence of context-free sentence-internal interpretation has been found, and the conclusion is that the brain does not engage in a two-step interpretation of semantics and pragmatics. What seems to be happening is that an initial quick and superficial

Table 1. Possible and typical (x) combinations of pragmatic objects of study and neuroscientific methods

Pragmatic phenomena/methods	Lesion-based studies studies of behavior		Brain activity studies	
	Empirical studies of behavior in context	Experimental studies	Neuroimaging, esp. fMRI	EEG/ERP
Comprehension and production of longer spoken contributions and texts, such as narratives	X	x	x	x
Inference	X	x	x	x
Cognitive semantics	X	x	x	x
Emotion in communication	X	x		
Own communication management (e.g., hesitation, self-repair)	X	x		
Interactive communication management (e.g., turn-taking, feedback)	X	x		
Speech-acts, language games	X	x		
Conversational principles	X	x		
Flexibility and adaptation; alignment, coupling, holistic patterns	X	x		
Body communication,embodiment, multimodality	X	x		

interpretation is followed or partially overlapped by a more precise one.

TYPICAL STUDIES II – NEUROIMAGING – fMRI. Using fMRI involves the comparison of brain activity in one task with activity in another via subtraction. It is not (yet?) possible to study interaction with fMRI. Labels used for the behavior studied are often too broad for specific comparisons between studies to be useful, and the method only shows activation across trials and participants, and not individual, diffuse, and weak signals that could also be important for modeling pragmatic processing.

One relevant fMRI study had (non-brain-damaged) subjects listen to connected versus nonconnected sentences. In this experiment by D. Robertson and colleagues (2000), no difference in brain activity between the two conditions was found for the left hemisphere (LH), whereas the right hemisphere (RH) showed increased activation for connected discourse in the middle and superior frontal regions. The same findings were replicated for picture stories. In passive listening only, however, it disappears. In addition, fMRI studies have shown that increased difficulty leads to more diffuse activation of brain regions. Activation of the temporal poles was also found only for this task. One suggested interpretation is that RH frontal lobe activation may only show up when the subject is activating memory to create coherence in a story representation. The same areas have been linked to abilities such as ToM, episodic memory, and integration.

As we have seen, studies of the comprehension and production of connected units of language, such as narratives, in comparison to single words and sentences, have most frequently been used to measure brain activity in studies of pragmatic phenomena. In general, many-to-many mappings of structures and functions are found, and this points to the need to develop theories and models.

TYPICAL STUDIES III – BEHAVIORAL STUDIES OF RIGHT HEMISPHERE DAMAGE. Studies of the behavior of LHD, RHD, and control subjects with no brain damage are perhaps the most prototypical ones in behavioral studies – both experimental ones and studies of naturalistic conversation. A number of such studies over the last 20 or 30 years have shown that RHD subjects, in spite of their good performance on traditional aphasia tests, definitely perform worse on many different aspects of pragmatics than LHD or control subjects. These findings have placed RHD at the center of the neuroscience of pragmatics. Studies of this type have used experimental group designs, as well as case studies and microanalysis of communicative interaction. They have given us a picture of RH functions in lexical semantics, the semantics of connected speech and writing, prosody, body communication, holistic processing, spatial imagery, ToM, topic management, sensitivity to interactive cues, inferencing (especially about emotions), and a number of other pragmatic abilities.

Some of the limitations to this approach are the (so far) relatively broad and uncertain mapping of specific areas in the RH to specific functions, the fact that groups of RH subjects are not homogeneous, and the relative lack of good instruments for measuring pragmatic functions in an experimental context.

It should also be stressed that when fine-grained methods are used, pragmatic deficits stemming from LH aphasia, traumatic brain injury, and other brain damage conditions are also found. Concerning the analysis of face-to-face interaction, the generalizability of results tends to be fairly low. Still, these types of analysis are extremely important to the neuroscience of pragmatics, as they provide studies of important pragmatic phenomena, which can also serve as input for further development of theories and methods. Most of the theoretical claims made on the basis of brain activity studies today in the area of pragmatics were made much earlier on the basis of empirical studies of behavior following brain damage.

– Elisabeth Ahlsén

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PRAGMATICS, UNIVERSALS IN

Changing Prospects for Universals in Pragmatics

The term **PRAGMATICS** has come to denote the study of general principles of language use. It is usually understood to contrast with **SEMANTICS**, the study of encoded meaning, and also, by some authors, to contrast with **SOCIOLINGUISTICS** and the ethnography of speaking, which are more concerned with local sociocultural practices. Given that pragmaticists come from disciplines as varied as philosophy, sociology, linguistics, communication studies, psychology, and anthropology, it is not surprising that definitions of pragmatics vary. Nevertheless, most authors agree on a list of topics that come under the rubric, including **DEIXIS, PRESUPPOSITION**, implicature (see CONVERSATIONAL IMPLICATURE), **SPEECH-ACTS**, and conversational organization (see CONVERSATIONAL ANALYSIS). Here, we can use this extensional definition as a starting point.

With the rise of **GENERATIVE GRAMMAR**, and the insistence on universals of grammar (see UNIVERSAL GRAMMAR), anthropologists began to emphasize the diversity of language use, implicitly accepting the underlying uniformity of grammar (Hymes 1982). But with the growth of linguistic **TYPOLOGY** and the empirical search for language universals, it has become increasingly clear that real universals – in the straightforward sense, properties that all languages have – are vanishingly rare (at least beyond the basic organizational principles outlined by Hockett 1960, and some of the architectural properties sketched by Jackendoff 2002). Instead, linguistic typologists have found that empirical generalizations are nearly always of the kind "Across all languages, if a language has property X, then it probably also has property Y." Meanwhile, generative grammarians have hoped to account for the diversity in terms of a limited set of variants (see PRINCIPLES AND PARAMETERS THEORY), but such variants are not manifested in grammars in any straightforward way, and the whole attempt does not appear successful to many dispassionate observers (Newmeyer 2004). The reality is that there is an extraordinary diversity of linguistic types, in which both shared patterns and differences seem best understood historically and geographically (see, e.g., Haspelmath et al. 2005).

With the waning of hopes for straightforward grammatical universals, the case for pragmatic universals looks, in contrast, stronger and stronger. The distinct possibility now arises that while grammatical patterns are in large part a matter of historical and cultural evolution, principles of language usage constitute the foundational infrastructure for language, to which commonalities across languages can be partially attributed. This inverts the traditional view (as in Hymes 1982) that grammar is universal and language usage variable. If this inverted picture is even partially correct, then we would expect significant absolute (unconditional) universals across the subdomains of pragmatics (see ABSOLUTE AND STATISTICAL UNIVERSALS). The following sections lay out the case for pragmatic universals.

Deixis

The fundamental use of language is in face-to-face conversation, where participants take turns at speaking. Aspects of this context are built into languages in many detailed ways. All spoken languages have a grammatical category of **PERSON**, that is, a grammatical reflection of the different roles that participants (and nonparticipants) have in an utterance (speaker, addressee, third party), which is likely to be reflected in personal pronouns, verbal inflections, imperatives, vocatives (as in address forms), and so forth. Likewise, all languages have at least one demonstrative, a special form for indicating entities in the context – typically, there are contrastive forms (like *this* and *that*) associated with pointing. They also have ways to distinguish the time and place of speaking (they may not have **TENSE**, but they will have forms denoting "now," "today," "here," etc.). These aspects of language structure are pragmatic in the sense that they refer to aspects of the context of utterance, and their interpretation is relative to that context. The peculiarity of these systems is that as speakers alternate, the reference of these terms also alternates (my *I* is your *you*, and my *this* may be your *that*), a fact that children can find difficult when learning a language. Since artificial languages (logics, programming languages) successfully purge their structures of such items, it is clear that

natural languages could be different and, thus, that deictic organization constitutes a nontrivial universal aspect of language built for interactive use.

Presupposition

Languages have various ways to foreground and background information, and this is crucial if the speaker's current point is to be identified. Information that is presumed in the context (either because it has already been mentioned or is taken for granted) is typically not asserted but presupposed, and this is reflected in language structure. The contrast between definite and indefinite articles, in those languages that have them, is a simple example: Both *The ninth planet has a peculiar orbit* and *The ninth planet does not have a peculiar orbit* presuppose that there is a ninth planet. This constancy under negation is often taken to be a defining property of presupposition – it shows that the presupposed content is not what is being asserted. Note that unlike what is asserted, presuppositions are defeasible (fall away) in certain contexts, as in *If there is one, the ninth planet must have a peculiar orbit*. Many structures have been identified that signal this presuppositional property: factive verbs like *regret* in *he regrets publishing it* (which presupposes he did publish it), cleft-sentences like *It was the police who hid the crime* (which presupposes that someone hid the crime), or comparatives like *He's a better golfer than Tiger* (which presupposes that Tiger is a golfer). Although this might seem to be purely a matter of the arbitrary conventions of a single language, in fact structures with similar semantics also tend to carry similar presuppositions in other unrelated languages (Levinson and Annamalai 1992), suggesting that it is properties of the semantic representation that trigger the presuppositional inferences. It is thus possible to make an inventory of types of structure that tend to universally signal presuppositional content.

Implicature

A conversational implicature is an inference that comes about by virtue of background assumptions about language use, interacting closely with the form of what has been said. H. Paul Grice (1975, 1989) outlined a **COOPERATIVE PRINCIPLE** instantiated in four such background "maxims" of use: Speak the truth (*quality*), provide enough but not too much information (*quantity*), be relevant (*relevance*), and be perspicuous (*manner*). For example, if A says "Have you seen Henk?" and B says "His office door is open," we read B's utterance as a partial answer (by relevance), which B chooses because he hasn't seen Henk but wishes to provide information that is both true (quality) and relevant, and sufficient to be useful (quantity) and clear enough (manner). By virtue of the assumption that B is following these maxims, B's utterance can suggest, or *conversationally implicate*, in Grice's terminology, that Henk is somewhere close by. Despite the fact that we often have reasons or cultural conventions for being obscure or economical with the truth (Sacks 1975; Ochs 1976), such indirect answers seem to be universal, suggesting that the background assumption of cooperation holds right across the cultures of the world.

The maxims of quantity and manner, in particular, seem to be responsible for detailed cross-linguistic patterns of inference (Horn 1984; Levinson 2000). For example, "the coffee is warm" suggests that it is not hot, or "Ibn Saud had 22 wives" suggests that he did not have 23 – even though if coffee is hot it is certainly warm, and if you have 23 wives you certainly have 22. The reasoning seems to be that if you know the stronger quantity holds, you should have said so – not saying so implicates that it does not hold. In a similar cross-linguistically general way, "It's not impossible that the war will still be won" implicates greater pessimism that the war will be won than the logically equivalent "It's possible the war will still be won." The reasoning seems to be that since the speaker has avoided the positive by using a double negative, by the maxim of manner he must have had some reason to do so. These cross-linguistic patterns seem to have systematic effects on grammar and lexicon (Levinson 2000).

Speech-Acts

The speech acts of questioning, requesting, and stating are found in conversation in any language, and they have grammatical repercussions in all language systems – for example, in interrogative, imperative, and declarative syntax (Sadock and Zwicky 1985). Languages differ, of course, in how, and the extent to which, these acts are grammatically coded, but they always are at least partially reflected in grammar. John Searle (1976) suggested that there are five major kinds of speech-acts: directives (a class including questions and requests), representatives (including statements), commissives (promising, threatening, offering), expressives (thanking, apologizing, congratulating, etc.), and declarations (declaring war, christening, firing, excommunicating, etc.). The types are individuated by different preconditions and intended effects, known as their **FELICITY CONDITIONS**. The broad taxonomy offers plausible universal classes, while subsuming culture-specific actions like declarations, such as divorce by announcement in Moslem societies or magical spells in a Melanesian society.

Despite the fact that there is an association between, for example, interrogative form and questioning, the link between form and action performed is often complex. In English, for example, requests are rarely done in the imperative, but typically in the interrogative, as in "Can you help me get this suitcase down?" It has been noticed that if a distinctive felicity condition for a successful request is stated or requested, this will itself serve as a request (the addressee being able to get the suitcase down being a precondition to a felicitous request). This seems to have general cross-linguistic application, suggesting that the action performed is in fact implicated by what is said (Brown and Levinson 1987, 136 ff). However, in many cases, less regular strategies link what is said to the actions performed, and the mapping from utterances to actions remains a serious theoretical problem in pragmatics.

Conversation Structure

The organization of conversation seems likely to provide some of the most robust pragmatic universals. As far as we know, in all societies the most informal type of talk involves rapid

alternation of speaking roles (Sacks, Schegloff, and Jefferson 1974). This turn-taking, of course, motivates the deictic system already mentioned. Such informal talk is also characterized by the immediacy of **CONVERSATIONAL REPAIR**; that is, if addressees do not hear or understand what is said, they may query either the whole or part, getting immediate feedback in the next turn (Schegloff, Jefferson, and Sacks 1977). Such talk is structured locally in terms of sequences (Schegloff 2006) – in the simplest case, **ADJACENCY PAIRS**, that is, pairs of utterances performing actions like question-answer, offer-acceptance, request-compliance, greeting-greeting, and so forth. Sequences can be embedded, as in A: "Do you have Marlboros?" B: "You want 20s?" A: "Yes." B: "Ah sorry, no. We do have 10s." They can also be extended over more turns, for example by adding a "presequence" as in: A: "Do you mind if I ask you something?" B: "No." A: "Why did you give up that amazing job?" B: "Burnout." Given the general expectation for rapid turn-taking, any participant wishing to have an extended turn at talk is likely to negotiate this, for example, through a prestory of the kind "Have you heard what happened to Bonny?" During such an extended turn at talk, feedback of restricted types (*mmhm, uhuh*, etc.) may be expected. In addition to these local levels of organization, conversations also generally have overall structures – for example, they are likely to be initiated by greetings and ended with partings, each with its distinctive structure.

All of this detailed structure seems entirely general across cultures and languages, although there may be constraints of many local kinds about who can talk to whom and where in this informal way. Ethnographic reports, to the contrary, do not seem to stand the test of close examination. There are, though, many aspects of cultural patterning that can be very distinctive. For example, although in all cultures conversation makes use of multimodal signals (gaze, gesture, facial expression, etc.) in face-to-face interaction, the details can differ strikingly, whereas Tzeltal speakers avoid gazes and the signals that would be thus made available, Rossel Islanders presume the mutual gaze and so can systematically signal responses like "yes," "no," "amazing!" and so on by facial expression.

In addition to these general observations about conversational universals, there seem to be very detailed generalizations about specific actions. For instance, in a wide sample of languages, it seems that reference to persons follows a precise set of expectations about the form of reference expressions, as well as the procedures to follow when the expression proves inadequate (Stivers and Enfield 2007). Thus, utterances of the following kind, where specific components are added incrementally and in order until recognition is signaled, can be expected in any language: "John (.) Wilkins (.) The man you met at the party."

Human Ethology and Communication

Human language is unique in the animal world by virtue of its complex internal structure, its potential displacement across modalities (as in **SIGN LANGUAGES**), and its wide range of functions. It is also the only animal communication system that exhibits great diversity in structure and meaning across social groups. This diversity shows that it is heavily interdependent with historical and cultural processes. Nevertheless, all normal children learn a language and use it in strikingly parallel ways. The strong universals of use suggest that language, in fact, rides on a rich, language-independent infrastructure. A crucial element is the ability to infer intentions from actions. Grice (1957) outlined a psychological theory of "non-natural meaning" or communication along the following lines: A communicator intends to cause an effect in an addressee by producing an action or utterance that is designed to cause that effect just by having that intention recognized (see COMMUNICATIVE INTENTION). Consider a nonverbal signal: A mother makes as if to smooth her own hair, thereby signaling to her daughter in a school concert that the daughter's hair is in disarray – if the child recognizes her intent, communication has succeeded. No conventional symbols are necessarily involved. Such a mode of communication, which can be observed in nonconventional sign languages like *home-sign* (Goldin-Meadow 2003), relies on some form of reciprocal "mind-reading" abilities (Levinson 2006). It plausibly forms the basis for the learning of language, as communication is evident in infancy (e.g., through pointing) prior to language acquisition (see COMMUNICATION, PRELINGUISTIC).

If a mind-reading ability is part of the infrastructure for language, there are also other aspects of the pragmatic infrastructure that are potentially independent of linguistic communication. For example, systematic turn-taking is discernable in infant–caretaker interaction long before verbal interchange is possible. Similarly, the use of gesture, facial expression, gaze, and posture in interaction appears early in child development. All of this points to a large raft of abilities and inherited dispositions that makes language use possible in the form that we know it. It is this infrastructure that infants use to bootstrap themselves into language. What is now observable in ontogeny was no doubt true also in phylogeny – for this infrastructure no doubt preceded the evolutionary specializations in anatomy and brain that now drive language (Enfield and Levinson 2006).

There are yet other universals of language use that are reflections of a common human ethology. We are one of the few species that shows evidence of cooperative instincts that are not based on kin selection. This cooperation is made possible by the subtle linguistic and paralinguistic expression of solidarity, dominance, and the juggling for position (see PARALANGUAGE), much of this explored by pragmaticists under the rubric of **POLITENESS** (Brown and Levinson 1987). Again, there seem to be systematic universals here, both in the underlying dimensions expressed (e.g., power, solidarity, degree of imposition) and in the basic strategies used to express them (e.g., modulations of deference or camaraderie).

In sum, then, an understanding of universals in pragmatics promises to give us deep insights into the infrastructure that lies behind human communication and the language that is so distinctive of it. This infrastructure is arguably what lies behind the development of language in infancy, as well as the evolution of language in the species. Taken as a core part of human ethology, it also tells us much about human nature and how it came to be the way it is.

– Stephen C. Levinson

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PRAGMATISM AND LANGUAGE

According to a very influential conception of language, language functions by tracing truth conditions. Individual **WORDS** denote objects, properties, and relations, and combinations of words in **SENTENCES** represent possible states of affairs (see TRUTH CONDITIONAL SEMANTICS). The pragmatist rejects this conception of language, arguing that we must focus not on what is the case if a sentence is true but, instead, on what follows if it is true.

As originally formulated by Charles Sanders Peirce in the late nineteenth century, pragmatism is motivated by a nonfoundationalist conception of scientific inquiry. Rather than taking inquiry to begin with some basic truths, deriving consequences in light of one's understanding of what follows from what, Peirce takes inquiry to begin with a hypothesis, asking what would follow on that hypothesis. If various consequences are true, then one has reason to believe that one's hypothesis is true as well; if any consequence is false, then the hypothesis must be rejected. Because it is impossible to exhaust all the consequences of a given claim, it follows immediately that there is no certainty, no indubitable truth. Anything we think we know, however self-evident it may seem, can turn out to have been mistaken; nothing is (as Wilfrid Sellars would say) *given*. But although nothing is given as the firm and indubitable foundation for inquiry, there is, at any stage in inquiry, much that one has no reason to doubt. That is where we must start, from where we are, while at the same time recognizing that in our inquiries we do not stand "upon the bedrock of fact" but are instead "walking upon a bog, and can only say, this ground seems to hold for the present" (Peirce 1992, 176–7). Judgment, on such a view, is inherently provisional; "it not only corrects its conclusions, it even corrects its premises" (Peirce 1992, 165). For the pragmatist, such a nonfoundationalist and fallibilist conception of inquiry motivates, in turn, the idea that meaning is to be understood not by reference to truth but by reference to consequences.

This pragmatist conception of meaning in terms of consequences is especially plausible for the case of mathematical and natural scientific concepts. Whereas the standard foundationalist view would seem to require some special insight into the basic truths of mathematics, the pragmatist takes mathematics to proceed "experimentally," by axiomatizing some domain, thereby making explicit our (current) understanding of the concepts relevant to that domain and deriving theorems as a means of testing the adequacy of that understanding. Similarly, in the empirical sciences, we form theories, the empirical adequacy of which is determined by reference to the observable effects of the theory. The pragmatist conception of meaning is much less plausible in the case of the everyday prescientific concepts of natural language, concepts of sensory qualities such as redness, say, or even of a substance such as water as it is prescientifically understood, concepts the contents of which seem

not to be exhausted by their (observable) consequences but ineliminably to involve also a particular phenomenal quality (see LANGUAGE, NATURAL AND SYMBOLIC). Pragmatists have nonetheless tended to understand the contents of all concepts, whether belonging to natural or to symbolic language, in terms of their consequences.

The pragmatist conception of meaning in terms of consequences shifts attention away from truth as the product of inquiry toward the process of inquiry, the striving for truth; and it does so because (in the absence of a given foundation) it is not settled in advance how conflicts, as they arise, are to be adjudicated, which of the competing claims are to be jettisoned, and which retained, if only provisionally. Suppose, for example, that we find some stuff that looks like water but, on analysis, is shown to be not H_2O but some other chemical stuff, call it XYZ. What should we conclude? There are many options. Perhaps the fault lies with our analytic procedure or in the execution of it. Perhaps water is not inevitably H_2O. Perhaps the stuff is not really water. And other responses are possible as well. At any given point in our ongoing inquiry, some responses will seem more plausible than others; nevertheless, it is not simply given what the correct response is. It is only the way we actually go on in the course of inquiry that will, retrospectively and defeasibly, settle what our words mean. In a slogan, meaning lies in use.

As originally conceived by Peirce, and defended more recently by Sellars, this pragmatist conception of meaning enables a fully robust notion of objective truth, a conception of scientific inquiry as answering to things as they are. As interpreted by William James, and defended more recently by Richard Rorty and (more subtly) by Robert Brandom, pragmatism entails relativism, a conception of scientific inquiry as answering only to our interests, to what the community of, say, scientists takes to be the case. There is, on this latter view, no objective standard governing the correctness of our judgments but only a social one, no truth but only solidarity. And it is not hard to understand how the pragmatist conception of meaning can seem to entail such a view. If, as the pragmatist thinks, there is no given foundation of meaning and truth, then it can seem to follow that we have only our takings, our subjective conceptions of things to go on. But if so, then objectivity would seem to require the impossible: that we step outside of language, outside of our subjective conceptions, to see how things are independent of those conceptions. If there is no given but only taking, then our inquiries cannot be answerable to things as they are.

In his *Philosophical Investigations* (1953), Ludwig Wittgenstein argues for what is, in effect, the pragmatist conception of meaning in terms of use and against the representationalist conception of meaning. And here again, both a Peircean, realist reading and a Jamesian, relativistic reading are possible. Language use is essentially normative, subject to standards of correctness that speakers in some way grasp or understand. It is, as Wittgenstein thinks of it, a matter of **RULE-FOLLOWING**. The task is to understand how exactly this works. We begin with an expression of the rule, a signpost, for instance, that shows the way. (We could equally well begin with a person's utterance showing what that person thinks or even with something like an apple that shows itself to a perceiver as an apple.) Because there is no given meaning to the signpost (or utterance or apple), no meaning that it has independent of the ways we actually go on in light of it, we suppose instead that the signpost has the meaning it does because we respond to it in a certain way, because it is taken a certain way, because, as Wittgenstein puts it, it is interpreted. But it can then be argued that this response, too, has no given meaning, no meaning independent of the ways we actually go on in light of it. So in order for it to be a normatively significant response, a taking of the sign as meaning such and such, a further response would seem to be needed. But this clearly starts a vicious regress. Perhaps, then, we need the notion of a response that is inherently meaningful, that just is normatively significant. Such responses are not answerable to things as they actually are (as this would require a given) but only to things as they are taken to be; and they are essentially social because otherwise whatever seems right to one will be right, and then we cannot speak of right (see PRIVATE LANGUAGE ARGUMENT).

According to this Jamesian reading (rehearsed, for instance, by Brandom), the fact that nothing is given requires turning instead to takings, socially articulated, normatively significant responses to things such as signposts, utterances of other speakers, objects, and states of affairs, in virtue of which the things responded to have the significances they are taken to have. A more radical, Peircean response jettisons not merely the given but also the whole framework relative to which we must choose between a mythic given and a merely socially articulated taking (see, for example, McDowell 2002). The model here is the way animals interact with things in their environments. Grass, for example, is food for some animals. But grass is not simply given as food; that it serves as food depends on there having evolved animals for whom grass is nourishing and is eaten for nourishment. Nor is grass food merely by being taken to be so, but by in fact being taken up and eaten. (An animal might on occasion eat something that is not nourishing for it, a piece of plastic, say; and it may at times be unable to digest food, that is, stuffs that generally are nourishing for it.) Instead, grass has the significance of being food only relative to the kind of animal for which it is food; and contrariwise, the animal is intelligible as the sort of animal it is, as an instance of a particular **FORM OF LIFE**, only in light of its environment providing opportunities (such as food) and hazards for it. Being an animal and having an environment are correlative notions; neither is intelligible without the other.

Similarly, being a speaker and having the world in view as the stuff of one's talk and the standard of the correctness of one's judgments are correlative notions, neither intelligible without the other. There is no given if by that one means things revealed as meaningful to us independent of the evolution and acquisition of language, but nor is language use merely a matter of takings. Rather, through one's acculturation into natural language, one comes to have the world in view as that about which one speaks, much as an animal, through its development into the kind of animal it is, comes to have an environment to which it is perceptually sensitive and through which it moves. And it is the world that is in view for a speaker, on this reading, precisely because meaning and truth are not given but are instead the fruits of inquiry.

The pragmatist critique of the representationalist conception of language in terms of unquestionable, or given, word–world relations of denotation does not show merely that the foundation is different than we had thought, that it is social rather than objective, but instead, and more radically, that the objectivity of inquiry requires not a foundation but the capacity for critical reflection: "[E]mpirical knowledge … is rational, not because it has a *foundation* but because it is a self-correcting enterprise which can put *any* claim in jeopardy, though not *all* at once" (Sellars 1997, §38). Not only do we revise our beliefs about things, but we also revise our conceptions of the kinds of things there are and can be. Indeed, we even revise our most fundamental understanding of the nature of reality as a whole, and in so doing, we come to ever more adequate languages with which to address things as they are, the same for all rational beings.

– Danielle Macbeth

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PREDICATE AND ARGUMENT

In all languages, the vocabulary consists of two basic types of **WORDS**: those that denote entities, such as pronouns and proper names, and those (such as verbs, adjectives, and adverbs) that present information about entities, such as their properties, states, or transformations. In a terminology derived from logic, the relational words are called predicates, and the entities that they relate to are called their arguments. Predicates are like functions in mathematics, with their arguments serving as variables. In traditional grammar, the term *predicate* is used also for one of two constituent parts of a **SENTENCE**, the other being the subject. (See also QUANTIFICATION, CATEGORIAL GRAMMAR, and MONTAGUE GRAMMAR.)

– Anat Ninio

PREFERENCE RULES

Preference rule systems constitute a form of rule interaction related to default logic and *harmonic grammar* (Smolensky and Legendre 2006). They are introduced in **SEMANTIC** theory in Jackendoff (1983) and in generative music theory in Lerdahl and Jackendoff (1983) and argued to be ubiquitous in cognition.

A standard example is the meaning of the verb *climb*. A stereotypical case such as *John climbed for hours* is interpreted as John a) moving upwards on a surface, b) with an effortful clambering manner of motion. Both conditions are violable. *John climbed down the mountain* and *John climbed across the cliff* do not involve upward motion; *the airplane climbed steadily* entails upward motion but not clambering. However, both conditions cannot be violated at once: **The airplane climbed down 5,000 feet*.

These examples make it impossible to analyze the meaning of *climb* in terms of **NECESSARY AND SUFFICIENT CONDITIONS**, as assumed in the philosophical and formal logic traditions. Neither condition is necessary, but either one is sufficient for an action to count as climbing. At first blush, this suggests that the conditions are simply disjunctive. However, there is a further wrinkle: Satisfying both constraints results in a more stereotypical use of *climb*, and in cases where there is no evidence to the contrary, both conditions are assumed by default. Thus, preference rule systems provide a formal characterization of Ludwig Wittgenstein's (1953) and E. Rosch and C. Mervis's (1975) notion of categories displaying a **FAMILY RESEMBLANCE***:* There is no single criterial condition for members of the category, stereotypical members satisfy all or most conditions, and marginal members satisfy fewer conditions.

Preference rule systems differ from **OPTIMALITY-THEORETIC** rule systems in that the constraints, though violable, are not ranked: Under proper conditions, either rule can dominate the other. A classical example comes from gestalt principles of visual grouping (Wertheimer [1924] 1938), where grouping of units can be based either on their relative distance (1a) or their relative similarity (1b). Thus, either condition is sufficient for grouping:

(1) a. xxx xxx xxx [identical units with variable spacing]
b. xxxXXXxxx [different units with identical spacing]

In displays with variable units and variable distances, alignment of the two conditions produces stronger grouping judgments (2a). If the two conditions are not aligned, a judgment can be forced by sufficient disparity either in distance (2b) or in form (2c).

(2) a. xxx XXX xxx [stronger judgment]
b. xxX XXx xxx [distance overrules size]
c. xx**X XX**x xxx [size overrules distance]

When attempting to state the conditions on a category or rule, then, one should suspect the presence of a preference rule system when a) every condition one can think of as criterial has important counterexamples, b) there are different counterexamples to each condition, and c) satisfaction of all (or most) conditions produces stereotypical instances of the category or rule.

– Ray Jackendoff

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PRESTIGE

Language prestige refers to the social position of a language, especially in multilingual settings (see BILINGUALISM AND MULTILINGUALISM), and the purposes it is used for, as well as people's beliefs and feelings about it. The prestige of a variety is unrelated to its structure and can only be determined in a social context. The prestige of a particular language may, therefore, differ greatly from one speech community to another and may also be subject to change. Typically, the languages of immigrant groups (e.g., Turkish in Germany) have a relatively low prestige in comparison to that in the country of origin (e.g., Turkish as the national and official language in Turkey). An example of a prestige change is the move of Ukrainian from low to high prestige in post-Soviet Ukraine, a position that had been previously held by Russian as the exclusive high-prestige language (Bilaniuk 1993).

Charles A. Ferguson (1959) used the term *prestige* to describe the functional distribution of two language varieties of the same language, a H(igh prestige) language and a L(ow prestige) language in **DIGLOSSIC** situations. The term often serves as an umbrella notion encompassing status and functions of languages, on the one hand, and language attitudes, on the other. As of the 1960s, various classifications of status and function of languages had been proposed (see, for instance, Ferguson 1966; Stewart 1968), mostly for the description of national **SOCIOLINGUISTIC** profiles in multilingual societies. Some of these suggestions were later taken up and redefined in other detailed frameworks (see Ammon 1989; Mackey 1989) where prestige stands for an important sociocultural dimension. Along with features such as demographic factors, institutional support, and status (see LANGUAGE POLICY), prestige is also seen as a factor of the **ETHNOLINGUISTIC** *vitality* of a linguistic group, that is, that which makes it behave as a distinctive entity within multiethnic and multilingual settings. In language attitude studies, we can distinguish between speaker evaluations in terms of *overt* prestige (i.e., as languages of authority) and *covert* prestige (i.e., as languages of solidarity). In a diglossic language situation, for instance in Guyana, the L-language (Guyanese Creole) is attributed a high-solidarity and a low-authority value, whereas the H-language (English) holds a low-covert and a high-overt prestige (Rickford 1983).

The prestige of a language is often explained in historical terms. Thus, William F. Mackey speaks of a language's "record, or what people think its record to have been" (1989, 4), not only describing the status quo but also including a diachronic dimension (see SYNCHRONY AND DIACHRONY). While prestige is mostly associated with speaker evaluations, its role as a catalyst for other characteristics, such as functional specialization, literary heritage, and **STANDARDIZATION**, has also been acknowledged. In a dynamic model of language prestige and prestige change, Susanne Mühleisen (2002) looks at the interaction among societal, institutional and interactional, and sociopsychological dimensions of prestige. The dynamics of this interaction may result in various types and directions of changes in language prestige.

– Susanne Mühleisen

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PRESUPPOSITION

A presupposition is a precondition of a sentence such that the sentence cannot be uttered meaningfully unless the presupposition is satisfied. The concept of a presupposition originated with Gottlob Frege (1892), but the English term was coined by Peter F. Strawson (1950). Presupposition theory is an area of active research at the **SEMANTICS/PRAGMATICS** interface. A related term is **CONVENTIONAL IMPLICATURE**. H. Paul Grice (1975) distinguished between presuppositions and conventional implicatures, however, it is still under debate whether such a distinction is necessary (cf. Potts 2007 and ensuing discussion).

DEFINITE DESCRIPTIONS have played a major role in the development of presupposition theory and are still generally analyzed as introducing a presupposition. Consider for example (1). No entity that satisfies the description *biggest natural number* exists. What is the status of (1)? Is it true or false?

(1) The biggest natural number is prime.

Presupposition theory says (1) is neither true nor false: A definite description *the NP* (noun phrase) presupposes the

existence of an individual that satisfies *NP* – in other words, definite descriptions carry an *existence presupposition*. *Presupposition failure* describes the case wherein a presupposition is not fulfilled like (1). Presupposition failures are analyzed as being neither true nor false, but as being truth value gaps. Presupposition theory, therefore, relies on a distinction among three possible truth values a sentence may have: true, false, and undefined. One important argument in support of a third truth value has been the interaction between negation and presuppositions: A presupposition failure in many cases remains a presupposition failure even when the sentence is negated:

(2) The biggest natural number is not prime.

It follows that (2), like (1), is a presupposition failure just if negation does not change the conditions under which a sentence has a truth value. Negation can be used in this way as a presupposition test: A presupposition follows from a sentence and its negation. The assertion, on the other hand, only follows from the sentence itself, and not from its negation.

Just as the existence presupposition of the sentences in (1) and (2) is triggered by the definite article *the*, many other words trigger presuppositions. Stephen C. Levinson's (1983) textbook lists several pages of presupposition triggers in English. A particularly interesting paradigm is that in (3) (cf. Abusch 2005): (3a) has no relevant lexically triggered presupposition, whereas (3b) presupposes that it is actually raining outside and asserts that Bill thinks so, too. Finally, (3c) presupposes that Bill thinks that it is raining outside, and asserts that it actually is raining outside. It is particularly interesting that *be right* and *know* have the same truth conditions, but differ on which part of them is presupposed. Paradigm (3) shows that part of our specific knowledge about *think*, *know*, and *be right* is whether they trigger a presupposition and which one.

(3) a. Bill thinks that it's raining outside.
b. Bill knows that it's raining outside.
c. Bill is right that it's raining outside.

Some presuppositions are not lexically triggered. For example, (3a) cannot be used if it is known that it really is raining outside. This presupposition, however, has been analyzed as an *implicated presupposition* (Sauerland 2007). It can be derived in a similar way to conversational implicatures as arising from the avoidance of a presupposition trigger and a principle of presupposition maximization (Heim 1991).

One central problem of presupposition theory is the question of how to predict the presuppositions of complex sentences – the problem of *presupposition projection*. Lauri Karttunen and S. Peters (1979) show that while negation does not affect presuppositions, in other complex sentences presupposition triggers can occur, but the presupposition may not project to the entire sentence: In example (4), the conditional clause blocks projection of the existence presupposition of *the biggest natural number*.

(4) If there was a biggest natural number, the biggest natural number would be prime.

Building on work by Robert Stalnaker (1973) and Karttunen (1974), Irene Heim (1983) has developed an influential account of presupposition projection that has given rise to dynamic semantics (see also Beaver 2001; Kadmon 2001). However, the projection problem is still subject to lively debate (see Schlenker 2007).

– Uli Sauerland

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PRIMATE VOCAL COMMUNICATION

Nonhuman primate vocal **COMMUNICATION** is one of our few links to understanding the evolution of human speech and its underlying physiological bases. Since the vocal tract and the brain do not fossilize, insights into the origins of human communication occur through a comparison of the vocal behavior of extant primates with humans. This comparative approach forms a framework upon which testable hypotheses on the evolution of speech can be based. Also, since the brain is critical for the production and perception of vocalizations, nonhuman primates

(hereafter, *primates*) are the ideal model system through which we can directly monitor neurons and neural ensembles to find the causal links between brain activity and vocal behavior.

Vocal Perception In Nonhuman Primates

To date, this comparative approach has been most fruitful when scientists have examined how primates *perceive* their own vocalizations and then compare how these perceptions relate to those occurring in human speech production. In this chapter, we review some of these findings.

SYNTACTIC PROCESSING OF VOCAL SEQUENCES. Many primate species produce bouts of vocalizations that contain sequences of similar acoustic units and/or different-sounding acoustic units. Do these units separately code meaningful information (akin to **WORDS** in a **SENTENCE**)? Or do they need to be combined to form a meaningful utterance (akin to **SYLLABLES** in a word)? For example, the chimpanzee (*Pan troglodytes*) "pant-hoot" consists of a series of "hoot" calls followed by a series of "screams." Since both hoots and screams are produced individually in other contexts, the pant-hoot could either be a single vocalization or a bout of several vocalizations.

Most of our insights into the units of perception come from studies of the orderly arrangement of the sound units in primate "long calls" (Marler 1968; Waser 1982). Long calls serve as localization cues for conspecifics and are produced in the context of territorial encounters, mate attraction, and isolation/group cohesion. These long calls provide evidence of **PHONOLOGICAL** *syntax* in which individual acoustic units are assembled to form a larger, more functional (meaningful) unit. For example, male titi monkeys and gibbons produce multiunit long calls that are used to demarcate and defend their territories (Robinson 1979; Mitani and Marler 1989). When one of these long calls is rearranged by a human experimenter and presented to a conspecific (in the form of a "playback experiment"), the primate recognizes this novel vocalization and responds as if there is a new male in the adjacent territory. Gibbons produce significantly more "squeak" calls (given during intergroup encounters) when hearing these novel stimuli, whereas titi monkeys produce significantly more "moaning" responses (also given in response to interspecies and intergroup encounters). These data suggest that, at least in these species, the global order of syllable sequences represents a cue to individual recognition.

The vocalizing behavior of cotton-top tamarins also provides evidence of phonological syntax (Ghazanfar et al. 2001). When socially isolated, tamarins elicit a long call that begins with one to two chirps and ends with two to five whistles. When conspecifics hear these vocalizations, they respond with their own calls, a behavior called *antiphonal calling*. Do the individual chirps or whistles provide functional information? Or is information provided only by chirp-whistle combinations? Playback experiments in which chirps, whistles, or the entire long call (chirp-whistle combinations) are presented to tamarins were used to address these questions. These experiments have shown that the entire long call is more effective in eliciting antiphonal long calls than isolated chirps and whistles, an observation consistent with the hypothesis that in this species, the whole call is the most meaningful unit from the perspective of socially isolated receivers.

There is also some evidence for a *lexical syntax* in which different combinations of acoustic units are used to transmit different meanings to listeners (Zuberbuhler 2002; Arnold and Zuberbuhler 2006). These data come from studies of two African forest monkey species. First, not only do Diana monkeys (*Cercopithecus diana*) perceive the leopard and alarm calls of a sympatric species, Campbell's monkeys (*C. campbelli*), but they also seem to understand that if these two calls are preceded by a Campbell's monkey's "boom" call, the threat is less urgent. Importantly, if a Campbell's monkey's boom call occurs before a Diana monkey's species-specific alarm call, it has no effect on the Diana monkey's behavior. Second, putty-nosed monkeys (*C. nictitans*) produce two different alarm calls: "pyows" for leopards and "hacks" for eagles. When produced, each elicits a stereotypical escape response from the listeners. However, when males combine the calls to form "pyow-hack" sequences, the combination does not elicit escape responses but, instead, elicits general group movement.

REFERENTIAL COMMUNICATION. The species-specific vocalizations of many primates, as well as many other animals, can be used by a listener as a source of information about objects, events, and the status of peers in their environment. These vocalizations are important since, on the basis of acoustic structure alone, listeners can extract functional (referential) information about a vocalization's meaning (see REFERENCE AND EXTENSION).

A classic example of referential communication signaling is use of predator alarm calls by the vervet monkeys (*Cercopithecus aethiops*) (Seyfarth, Cheney, and Marler 1980). Vervets produce unique alarm calls for three different predators: snakes, leopards, and eagles. When an alarm call is produced, it initiates predator-appropriate behaviors in listeners. For example, when vervets hear an eagle-alarm call, they scan the sky for visual cues of the airborne predator, and in some cases, run to locations that provide overhead coverage. In contrast, when they hear a snake-alarm call, they stand up and scan the ground. Finally, a leopard-alarm call initiates a third distinct behavior: Vervets run up the nearest tree while scanning the horizon for the leopard.

The capacity to process referential signals successfully also allows animals to use the referential information that is transmitted by the vocalizations of other species (Zuberbuhler 2000). For example, female Diana monkeys elicit a predator alarm call when they hear a male Diana monkey producing a leopard alarm or when they hear the leopard-alarm call of a crested guinea fowl. This observation is important since it suggests that Diana monkeys can form abstract categorical representations of a vocalization's functional meaning that is independent of acoustics and the species generating the signal.

Another example of the categorization of referential information is the food-associated calls of rhesus macaques (*Macaca mulatta*) (Hauser 1998; Gifford, Hauser, and Cohen 2003). When free-ranging rhesus monkeys encounter low-quality food, they elicit one of two acoustically distinct vocalizations, "coos" or "grunts." In contrast, when they encounter

rare, high-quality food, they elicit one of two acoustically distinct vocalizations, "harmonic arches" or "warbles." However, despite the fact that these four vocalizations are all acoustically distinct, rhesus do not discriminate among the vocalizations on the basis of differences in their acoustics but instead discriminate and categorize these vocalizations on the basis of the type of referential information transmitted (e.g., low-quality versus high-quality food).

TEMPORAL CUES FOR VOCAL RECOGNITION. Duration, interval, the order of acoustic features, and other temporal cues are important components in the capacity of humans to distinguish between different speech sounds. The difference between the two **PHONEMES** /pa/ and /ba/ is due to differences in voice-onset time. Similarly, the difference between /sa/ and /sta/ is due to differences in the silent time between the consonants and the vowels.

Primates can also use temporal information to distinguish between different vocalizations. As discussed, cotton-top tamarins antiphonally call preferentially when they hear entire long calls versus portions of the long calls (Ghazanfar et al. 2001). Further studies revealed that while tamarins did not distinguish between normal calls and time-reversed or pitch-shifted long calls (Ghazanfar et al. 2002), normal response rates did require the species-specific temporal structure of the amplitude envelope (Ghazanfar et al. 2001). Finally, the number of acoustic units and the presentation rate may also influence antiphonal calling. Along similar lines, rhesus respond differently to "shrill barks" and grunts than to copulation calls when the interval between the acoustic units is expanded or contracted beyond the normal range (Hauser, Agnetta, and Perez 1998). Finally, at least for shrill barks and harmonic arches, there is evidence suggesting that rhesus are sensitive to the temporal progression of these vocalizations' amplitude envelope: When shrill barks or harmonic arches are time-reversed, which changes their temporal structure but not their spectral content, rhesus monkeys act as if they do not recognize these stimuli as species-specific vocalizations (Ghazanfar, Smith-Rohrberg, and Hauser 2001).

Neural Bases of Primate Vocal Communication

Overall, the referential, syntactic, and temporal features of primate vocalizations, from many different species, suggest striking parallels with human speech processing. How are these features represented and processed at the level of neurons and neural assemblies? Here, we review some relevant recent findings.

AUDITORY CORTEX. Despite the ethological importance of primate vocal communication in the lives of primates, we lack a complete understanding of how biologically relevant features of complex sounds are processed at the level of single neurons or small populations of neurons. For many years, the squirrel monkey was the only primate model for investigating the role of auditory cortex in processing species-specific vocalizations. Studies using this species found that many cells in the superior temporal gyrus responded to species-specific vocalizations. However, one of the drawbacks of these studies was that recordings were made across the superior **TEMPORAL** gyrus without reference to any neuroanatomical subdivisions.

Recent anatomical and neurophysiological experiments (Hackett, Preuss, and Kaas 2001; Rauschecker and Tian 2004; Tian et al. 2001; Kaas and Hackett 1998) in rhesus monkeys have identified the serial and parallel processing that occurs between the primary **AUDITORY** cortex (A1) and secondary levels of auditory processing along the superior temporal gyrus. These higher-order areas are called the *caudolateral*, *middle lateral*, and *anterolateral belt* areas (CL, ML, and AL, respectively). These studies suggest that belt neurons responded to more complex sounds than A1 neurons. For instance, neurons in all three lateral belt areas seem to prefer vocalizations to energy-matched pure tone stimuli.

Other studies, however, suggest that A1 neurons are also sensitive to the complex acoustic features needed in speech and other types of auditory-object processing. For example, in common marmosets (*Callithrix jacchus*) and squirrel monkeys, A1 neurons are selective for species-specific vocalizations and phase-lock their firing pattern to the functional acoustic units that comprise a vocalization, as opposed to the finer-grain acoustic features that are not functionally meaningful (Bieser 1998; Wang et al. 1995; Lu, Liang, and Wang 2001). Also, A1 neurons, as well as those in belt and parabelt regions, are sensitive to the pitch of an auditory stimulus, which may be used to infer a vocalization's affective content (Bendor and Wang 2005). These studies highlight the fact that the flow of information from primary auditory areas to belt and parabelt regions is not strictly serial but is parallel with both feedforward and feedback interactions.

PREFRONTAL CORTEX. The **FRONTAL** lobes contain an auditory responsive region that responds robustly to vocalizations (Romanski, Bates, and Goldman-Rakic 1999). This region, the ventrolateral prefrontal cortex (vPFC), has been hypothesized to play an important role in processing the more abstract components of vocalizations. Specifically, it has been suggested that the vPFC plays an important role in processing the referential information transmitted by a vocalization. Indeed, in one set of experiments, it was demonstrated that vPFC neurons were modulated more by differences between the food-related referential information (see section on referential communication) that is transmitted by a vocalization than by differences between their acoustic features (Gifford et al. 2005). These data suggested that, on average, vPFC neurons are modulated preferentially by transitions between presentations of food vocalizations that belong to functionally meaningful and different categories. Consistent with the proposed role of vPFC in categorical processing, vPFC neurons in a second experiment responded in the same way to different vocalizations that transmit information about different types of food quality (i.e., high-quality and low-quality food) (Cohen, Hauser, and Russ 2006). However, these same vPFC neurons responded differently to different vocalizations that transmitted information about different nonfood events.

– Yale E. Cohen and Asif A. Ghazanfar

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PRIMING, SEMANTIC

PRIMING is used to describe a situation with two words (or other entities) that are related, whereby an encounter with the one will either facilitate or inhibit recovery of the other, either as regards the speed or the accuracy with which it is recovered (see also SPREADING ACTIVATION). There are various kinds of priming, of which semantic priming is perhaps the most discussed in the psycholinguistic literature. An example of semantic priming is that the word *dog* will be processed more quickly if the word *bark* has just been encountered. If the two words are unrelated or an encounter with a non-word precedes the encounter with a word, an encounter with the former will have no effect on the speed with which the latter is processed; thus, the processing of *dog* will be unaffected if either *teaching* or *priff* has just been encountered. This is automatic and independent of any intention or task-related motivation. When processing is affected, the affected word is known as the *target*; the word or entity that affects the process is known as the *prime*. Primes do not have to be words; they can be groups of words or complete sentences, or they can be pictorial or aural. The prime is assumed to partially activate circuits that include the target.

The assumption is that the degree of priming is proportional to the semantic relatedness of the items (though this is not accurate for all types of priming) and that priming is an "automatic" process. Another assumption, which gives rise to the assumption of proportionality, is that related words are stored closer in semantic space to one another than are nonrelated words (non-words are, of course, stored nowhere prior to encounter). Indeed, one of the major values of priming studies is that they permit investigation of the interconnections of the mental lexicon (Rumelhart and Norman 1985). Interpreting the results of such studies, though, is not unproblematic; Kenneth I. Forster (1976) shows that the facilitation of processing is affected in

complex ways by whether the prime and target are low frequency or high frequency (or combinations of these).

Different kinds of priming have different kinds of effect. If the prime is formally similar but semantically unrelated to the target (e.g., *from* and *frog*), the prime inhibits recognition of the target, presumably because one is momentarily mistaken for the other in the recognition process (Colombo 1986). Where the prime and the target are drawn from the same semantic set (e.g., *dog* and *cat*) or are otherwise related semantically, as in the *dog-bark* example, the target is retrieved more quickly. This phenomenon was first demonstrated (though not first noticed) by D. E. Meyer and R. W. Schvaneveldt (1971) and has become a cornerstone of psycholinguistic methodology.

Semantic priming automatically accelerates the recognition process if the time between sight of the prime and sight of the target is short, but if the gap is greater, other factors may impact. In particular, even if the prime and the target are semantically related, there may be inhibition rather than acceleration if the informant has been led to expect something else to occur (Neely 1977), though this inhibitory effect does not occur if there is a very short time between prime and target display (technically known as the *stimulus-onset asynchrony*, or SOA). This leads one to conclude that there are two types of priming, one of which is automatic and short-lived and the other of which – attentional priming – is longer lasting and more available for conscious inspection. The former can be interfered with but will persist in the speaker in subsequent occasions; the latter can be created and equally can disappear. So in an influential experiment, Neely (1977) told informants that whenever they were primed with *body*, they should expect a word associated with buildings to be the target. He then sometimes gave a word associated with the body as target instead. He found that with an extremely short SOA, both *heart* and *door* were processed equally quickly after use of *body* as a prime. With a slightly longer SOA, however, the processing of the unexpected *heart* actually took longer than the (in the circumstances) expected *door*. Outside the context of the experiment, though, there are no reasons to suppose that the *body-heart* connection would be affected, and equally it seems unlikely that the attentional priming would persist much beyond the end of the experiment.

Successful processing has an effect here, too, and further confirms the existence of attentional priming as a separate kind of priming from automatic priming. If informants find that the primes they are given relate regularly and reliably to the targets, the effect of the priming gets increasingly strong. If, on the other hand, they find little connection between the primes and the targets, the priming effect gets weaker (Den Heyer 1985)

It is important to note that priming of either the automatic or attentional kind presupposes a cause–effect relationship: The prime affects the target. However, it is implicit in this causal relationship that the word that is the target has some prior mental connection with the word (or other linguistic, or indeed nonlinguistic, entity) that is chosen as prime, and it is this prior connection that the prime activates, whether the connection takes the form of the words being stored near to each other because of their semantic or pragmatic proximity or because they regularly co-occur for some reason. An exploitation of the latter kind of connection occurs when a textual co-text is used as prime and the completion or continuation of the co-text as target. So *it's time to go* will accelerate recognition of *home*, but inhibit recognition of *feet*. It is interesting to note that even where the target is semantically unpredictable, the co-text prime will still accelerate, rather than inhibit, recognition of the target so long as it is syntactically predictable from the co-text (as in *it's time to go hang-gliding*) (Wright and Garrett 1984; West and Stanovich 1986)

Fairly obviously (but importantly), if people are primed with a particular word, then they will recognize it more quickly when it occurs again as target; this is known as *repetition priming*. (So *dog* accelerates the processing of a second instance of *dog*.) Repetition priming affects both accuracy of response (Jacoby and Dallas 1981) and speed of response (Scarborough, Cortese, and Scarborough 1977). The priming may be over very short intervals (tiny fractions of a second) or long intervals (minutes, hours, or even days), and many believe that long-term repetition priming is explicable in terms of quite different mechanisms from short-term priming. The way that repetition priming works has been disputed (Jacoby 1983; Tulving and Schacter 1990), but it can be assumed to be a key factor in priming for cohesion (see following discussion) particularly as repetition priming has been shown to last for several hours. Long-term repetition priming is often referred to as *implicit memory*.

We have seen that psycholinguists have interested themselves in the way a prime may accelerate or retard the processing of a target. The target itself must, however, be assumed to have a preexistent relationship with the prime in advance of the particular priming effect. Otherwise, the relationship would have to be created at the time of processing the target and the effect would presumably be one of retardation. This prior relationship is investigated by Michael Hoey (2005) using corpus-linguistic rather than psycholinguistic methodology; he assumes the relationship to have been created by a type of repetition priming, such that repeated encounters of the same items within the same environment result in the creation of an association between them. Hoey terms these relationships *lexical primings* and uses them to account for a wide range of linguistic phenomena. Although he does not explicitly relate his model to the claims of connectionism, there are clear points of parallel.

As noted, lexical priming draws on a different evidential base from the semantic (and repetition) priming research described so far, drawing on corpus-linguistic evidence to demonstrate the probability of particular psycholinguistic associations. The first of these types of associations, and perhaps the most fundamental, is that of collocation (Sinclair, 1991). A collocation such as *dog* and *bark* is created for a speaker whenever each word is semantically primed by the other as a result of repetition priming of word combinations, such as *the dog barked*. The implication is that repetition priming is primary both because it is long lasting and because its existence accounts for (some) semantic priming. From these primings, semantic associations (or preferences) (Hoey 2005; Sinclair 2004), such as that of *bark* with *spaniel-Alsatian-poodle-Labrador* (etc.), are created. Members of the set may be stored close to each other, but their presence in the set is a result initially of the repetition priming of one or more members

of the set in conjunction with *bark*. Thus, the mind stores several instances of *the Alsatian barked* and of *the poodle barked*, as well of course *the dog barked*, and from this creates an association of *bark* with all types of dog. This set remains sound until conflicting evidence is encountered. So *Chihuahua* may never be encountered with *barked* but with *yelped*. The conflict persists until the speaker modifies the original priming or treats the new priming as either an exception or an anomaly. So, for instance, *bark* might be placed in a semantic set of nonverbal noises, which would include *growl* as well as *bark* and *yelp*. According to Hoey, the same processes result in the establishment for the speaker of quasi-grammatical relations associated with the lexical item (*colligational relations*; Hoey 2005; Sinclair 2004), and grammar is argued to be an output from the primings, rather than having an existence independent of them.

Hoey (2005) also claims that speakers are primed to associate words with textual position and cohesive patterning. All primings are assumed to be genre and domain specific, and this is particularly noticeable of the textual primings. Thus, for example, British newspaper readers are primed by British news stories to associate *yesterday* with text-initial sentences and to associate *Mr* with first-word position in paragraph-initial sentences. The words *Blair* and *Bush* are primed for most readers to be followed cohesively by pro-forms (*he*, *his*), while *Pluto* is primed to be followed by co-hyponyms (*Neptune, Saturn,* etc.).

The term *priming* is used by Hoey to describe both the process and the product of that process. The association created by priming may itself be subject to priming (which Hoey terms *nesting*). Thus, we are primed to collocate *Bush* with *George*, and then to collocate the nested pair *George Bush* (with or without *W*) with *President*. As a further step, we are then primed to associate *(President) (George)(W) Bush* as a combination with pronominal cohesion. No assumptions are made, however, about the order in which the primings may occur. Primings necessarily vary from individual to individual.

The accumulation of collocational, colligational, and semantic relationships may explain linguistically the efficacy of semantic primings, though experimental evidence has not yet been offered in support of this claim. The phenomenon of semantic priming would appear to have no effect in giving rise to the lexical primings as described by Hoey, but the existence of semantic priming is confirmation of the efficacy of the prior lexical primings.

– Michael Hoey

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PRINCIPLES AND PARAMETERS THEORY

The Framework

Principles and parameters (P&P) theory has been the prevailing approach to natural language **SYNTAX** within **TRANSFORMATIONAL GRAMMAR** and **GENERATIVE GRAMMAR** since the beginning of the 1980s. According to the P&P theory, the initial, innate state of the human faculty of language FL_0 is characterized as a finite set of general principles complemented by a finite set of variable options, called **PARAMETERS**. These principles and parameters together constitute **UNIVERSAL GRAMMAR** (UG), a model of FL_0. FL_0 functions as a **LANGUAGE ACQUISITION DEVICE**: It imposes severe constraints on attainable languages, thereby facilitating the process of language acquisition, the core of which lies in fixing the open parameter values of FL_0. On this view, **COMPETENCE** in a given language is the result of a particular specification of the parameters of FL_0 (called *parameter-setting*), which determine the range of possible variation among languages.

Interpreted broadly, the P&P framework can be seen as a general model of the interaction of "nature" and "nurture" (genetic endowment and experience) in the development of any **MODULE** of human cognition. Accordingly, it has come to be applied beyond syntax both inside and outside of linguistics. An example of the former case is the theory of **PHONOLOGY** called

Government Phonology (see Kaye 1989), and an instance of the latter is a recently emerging principles and parameters–based approach to moral psychology (see Hauser 2006, and references therein). In the domain of natural language syntax, the P&P framework subsumes both **GOVERNMENT AND BINDING** (GB) theory and its more recent development, called the *minimalist program*, or linguistic **MINIMALISM**, even though the term is often used narrowly to refer to the former model only.

From Rules to Principles

The P&P framework crystallized by the end of the 1970s as a way to resolve the tension between two goals of generative grammar. One objective was to construct descriptively adequate grammars of individual languages (see DESCRIPTIVE, OBSERVATIONAL, AND EXPLANATORY ADEQUACY). Another was to address the logical problem of language acquisition (see INNATENESS AND INNATISM) by working out a theory of UG that constrains possible grammars to a sufficiently narrow range, so that the determination of the grammar of the language being acquired from the *primary linguistic data* can become realistic (this is referred to as *explanatory adequacy*). The two goals clearly pull in opposing directions: The former seems to call for allowing complex rules and a considerable degree of variation across grammars (a liberal UG), while the latter requires that possible grammatical rules be as constrained as possible (a restrictive UG).

The research program that culminated in P&P theory aimed to approximate these twin goals by establishing in the ways in which grammatical rules can and should be restricted, extracting from them properties that seemed to be stable across constructions and languages, and formulating them as constraints imposed by UG on the format of rules of individual grammars. Uncovering, generalizing, and unifying such constraints eliminated from rules the general conditions on their operation, which made it possible for rules themselves to be considerably simplified. For instance, the transformational rule that forms wh-interrogatives, the rule of relativization producing relative clauses, the rule of **TOPICALIZATION**, and several others, each corresponding roughly to some construction recognized by traditional grammars, share certain notable properties. Noam Chomsky (1977) argued that instead of stating such properties as part of each of these rules, some of them should be incorporated into UG, while others should be ascribed to the generalized rule dubbed *front-wh*, of which each of the individual rules is an instantiation. The furthest such a "factoring out and unification" strategy can potentially lead to is a model of language where rules (as well as the corresponding constructions of traditional grammar) are eliminated altogether from the theory as epiphenomena deducible from the complex interaction of the general principles of UG. This is precisely the approach that the P&P framework has been pursuing.

Modularity

In the government and binding model of the P&P approach (Chomsky 1981), principles of UG are organized into modules, or subtheories. Such modules include **X-BAR THEORY**, which constrains possible **PHRASE STRUCTURE** configurations, and *theta theory*, which determines a bi-unique mapping between lexically specified theta-role-bearing arguments of a predicate and the syntactic base positions they occupy. As for structures derived by transformations, **MOVEMENT** rules are reduced to a single and maximally general operation *Move* α that can move anything anywhere. A representational **FILTER** that limits the application of Move α is the *empty category principle* (ECP), which demands that **TRACES** of movement be licensed under a local structural relation called *government*. Apart from the ECP and the **BOUNDING THEORY**, which places an upper bound on how far movement can take an element, various other modules of UG, not narrowly geared to cut down the overgeneration of structures resulting from Move α, act to filter the output **REPRESENTATIONS** produced by movements. **CASE** *theory* requires that (phonetically overt) noun phrases (NPs) occupy a position at surface structure where they are assigned a case. The three principles of **BINDING** *theory* (which constrain the distribution of **ANAPHORS,** personal pronouns, and referential NPs, respectively, relative to potential antecedents they can/cannot be coreferential with) are sensitive to the binary [± anaphoric] and [± pronominal] features of NP categories generally, including phonetically empty NPs like various types of traces and null pronouns.

The modular organization itself, that is, the dissociation of various aspects of syntactic phenomena for the purposes of the grammar, is what makes it possible to keep principles of UG maximally simple. The cohesion of each module is supplied by some notion and/or formal relation on which its principles are centered. The whole of the grammatical system is also characterized by unifying concepts, most notably the notion of government, which plays a key role in a variety of modules. The components interact in complex ways to restrict the massive overgeneration of syntactic expressions that would otherwise result from the fundamental freedom of possible basic phrase structures and transformations applied to them, which ultimately yields the actual set of well-formed expressions.

The modularity of the different (sets of) principles is due not only to the dissociation of the properties relevant to them but also to the stipulation of distinctions with regard to where in the grammar they apply. According to GB theory, each sentence corresponds to a sequence of representations, starting from D-structure (or *deep structure*, DS), proceeding through S-structure (or *surface structure*, SS) to the final representation called **LOGICAL FORM** (LF), where adjacent representations are related by transformations. The derivation from DS to SS feeds phonetic realization, in particular the mapping from SS to *phonetic form* (PF) (it is *overt*), whereas the derivation from SS to LF does not (it is *covert*). A principle can apply to transformations (like bounding theory), or to one or more of the three syntactic representational levels DS, SS, and LF (these constraints are filters), though not to any intermediate representation. Figure 1 depicts this so-called Y- or T-model of GB, tagged to indicate where the most prominent modules apply.

Parameters

UG, as a model of language competence, includes the principles along with the locus of their application, as well as the primitive syntactic objects (e.g., labels distinguishing full phrases, heads of phrases, and intermediate-level categories), relations

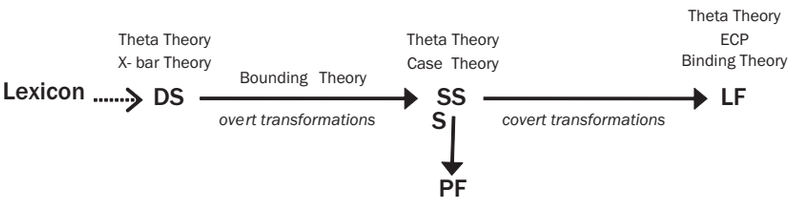

Figure 1.

(e.g., **C-COMMAND**, dominance, government), and operations (e.g., movement, deletion) that collectively define the syntactic expressions. Cross-linguistic variation, according to GB theory, is rather limited. An obvious element of variation involves the identity and properties of lexical items (referred to collectively as the **MENTAL LEXICON**). Apart from acquiring a lexicon, the primary means of grammar acquisition and the key source of cross-linguistic differences is the inference of underspecified aspects of UG principles, that is, the setting of open parameters. Parametric principles are an innovation to allow the model to furnish descriptively adequate – because suitably different – grammars for individual languages. To provide a realistic account of language acquisition, a process that is fairly uniform and remarkably effective both across speakers and across languages, the number of parameters to be fixed must be reasonably low, the parameter values permitted by UG must be limited to relatively few, and the cues in the primary linguistic data that can trigger their values must be sufficiently easy to detect. Due to their rich deductive structure, a distinct advantage of parameterized principles over language- and construction-specific rules is that the setting of a single parameter can potentially account for a whole cluster of syntactic properties, thereby contributing to a plausible explanation for the outstanding efficiency of the process of language acquisition itself. Such parameters are often referred to as *macro-parameters*.

A canonical macro-parameter of GB theory is the so-called *pro*-drop (or *null subject*) parameter. Null subject languages like Italian or Greek, in contrast to non-*pro*-drop languages like English or Dutch, allow phonetically null pronominal subjects (designated as *pro*) in tensed clauses, have no overt pleonastic element filling the subject position of weather verbs (cf. *It rained*), exhibit free subject inversion to the right of the verb, and permit movement of a subject out of an embedded wh-clause and from a position following a lexical complementizer (cf. *Who_i do you think that t_i will win*?). The classic account of this cluster of properties ascribes them to a single parameter, namely, whether or not the finite verbal agreement inflection syntactically *governs* the preverbal subject position, which in turn is related to the morphological richness of the relevant conjugation paradigm. It is due to the positive setting of this (ultimately lexical) parameter that null subject languages license a phonetically null pronoun or a trace in the canonical subject position of tensed clauses relatively freely.

Parameters range from macro-parameters like the null subject parameter to micro-parameters whose scope is comparatively narrow, for instance, the parameter determining whether or not the (finite) main verb raises out of the verb phrase (VP) before S-structure to a position above VP adverbs or clausal negation (the *verb raising parameter*). Another dimension along which parameters differ concerns the number of options, that is, parameter settings that are allowed. Most parameters are binary, but proposals have been made for parameters with more options: for instance, the choice of the *local domain* in which anaphors must find an appropriate antecedent. Binary parameters include the choice of the "timing" of a movement transformation with respect to S-structure (either overt or covert; see Figure 1). Finally, while some parameters are simply underspecified aspects of UG principles, others are grammatical properties of (classes) of lexical items. The *head directionality parameter* (set as *head-initial* for English where verbs, nouns, adjectives, and adpositions precede their complements, and *head-final* for Japanese, where they follow them) belongs to the first of these two types, while variation in terms of the lexical items that are lexically [+anaphoric] exemplify the second.

The Shift to Minimalism

The P&P framework inspired a vast amount of research on similarities and differences across languages, as well as on language acquisition (see PRINCIPLES AND PARAMETERS THEORY AND LANGUAGE ACQUISITION, and SYNTAX, ACQUISITION OF), which has produced an impressive array of novel discoveries and analyses that are both attractively elaborate in terms of data coverage and at the same time genuinely illuminating as regards the explanations they offer. That said, in pursuit of the twin objectives of descriptive and explanatory adequacy, some of the basic notions and principles became increasingly non-natural and complex (like government and the ECP, or the notion of *local domain* in binding theory). This gave cause for growing concern in the field, in no small part because the question of why UG is the way it is became disappointingly elusive. The ultimate source of the emergent complexities, beyond the strive for ever-improving empirical coverage, was the fact that GB lacked an actual theory of possible principles or, for that matter, of possible parameters. As for the latter, continued in-depth research on cross-linguistic variation has shown many of the macro-parameters, among them the null subject parameter, to be unsustainable in the strong form they were originally proposed: Several of the linguistic properties correlated by macro-parameters turned out to be cross-linguistically dissociable. Even though the idea of parametric linguistic variation was upheld, parameters themselves needed to be scaled down. In addition, as GB relied on massive overgeneration resulting from the fundamental freedom of basic phrase structure and transformations, downsized by declarative constraints imposed (mainly) on syntactic representations, the computational viability of the model was often called into question.

The current minimalist research program (MP), initiated by Chomsky in the early 1990s (see Chomsky 1995), while building

on the achievements of GB theory, departs from it in various important ways. It refocuses attention on the shape of UG itself as a model of the innate faculty of language (FL), a computational-representational module of human cognition, as well as on the way it interfaces with (articulatory-phonetic and conceptual-intentional) external systems. The MP adopts the substantive hypothesis (called *full interpretation*) that representations that the FL feeds to the external interface systems are fully interpretable by those components, with all uninterpretable aspects of the representations eliminated internally to FL. As for the shape of UG as a computational system, the MP puts forward the substantive hypothesis that FL is computationally efficient: It incurs minimal operational complexity in the construction of representations fully interpretable by the interface systems. Syntactic operations like movement apply only if they are triggered: only if they must be carried out in order to satisfy full interpretation by eliminating some uninterpretable property in the syntactic expression under computation (a principle of computational economy called *last resort*). If there is more than one way that a derivation can satisfy full interpretation, the least complex (set of) operation(s) is selected by FL (the principle of *least effort*).

On the methodological side, the MP proposes to apply Ockham's razor considerations of theoretical parsimony to UG as rigorously as possible. All syntax-internal principles constraining representations are disposed of, thereby eliminating syntax-internal *representational levels*, including S-structure and D-structure. The incremental structure-building operation **MERGE** starts out from lexical items, combining them recursively into successively larger syntactic units. Empirical properties formerly captured at D-structure and S-structure are accounted for by shifting the burden of explanation to full interpretation at the interface levels of PF and LF, and to principles of economy of derivation, the only principles operational in UG. Economy principles have no built-in parameters: All "parametric" differences across languages are confined to the domain of lexical properties, an irreducible locus of variation, to which, accordingly, the acquisition of syntax is reduced (cf. the **LEXICAL LEARNING HYPOTHESIS**). For instance, **WORD ORDER** variation, previously put down to the head directionality parameter, is typically attributed to movement operations: Movements can occur either in overt or in covert syntax, and they can affect smaller or larger units of structure, these choices being a function of uninterpretable lexical properties of participating elements.

Non-naturally complex notions and relations (including government) are also eliminated from UG. A syntactic expression is taken to be a plain set (of sets of sets, etc.) of lexical items, produced by recursive applications of merge: Nothing beyond that is added in the course of the derivation. It follows from this simplifying proposal (called *inclusiveness*) that syntactic expressions include no indices (to link a moved element to its trace, or a binder to its bindee), no traces (but silent copies of the moved elements themselves), no syntactic label for "phrase" or "head" status, and perhaps no labels borne by complex syntactic units at all. The two stipulative assumptions of the GB model – that all overt movements precede all covert movements and that transfer to phonetic and conceptual interpretation can only take place at a unique point in the derivation – are also dropped. This yields a model that has overt and covert movements intermingled

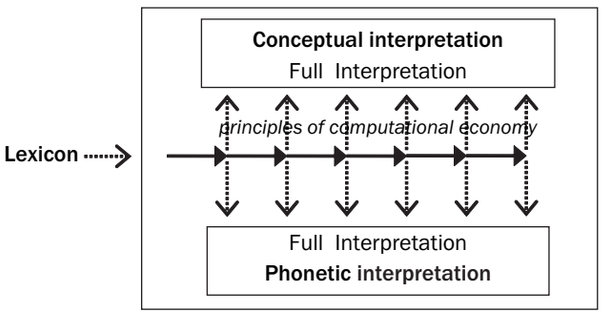

Figure 2.

(applying them as soon as their respective trigger is merged in) and that has multiple transfers (derivational sequences between two transfer points are called *phases*). The basic architecture is shown in Figure 2.

Finally, grammatical components are reduced as well. First of all, there are no distinct phrase structure and transformational components, as both basic phrase structure and movements are brought about by the operation merge: While basic structure building involves merging two distinct elements, movement involves (re)merging an element with a constituent that contains it. In addition, the burden of description carried by modules of GB is partly reallocated to syntax-external components, and is partly redistributed among the residual factors that can enter syntactic explanation: the principal constraint imposed by the interface components (full interpretation), the character of the syntactic derivation (multiple transfers, principles of computational economy, the nature of basic syntactic operations, etc.), and the properties of lexical items. For instance, much of the binding theory of UG is reduced to movement operations and rules of interpretation, case theory is recast in more general terms and is subsumed in a broader account of triggers for movements (called *checking theory*), and bounding theory is deduced from the "multiple transfers" nature of the derivation.

Conclusion

The fundamental question pursued by the P&P framework is whether it is possible to construct an explanatorily adequate theory of natural language grammar based on general principles. Two further ambitions of P&P, gaining prominence with the advent of its minimalist research program, are to find out whether the primitive notions and principles of such a model are characterized by a certain degree of naturalness, simplicity, and nonredundancy, and concurrently, whether some properties of the language faculty can be explained in terms of "design" considerations pertaining to computational cognitive subsystems in general, or even more broadly, in terms of laws of nature. Should it turn out that these questions are answered in the positive (as some initial results suggest), that would be a surprising empirical discovery about an apparently complex *biological* subsystem (cf. **BIOLINGUISTICS**): in the case at hand, the human language faculty. The exploration of the ways in which general laws of nature might enter linguistic explanation has barely begun. Clearly, most of the work lies ahead.

– Balázs Surányi

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PRINCIPLES AND PARAMETERS THEORY AND LANGUAGE ACQUISITION

Nativism

The basic idea in **PRINCIPLES** and **PARAMETERS THEORY** is to distinguish the invariants of human language (the *principles*) from the major points of cross-linguistic variation (the *parameters*). Both principles and parameters are taken to reflect innately determined, biological characteristics of the human brain (see UNIVERSAL GRAMMAR). In the course of normal child development, however, the two diverge: The principles come to operate in much the same way in every child, with minimal sensitivity to the child's environment, while the parameters take on distinct values as a function of the child's linguistic input.

The term *parameter* is normally reserved for points of narrowly restricted variation. The principles and parameters (P&P) framework also acknowledges that languages vary in ways that are relatively unconstrained by universal grammar, such as the exact form of vocabulary items. These latter points of variation are usually treated as arbitrary idiosyncrasies, to be listed in the *lexicon*.

The P&P framework has its origins in the two foundational questions of modern linguistics (Chomsky 1981): *What* exactly do you know, when you know your native language? And *how* did you come to know it? A satisfactory answer to these questions must address the *poverty of the stimulus*, including the fact that children are not reliably corrected when they make a grammatical error (Brown and Hanlon 1970; Marcus 1993).

Despite the poverty of the stimulus, by the age of about five years we observe "uniformity of success" at language acquisition (Crain and Lillo-Martin 1999): Aside from cases of medical abnormality, or isolation from natural-language input, every child acquires a grammar that closely resembles the grammar of his or her caregivers. Moreover, even when a child is younger, and still engaged in the process of language acquisition, extraordinarily few of the logically possible errors are actually observed in the child's spontaneous speech (Snyder 2007). Clearly, children do not acquire grammar through simple trial-and-error learning.

Linguists working in the P&P tradition have concluded that a great deal of grammatical information must already be present in the child's brain at birth. Of course, different languages of the world exhibit somewhat different grammars, but the claim in P&P is that the options for grammatical variation are extremely limited. On the P&P approach, the child's task during language acquisition is akin to ordering food in a restaurant: One need only make selections from a menu, not give the chef a recipe.

In other words, the information required for the child to select an appropriate grammar from among the options is far less, both in quantity and in quality, than would be required to build a grammar from the ground up. First, grammars that cannot be attained with the available parameter settings will never be hypothesized by the child, even if they are compatible with the child's linguistic input up to that point. Second, to the extent that parameters are abstract, and thus have wide-spread consequences, a variety of different sentence types in the linguistic input can help the child select the correct option. The challenge of identifying the correct grammar is still considerable, but is far more tractable than it would be if the child had to rely on general learning strategies alone.

Investigating Language and Its Acquisition Within a P&P Framework

The P&P framework was first clearly articulated for syntax, in the context of **GOVERNMENT AND BINDING THEORY** (e.g. Chomsky 1981, 1986). Yet the framework is considerably more general. First, the same basic architecture has been applied to phonology, notably in the framework of *government phonology* (e.g. Kaye, Lowenstamm, and Vergnaud 1990), and also (in certain work) to semantics and morphology. Second, recent syntactic and phonological research in the *minimalist program* (Chomsky 1995, 2001; see MINIMALISM) and in **OPTIMALITY THEORY** (Prince and Smolensky 2004) still crucially assumes a P&P framework, in the broad sense that it posits universal principles and narrowly restricted options for cross-linguistic variation. (This point is discussed further in the next section.)

Within the P&P framework, research on children's acquisition of language plays a number of important roles. First, such research can clarify the *logical problem of language acquisition*, which any "explanatorily adequate" linguistic theory must address: How in principle can the correct grammar be chosen from among the proposed options, using only the types of linguistic input that children actually need for successful language acquisition? (See DESCRIPTIVE, OBSERVATIONAL, AND EXPLANATORY ADEQUACY.) Acquisition research can help determine which types of linguistic input are (and are not), in fact, necessary for children to succeed at language acquisition.

For example, some of the most compelling evidence for the *irrelevance* of corrective feedback comes from Eric H. Lenneberg's (1967, 305–9) study of a hypolingual child. Despite the fact that the child had been mute since birth, and therefore had had no possibility of producing any errors to be corrected, he performed at an age-appropriate level on comprehension tests of English grammar. Hence, receiving corrective feedback on one's own utterances seems to be unnecessary. Hearing the linguistic utterances of other speakers, produced in context, can suffice. To achieve explanatory adequacy, a linguistic theory must be able to account for this.

A second role of acquisitional evidence within the P&P framework lies in testing the acquisitional predictions of proposed linguistic principles. All else being equal, if one proposes that

a given property of language is an innate principle of universal grammar, then one expects the principle to be operative in children as early as we can test for it. (A notable exception is found in the work of Hagit Borer and Ken Wexler 1992, who propose that several specific linguistic principles undergo maturational change during childhood.)

For example, Stephen Crain and Mineharu Nakayama (1987) conducted an acquisitional test of *structure dependence*, the proposed principle that syntactic movement is always sensitive to hierarchical structure. Their study tested the prediction that structure dependence, as an innate principle, should be operative very early. The study was conducted with children acquiring English who were three to five years old (the youngest subjects capable of performing the experimental task), and used prompts such as the following: "Ask Jabba if [the man who is beating a donkey] is mean." Crucially, children never produced errors of the form, "Is [the man who __ beating a donkey] is mean?" Such errors might have been expected, however, if the children had been at liberty to hypothesize structure-independent rules (such as "Move the *first* auxiliary to the beginning of the sentence").

Third, by proposing a parameter of universal grammar, one makes predictions about the time course of child language acquisition. These predictions may involve concurrent acquisition or ordered acquisition. To see this, suppose that two grammatical constructions A and B are proposed to have identical prerequisites, in terms of parameter-settings and lexical information. A and B are then predicted to become grammatically available to any given child "concurrently," that is, at the same point during language acquisition.

A prediction of *ordered* acquisition results when the proposed linguistic prerequisites for one construction (A) are a proper subset of the prerequisites for another construction (B). In this case A might become available to a given child earlier than B, if the child first acquires the subset of B's prerequisites that are necessary for A. Alternatively, A and B might become available to the child concurrently, if the last-acquired prerequisite for B is also a prerequisite for A. In contrast, *no* child should acquire B significantly earlier than A.

As a concrete example, consider William Snyder's (2001) work on *the compounding parameter* (TCP). Theoretical research had suggested a link (at least in Dutch and Afrikaans) between the verb-particle construction (cf. *Mary lifted the box up*) and morphological compounding (cf. *banana box*, for "a box where bananas are kept"). Snyder observed a one-way implication in the data from a sizable number of languages: If a language permits the verb-particle construction, then it also allows free creation of novel compounds like *banana box*. The implication is unidirectional, however: There do exist languages that allow this type of compounding, yet lack the verb-particle construction. Snyder therefore proposed that the grammatical prerequisite for the English type of compounding (i.e., the positive setting of TCP) is one of several prerequisites for the verb-particle construction.

A clear acquisitional prediction followed: Any given child acquiring English will either acquire compounding first (if [+TCP] is acquired prior to the other prerequisites for the verb-particle construction), or acquire compounding and the verb-particle construction at the same time (if [+TCP] is the last-acquired prerequisite for the verb-particle construction). In no case will a child acquire the verb-particle construction significantly earlier than compounding. This prediction received strong support from a longitudinal study of 10 children.

This example illustrates how the investigation of language acquisition and the investigation of mature grammars can be mutually reinforcing activities within the P&P framework. Another example is provided by the work of Diane Lillo-Martin and Ronice Müller de Quadros (2005), who considered the parametric prerequisites for the different types of wh-questions in American Sign Language (ASL), according to two competing syntactic analyses. The two analyses yielded distinct predictions about the time course of acquisition, which were then successfully tested against longitudinal data from children acquiring ASL.

Areas of Debate

We mention here two areas of debate within the P&P approach to child language acquisition, and of course there are others. 1) What types of parameters, exactly, is the child required to set? 2) What are the observable consequences of an *unset* or *misset* parameter?

One point of disagreement in the P&P literature quite generally, including the acquisition literature, concerns the proper conception of parameters. A classic conception, which Noam Chomsky (1986, 146) attributes to James Higginbotham, is the switchbox metaphor: Each parameter is like an electrical switch, with a small number of possible settings.

Yet this is only one of many possible ways that parameters could work. A radically different conception is found in optimality theory, which posits a universal set of violable constraints. Instead of choosing particular settings for switches in a switchbox, the learner has to *rank* the constraints correctly. The result is a narrowly restricted set of options for the target grammar, as required by the P&P framework. (Indeed, on the mathematical equivalence of a constraint ranking to a set of switchbox-style "dominance" parameters, see Tesar and Smolensky 2005, 45–6.)

Still another approach to parameters is to connect them to the lexicon. (See LEXICAL LEARNING HYPOTHESIS.) This is conceptually attractive because the lexicon is independently needed as a repository of information that varies across languages. Exactly what it means to connect parameters to the lexicon, however, has been open to interpretation.

One idea is to connect points of abstract grammatical (e.g., syntactic) variation to the paradigms of inflectional morphology. The idea is that paradigmatic morphology has to be stored in the lexicon anyway, and might provide a way to encode parametric choices. This approach can be found in Borer (1984) and Lillo-Martin (1991), for example. A related idea is to encode parametric choices in the morphology of closed-class lexical items. A good example is Pica's (1984) proposal to derive cross-linguistic variation in the binding domain of a reflexive pronoun from the pronoun's morphological shape. A variant of Pierre Pica's approach is to encode parametric choices as abstract (rather than morphologically overt) properties of individual lexical items. This is the *lexical parameterization hypothesis* of Wexler and Rita Manzini (1987), who took this approach to cross-linguistic variation in the binding domain for both reflexives and pronominals.

Yet another idea is to encode cross-linguistic grammatical variation in the abstract (often phonetically null) features of functional heads. Chomsky (1995**,** Chapter 2) takes this approach to V-raising in French, for example, and its absence in English: In French, the functional head Agr^0 is "strong," and causes the verb to move up and adjoin to Agr^0 before the sentence is pronounced. The result is the word order in *Jean* [$_{AgrP}$ *voit* [$_{VP}$ *souvent* [$_{VP}$ V_t *Marie*]]], literally "John [$_{AgrP}$ *sees* [$_{VP}$ often [$_{VP}$ V_t Mary]]]," in place of English "John [$_{AgrP}$ [$_{VP}$ often [$_{VP}$ *sees* Mary]]]."

Chomsky's approach is "lexical" in the sense that the morphosyntactic features of functional heads like Agr^0 are taken to be listed in the lexicon. Note, however, that the possible features of a functional head are still assumed to be quite narrowly restricted. Thus, where earlier work might have posited a switch-like parameter of [± verb raising], for example, Chomsky instead posits a choice between a strong feature versus a weak feature on Agr^0, and assumes that this particular lexical item will be present above the verb phrase (VP) in most or all cases. For purposes of language acquisition, the difference is extremely minor; the child makes a binary choice, and it has consequences across a wide range of sentence types. Therefore, Chomsky's approach still falls squarely within the P&P framework.

The second and final point of disagreement that we mention here concerns the consequences of unset or misset parameters. For concreteness, we focus on the switchbox model: Can a switch be placed in an intermediate, unset position? Alternatively, must a child sometimes make temporary use of a setting that is not in fact employed in the target language? If so, what are the consequences for the functioning of the language faculty?

One school of thought is that there is no such thing as an unset parameter: Every parameter is always in a determinate setting, be it an arbitrary setting (cf. Gibson and Wexler 1994), or a prespecified "default" setting (e.g. Hyams 1986). On this view, temporary missettings may be routine during the period when language acquisition is still underway. (The notion that certain parameter settings might be defaults, or "unmarked options," has its roots in the phonological concept of **MARKEDNESS**.)

A second school of thought maintains that parameters are initially unset. Virginia Valian (1991) proposes that an unset parameter permits *everything* that any of its potential values would allow. Somewhat similarly, Charles D. Yang (2002) proposes that the learner begins the language acquisition process not with a single grammar but, rather, with a multitude of different grammars, all in competition against one another. Every grammar corresponding to a permissible array of parameter-settings is included. A consequence is that competing values of the same parameter can be in play at the same time.

A cross-cutting view is that children may temporarily entertain nonadult parameter settings (whether "default" or not; see, e.g., Thornton and Crain 1994). Children may then produce utterances that use a grammatical structure found in some of the world's languages, but not in the target. On this view, what is crucial is simply that the learner must *eventually* arrive at the target parameter-setting, regardless of what parameter-settings have been temporarily adopted along the way. This is the learning problem that is addressed by Edward Gibson and Wexler's (1994) *trigger learning algorithm*, for example.

An alternative view is that the child reserves judgment on any given parameter setting until he or she has enough information to set it with confidence. Initially the parameter is in an unset state, but this time the consequence is that *none* of the grammatical options tied to a specific setting of the parameter is actually endorsed by the child. Snyder (2007) advances this view when he argues that children who are speaking *spontaneously*, in a natural setting, make astonishingly few of the logically possible grammatical errors. The vast majority of the errors that do occur either are errors of omission or belong to a tiny subset of the logical possibilities for *commission* errors (where the words are actually pronounced in configurations that are ungrammatical in the target language).

Most of the grammatical comission errors that are found in studies of *elicited* production or *comprehension* are absent from children's spontaneous speech, even when the opportunities exist for the child to make them. Snyder concludes that many of these errors result from the demands of the experimental tasks. When left to their own devices, children successfully avoid putting words together in ways that would require them to make a premature commitment to a particular parameter-setting.

Conclusion

Language acquisition is a rich source of evidence about both the principles and the parameters of the human language faculty. For this reason, research on language acquisition plays a central role in the P&P framework.

– William Snyder and Diane Lillo-Martin

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PRINT CULTURE

Print (or typographic) culture designates all the activities entailed in producing, distributing, collecting, and reading printed materials and engraved images. As a historical construct, it usually refers to the literary environment that first emerged in Western Europe during the second half of the fifteenth century. Diverse developments elsewhere (such as the use of xylography in China and of movable type in Korea, prohibitions against Arabic printing by Ottoman rulers, and the sluggish pace of Russian printing) lend themselves to comparative study but cannot be covered here.

In Western Europe (unlike other areas), the printing arts, once introduced, spread with remarkable rapidity. Between the 1460s and 1490s, printing shops were established in all of the major political and commercial centers. New occupations (typefounding and presswork) were introduced; bookmaking arts were reorganized; trade networks were extended; book fairs inaugurated. By 1500, the use of movable type had become the dominant mode for duplicating texts, and xylography had replaced hand illumination for replicating images.

Though often classified under the heading of *book history*, print culture encompasses a vast variety of nonbook materials, such as advertisements, almanacs, calendars, horoscopes, proclamations, tickets, and timetables. It also entails the provision of visual aids (such as maps, charts, tables, graphs, and detailed drawings) that are especially difficult to duplicate in large quantities by hand. Print culture is defined largely in contrast to the scribal (or **CHIROGRAPHIC**) culture that had prevailed in the West during previous millennia when handcopying was the sole means of duplicating writing and drawing. Although handcopying persisted and indeed thrived after the introduction of printing, it did so within a changed literary environment. Handwriting itself was taught with reference to printed manuals; copyists imitated the title pages, the punctuation, and pagination of printed books.

Scribal culture had been characterized by an economy of scarcity. The large collections of texts gathered in the Alexandrian library and in some later centers of learning were exceptional and relatively short-lived. The retrieval, copying, and recopying of surviving texts took precedence over composing new ones. The acquisition of **LITERACY** was confined to restricted groups of churchmen and lay professionals. Oral interchange predominated. (As noted in the following, this has led some authorities to contrast print, not with scribal but with **ORAL CULTURE**.)

Print culture introduced an economy of abundance. The continued output of handcopied books simply added to a growing supply. Wholesale production replaced a retail book trade. Increased output was spurred by competition among printers and booksellers, who curried favor with the authorities in order to win the privilege of issuing primers, prayer books, official edicts, and other works for which there was a steady demand. Print culture gave rise to new laws governing copyright, patenting, and intellectual property. The literary diets of Latin-reading professional groups were enriched by access to many more books than had been available before. More abundantly stocked bookshelves increased opportunities to compare ancient texts with each other and with more recent work. Academic activities were reoriented from preserving ancient wisdom to registering new findings and venturing into uncharted fields. The expansive character of print culture grew more pronounced over the course of centuries. Multivolumed reference works required constant updating; serial publication was introduced; bibliographies grew thicker and more specialized. Concern about information overload was experienced by each generation in turn.

The drive to tap new markets encouraged popularization, translations from Latin into the vernaculars, and a general democratization of learning and letters. The church was divided over whether to support or counter these trends, especially over whether or not to authorize vernacular translations of Bibles and prayer books. After the Lutheran revolt, lay Bible reading was encouraged in Protestant regions and discouraged in regions that remained loyal to Rome. Whereas a single Index of Prohibited Books provided guidance to all Catholic officials, Protestant censorship was decentralized, taking diverse forms in different realms.

In all regions, learning to read paved the way for learning by reading. Autodidacts were urged to master various arts by means of "how-to" texts (Cormack and Mazzio 2005). Authors, artists, and craftsmen, in collaboration with printers and publishers, used self-portraits, title pages, and paratextual materials to advertise their products and themselves. Individual initiative was rewarded; the drive for fame went into high gear. But the preservative powers of print made it increasingly difficult for successive generations to win notice from posterity. An ever

more strenuous effort was required to cope with "the burden of the past" (Bate 1970).

There are synchronic as well as diachronic aspects to print culture (see SYNCHRONY AND DIACHRONY). Unlike hand-copied texts, printed copies get issued not consecutively but simultaneously. The distribution of printed copies was relatively slow before the development of modern transport systems. Nevertheless, the age of the wooden handpress saw a marked improvement in the coordination of diverse activities, such as checking the path of a comet against diverse predictions, incorporating new findings and corrections in successive editions of reference works, or mobilizing a protest movement in different parts of a given realm. "We made the thirteen clocks strike as one," commented an American revolutionary.

Simultaneity went together with standardization, as is illustrated in an anecdote about Napoleon's minister of education, who looked at his watch and announced that at that moment all French schoolboys of a certain age were turning the same page of Caesar's Gallic Wars. The output of the handpress fell short of achieving the degree of standardization that marks modern editions. Yet early modern readers were able to argue, in both scholarly tomes and polemical pamphlets, about identical passages on identically numbered pages.

Simultaneity is of special significance in conjunction with journalism. Especially after the introduction of iron presses harnessed to steam and wire services that made use of the telegraph, the newspaper press would restructure the way readers experienced the flow of time. Simultaneity is nicely illustrated by the front page layout of a modern newspaper, which has been described by Marshall McLuhan as "a mosaic of unrelated scraps in a field unified only by a dateline" (1964, 249). Given the juxtapositions and discontinuities presented by the front page, it is a mistake to associate print only with "linear sequential" modes of thought. Although books and newspapers are now filed separately in libraries and archives, they are intertwined manifestations of print culture, beginning with early newsbooks and going on to later serialized novels.

Even in the age of the handpress, newsprint altered the way readers learned about affairs of state. It created a forum outside parliaments and assembly halls and invited ordinary subjects to participate in debates (by contributing letters to editors). It provided ambitious journalists (from Jean-Paul Marat to Benito Mussolini) with new pathways to political power. It served to knit together the inhabitants of large cities for whom the daily newspaper provided a kind of surrogate community. According to Benedict Anderson (1983, 37–40), newsprint served a similar function for millions of compatriots who lived within the boundaries of a given nation-state.

The reception of news via print rather than voice points to a facet of print culture that has given rise to much debate. It centers on a contrast not with scribal but with oral culture. To an Enlightenment philosopher such as the Marquid de Condorcet (see Baker 1982, 268), who was impressed by advances in mathematics, the use of print held the promise of introducing rationality into political affairs. Whereas speech was ephemeral, Condorcet argued, a printed account lent itself to rereading and careful consideration. By means of rhetorical devices, orators could persuade their audiences to perform ill-considered acts. Legislators were less likely to be "carried away" by a treatise than by a speaker, and were more likely to think calmly and carefully before taking action.

The same "distancing" effect of print that Condorcet regarded as beneficial was found objectionable by others. The romantic movement was in part a reaction against the mathematical reasoning and abstract thinking that were associated with print culture. Political romanticism took the form of lamenting the way "the age of chivalry" had succumbed to that of "economists and calculators" (Burke 1790). Readers were urged by romantic poets, such as William Wordsworth, to abandon dry-as-dust books: "close up those barren leaves!" Objections to the purported distancing effects of print persisted among critics and media analysts in the twentieth century. "Through the habit of using print and paper," wrote Lewis Mumford (1934, 136–7), "thought lost something of its flowing organic character and became abstract, categorical, stereotyped, content with purely verbal formulations and solutions." A similar position was taken by McLuhan in his depiction of "Typographical Man" (1962, 36–7).

Both the proponents and opponents of the ostensibly impersonal character of print tended to overlook its coexistence with a human presence and a human voice. One thinks immediately of parents reading to children. But any text that appears in print lends itself to being read aloud. During the early modern era, printed broadsides and news reports were especially likely to be transmitted by word of mouth to listeners gathered around a few literate townsmen. Even now, public readings or lectures are delivered to hearing publics by authors of printed best-sellers.

Print culture did not supersede oral culture but did have an effect upon it. As was true of handwriting and handcopying, the speech arts, far from languishing, flourished in a more regulated form. Instruction in elocution and in holding debates figured among the many how-to books that printers kept in stock. There were exceptional preachers (such as the Marian exiles or the Huguenot refugees) who, when deprived of their pulpits and sent into exile, turned to printing as their only recourse. But most preachers (like Martin Luther himself) made full use of both pulpit and press.

Other considerations cast doubt on the "distancing" effect of print. As noted previously, print culture encompasses images as well as texts. Whatever the persuasive effects of printed cartoons and caricatures, they cannot be described as distancing. Similarly, the figure of a distant ruler became less distant when printed (or photographed) portraits could be cut out of newspapers and enshrined in peasant huts. Even with regard to bare texts, a skillful writer (whether distant or dead) can still move unknown readers "to tears" or incite them to take action.

Before printing, powerful lungs were required for preachers or orators who hoped to gain a popular following. But the later political scene saw effective action taken by numerous figures who (like John Wilkes) were notably deficient in the speech arts. Condorcet, for one, was remarkably blind to the political passions that could be aroused by pamphleteers and journalists. During the revolutionary era, readers of Tom Paine or Marat were not "distanced" from political contestation but were drawn into it.

The basic features of print culture remained more or less the same after the industrialization of printing processes in the early

nineteenth century and after the adoption of other new technologies (such as lithography, photography and the shift from "hot" to "cold" type). Nineteenth-century observers believed that the advent of newspapers signaled the end of the book. Late twentieth-century commentators believed that radio, television, and other electronic media were going to supersede print. At present, the movement of texts onto screens has persuaded some observers that supersession is finally at hand. In my view, continued coexistence seems more likely, especially since the preservative powers of print are still uncontested. An ever-growing shortage of space on library shelves and an unending concern about information overload suggest that print culture is still exerting a cumulative effect and will continue to do so for the foreseeable future.

– Elizabeth L. Eisenstein

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PRIVATE LANGUAGE

Ludwig Wittgenstein (1889–1951) is considered one of the most influential philosophers of the twentieth century. While his contributions to philosophy are wide-ranging, one of his most widely discussed and influential contributions is taken to follow from the sections of his *Philosophical Investigations* that explore the possibility of a logically private language ([1953] 1958, §§243–315). These remarks have come to be called *Wittgenstein's private language argument*. The label is not, however, without controversy; we explore why in this entry.

Wittgenstein's remarks need to be read closely; they are designed to work on the reader rather than proffer arguments entailing conclusions, which might be summarized. For Wittgenstein, philosophy was an activity, and its goal ought to be to free us of problems, formulated through our misunderstanding the logic of our language (1922, 3). The interested reader's first "port of call," therefore, should be his central text, *Philosophical Investigations* (hereafter *PI*). This is the most complete of the posthumously published works and the one that has had most influence on subsequent philosophical thought. I discuss the ways in which interpreters have read the remarks so often referred to as the private language argument and the conclusions those interpreters have drawn. Wittgenstein's writings are designed to wean one away from certain alluring, though maybe unconscious, commitments, pictures, analogies, and prejudices. One cannot, therefore, merely summarize his "argument(s)" and "conclusion(s)," for there is (are) none, in the traditional sense.

In *PI*, Wittgenstein asks, could we "imagine a language in which a person could write down or give vocal expression to his inner experiences – his feelings, moods, and the rest – for his private use?" ([1953] 1958, §243). His imaginary interlocutor responds by remarking that we do so in our ordinary language. Wittgenstein rejoins: "But that is not what I mean. The individual words of this language are to refer to what can be known only to the person speaking; to his immediate, private, sensations. So another person cannot understand the language" (§243).

Wittgenstein is variously taken, in the 72 (or so) remarks that follow this passage to be doing one of two things. Some interpreters take him to be providing a *refutation* of the claim that the "language" described in §243 is possible through a *reductio ad absurdum*, in the process advancing positive philosophical claims such as an expressive theory for the meaning of first person, present tense, psychological utterances, refuting certain (alleged) Cartesian prejudices regarding the mind–body relationship, and availing us of a new answer to the problem of other minds. On another reading, he is taken to bring readers to a position whereby they freely acknowledge that such a logically private language could have no significance for them, that in trying to state what such a language could be, the philosopher fails to make sense; furthermore, that their thought that such a language could have significance, could be stated sensically, stemmed from an unacknowledged, thought-constraining, attachment to a particular – nonobligatory – picture of language, the mind or privacy. The debate, therefore, cashes out in the following way.

Those who take Wittgenstein to provide an *argument* in these 72 or so remarks take that argument to be something along the lines of the following: For something, say, a set of utterances – say, the signals of the "builders" in the opening remarks of *PI*, say, a "logically private language" such as that which we are asked to imagine in §243 – to rightly be called a "language," it must fulfill a certain set of criteria. The criteria give us the meaning of the word *language*. Something failing to fulfill these criteria, therefore, cannot meaningfully be called language. There is a second-order debate about the nature of the criteria: Are they formal/logical or are they social? There are, thus, those who hold that the existence of a language entails the existence of a linguistic community, "communitarians," and those who hold that it does not do so. However, regardless of which position on this second-

order debate such readers take, they all (*if* they take Wittgenstein to have been *successful* in his alleged aim) hold that a "logically private language," as described in the final paragraph of *PI* §243, is shown by Wittgenstein to fail to fulfill the relevant criteria for being a language. It is this, such readers claim, that he demonstrates – argues – in the 72 or so remarks that follow it.

The alternative way of reading these remarks is as follows: Wittgenstein, in *PI*, asks us to *imagine* such a language ([1953] 1958, §243), that is, to (try to) entertain the thought of the possibility of a "language which describes my inner experiences and which only I can understand" (§256). The remarks that follow work on the reader to the extent that he or she sees that however one tries to give sense to such a (putative) "language," we never arrive at a position where our desire to see it as such is satisfied. Read aright, the remarks serve to dispel the desire to attempt to give sense to the locution "[a] language which describes my inner experiences and which only I can understand" or "a logically private language." On this reading, it is not that there is something akin to a misuse – according to the rules of grammar – of the concepts "private" and "language," such that such locutions are nonsense. It is not *something* that the philosopher wants to say but cannot owing to the configuration of grammatical rules. It is, rather, that when we try to *imagine* a "private language," we realize that there is no *determinable thing* – a private language – to imagine. The very notion of a private language dissipates as we try to grasp it.

On the latter reading, therefore, Wittgenstein does not advance a theory as to the nature of first person, present tense, psychological utterances but merely offers *suggestions* as to how it might be *possible* to understand these as learned replacements for (say) a cry of pain, rather than as, for example, a description or report of an inner state, such as a sensation. He offers such suggestions, as it were, as prophylactics. To accept such suggestions as *possible* weans one off of the assumption that such utterances *must* be descriptions of inner states (sensations, for example) and feeds into weaning one away from the assumed need and the desire to give sense to the locution "private language."

The debate between the two readings, therefore, hinges on how one should understand Wittgenstein's philosophical method (or metaphilosophy). Those who take him to offer a *refutation* of a logically private language and to be, in the course of doing so, advancing positive claims as to (say) the nature of first person, present tense, psychological utterances, do so, as their opponents suggest, by underplaying his remarks on philosophical method (especially *PI* §109 and §§126 through 133), where he lays out his therapeutic vision of philosophy. Here, the practice of philosophy is undertaken as a therapeutic dialogue between the Wittgensteinian philosopher and his or her interlocutor – indeed, the therapist and interlocutor might be conflicting tendencies in oneself. The task of the philosopher-as-therapist is to facilitate the interlocutor's free realization that he or she is in the grip of a particular picture of the way things *must* be that leads him or her to be committed to certain nonobligatory philosophical positions.

What one takes to be done by Wittgenstein in these 72 (or so) remarks has more than merely exegetical significance. If one understands him to have refuted the possibility of a logically private language and, in so doing, to have advanced, for example, the "expressive theory for the meaning of first person, present tense, psychological utterances," then one will be led to argue that such utterances are *not* – cannot be – reports or descriptions of inner states but *are* – must be – rather, expressions or avowals of judgments or evaluations/appraisals: So, for example, many "cognitivist" philosophers (e.g., Lyons 1980; Nash 1989) and psychologists (e.g., Lazarus 1982) of emotion advance this view (some, such as Kenny 1963, even drawing on Wittgenstein as chief influence).

If one understands Wittgenstein as not having advanced such views and, rather, takes his remarks to be designed to work on one so as to facilitate the realization that there is nothing we would wish to hold onto answering to the name "private language," we are not led to a philosophical commitment to *any* view on psychological language. We might then, rather, engage with those who claim or assume that first person, present tense, psychological utterances *must* be reports or descriptions of inner states or sensations – Jamesian accounts of emotion in general and cognitive neuroscience in particular (e.g., Damasio 1994) – *and* with those who claim or assume that they must be expressions or avowals as *both* being driven by prejudice. Jamesian/neoJamesian *and* "cognitivist" theories of emotion can be seen to rest on prejudice about our use of psychological language (see also EMOTION WORDS).

Wittgenstein, read aright, can provide much help in our attempts to dissolve such prejudice in the human sciences.

– Phil Hutchinson

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PROJECTIBILITY OF PREDICATES

The distinction between projectible and nonprojectible predicates arises in analyses of inductive inference. David Hume ([1748] 2000) showed that it is not possible to justify the belief that past empirical regularities will continue into the future. Nelson Goodman's 1953 "new riddle of induction" raised a further problem. Goodman showed that there are always an unlimited number of hypotheses that encompass all of the evidence, yet conflict in their predictions. For example, if we introduce the predicate "grue" (grue = examined before some future time

t and green, or not so examined and blue), the hypotheses [H1] "All emeralds are green" and [H2] "All emeralds are grue" both conform to the observed data, though making divergent predictions. So, Goodman asks, what justifies adopting H1 rather than H2 or countless other conflicting hypotheses? Why, that is, on the basis of the very same evidence do we project some predicates (e.g., "green") and not others (e.g., "grue")? A predicate, then, is considered *projectible* if it is suitable for use in inductive inference.

The projectible/nonprojectible distinction, however, has significance for other important issues. In particular, it is appealed to in distinguishing laws of nature (eg. H1) from generalizations that while true, seem true only by "accident" (e.g., [H3] "All the objects on table D are green"). The distinction is also central in evaluating the truth or falsity of counterfactual conditionals and in accounts of the basis of similarity judgments. This leads some to identify projectible predicates with so-called *natural kind* predicates. "Green" and "emerald" pick out natural kinds; "grue" and "on table D" do not.

Providing criteria for distinguishing projectible from nonprojectible predicates (or natural kinds from other kinds) remains a challenge (Scheffler 1981; Stalker 1994; Schwartz 2005). The difference between projectible and nonprojectible predicates does not hinge on explicit temporal reference. If "grue" and "bleen" (bleen = blue and examined before time *t*, or not so examined and green) are taken as primitives and "green" and "blue" defined, the latter predicates, not the former, will mention time. In fact, temporal considerations need not play any role in setting the new riddle. A curve drawn through data points represents a hypothesis that projects new values from those observed. But an unbounded number of curves that make conflicting predictions about unobserved values can be drawn through these same points.

Continuing efforts to explicate the concept *projectible predicate* in purely syntactic or semantic terms have not been successful. Attempts to draw a projectible/nonprojectible distinction along epistemological and metaphysical lines have also been unsatisfactory, tending either to be parochial or to presuppose dichotomies tantamount to the distinction itself. Solutions appealing to simplicity, similarity, and innate quality spaces have run into like difficulties. Goodman proposes drawing the distinction along pragmatic lines. Projectible predicates are those with a history of successful predictive use. As a result, they become "entrenched" in our vocabulary and inductive practices. Pragmatic entrenchment underlies the confidence we have in projecting them and is a primary reason for their felt naturalness.

– Robert Schwartz

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PROJECTION (BLENDING THEORY)

METAPHOR, ANALOGY, CATEGORIZATION, and many other cognitive operations are customarily understood within **COGNITIVE LINGUISTICS** in terms of projected conceptual structures or in terms that are compatible with conceptual projection. In the **CONCEPTUAL BLENDING** framework, in particular, projection describes the way that conceptual structures can be combined or superimposed by copying conceptual content from one **MENTAL SPACE** to another. This term is unrelated to the use of *projection* to describe anticipatory utterances and **GESTURES** in conversation (e.g., Streeck 1995) or the **PROJECTION PRINCIPLE** of **GOVERNMENT AND BINDING** theory.

The notion of projection as a kind of **MAPPING** that serves as a fundamental mechanism of thought has its roots in ideas from **CONCEPTUAL METAPHOR** theory and **FRAME SEMANTICS**, as well as **MENTAL SPACE** theory. George Lakoff and Mark Johnson (1980) explain individual instances of metaphorical language as reflections of systematic relationships between two conceptual domains, in which language and structure from a source domain is projected, or *mapped onto*, a situation in a *target* domain (see SOURCE AND TARGET). A sentence like *We're drifting apart* depicts elements from the domain of emotional intimacy in terms of structures mapped from the domain of physical proximity. Charles J. Fillmore (1982) observes that words like *lend* make sense only in light of certain **SCHEMATIC** representations of situation types, or *frames*. A word is said to *evoke* an associated frame or frames, prompting a language user to project the evoked frame's structure onto an unframed assembly of elements. This projection allows the language user to understand those elements in terms of the relationships and roles belonging to the frame.

Projection in the conceptual blending framework differs from its counterparts in conceptual metaphor theory and frame semantics in two ways. First, projection in conceptual blending is a process that takes place between mental spaces, not domains or schemas. Second, where the former theories describe projections involving exactly two conceptual structures, the conceptual blending framework calls for four at a minimum. Material is projected from at least two input spaces into at least two *middle spaces* (Fauconnier and Turner 1994): a generic space that reflects the roles, frames, and schemas that the inputs have in common, and a **BLENDED SPACE** where projected elements are integrated and develop **EMERGENT STRUCTURE** through processes of *composition*, *completion*, and *elaboration* (Fauconnier and Turner 1998, 2002).

Backward projection refers to circumstances whereby structure is projected from the blended space back to its inputs. This can be a desirable outcome in which inferences developed in the blend enhance understanding of the input material. Gilles Fauconnier and Mark Turner (2002) illustrate this kind of desirable backward projection with the Buddhist Monk riddle: A monk walks up a mountain one day and walks down the same path over the same time period on another day. A solution to the puzzle of whether there is a place on the path that the monk occupies at the same time of day on both journeys is to imagine that the monk takes both walks on the same day – in this blended scenario, at some moment he will "meet himself." Only projecting the location of the "meeting place" from the blended space back to the input spaces yields the conclusion that the original

single monk, walking on two different days, will indeed cross some spot on the path at the same time on each day.

An important principle of projection in conceptual blending theory is that it is always *selective*. Not all elements and relations in the input spaces are projected into the blended space. Sometimes only one of a pair of counterpart elements is projected, sometimes both, and sometimes none. The organizing structure of one or both inputs can also be projected in part, or not at all. In some integration networks, called *single-scope networks*, only one input projects its organizing frame to the blended space, while the other input contributes other elements but little or no organizing structure. (Conventional source–target metaphors are considered **PROTOTYPE** examples of this kind of integration network.) The projection involved in other kinds of networks is also selective: *If I were you, I'd take the job*, for example, prompts the listener to take some aspects of the interlocutor into consideration and some aspects of himself or herself, but by no means all of either.

Unconstrained projection, by contrast, would undermine the usefulness of these inferences, and projecting too much structure in either direction constitutes an error. Excessive projection from the inputs in a blend leads to mistakes, such as assuming that because my computer interface includes something called a "menu," I will need to find some "waiter" who can accept my "order." Inappropriate projection of emergent structure from the blended space back to the inputs leads to other mistakes, such as confusing actors with the characters they play on TV. The possible competing pressures governing these constraints on projection are examined in detail in Fauconnier and Turner (1998 and 2002, 309–52).

– Vera Tobin

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PROJECTION PRINCIPLE

The projection principle (Chomsky 1981) is a cornerstone of **PRINCIPLES AND PARAMETERS THEORY**. It states that the properties of lexical items (that is, both their features and selectional requirements) must be represented at every **SYNTACTIC** level of representation. Its key effect is to allow structure at every level of representation to be directly determined by lexical properties, thereby largely eliminating the need for language-particular rules. For this reason, the projection principle has played a key role in the transition from early rule-based **TRANSFORMATIONAL GRAMMAR** to principles and parameters theory.

Let us briefly review two major consequences of the projection principle. The first concerns the elimination of language-particular base rules (the rules that generate deep structures; see UNDERLYING STRUCTURE AND SURFACE STRUCTURE) in transformational grammar. Such rules would state, for example, that in English a verb phrase may consist of a verb followed by either a noun phrase or a prepositional phrase or a noun phrase and a prepositional phrase, and so on. In addition, the lexical entries of verbs specify the syntactic environment in which they can occur. Thus, the entry for the verb *put* states that it must be followed by a noun phrase and a prepositional phrase. This arrangement gives rise to redundancy: In the case at hand, the fact that there are English verbs that can be followed by a noun phrase and a prepositional phrase is expressed twice, namely, in the base rules and in the lexical entry of *put* (and other verbs). Since lexical properties are idiosyncratic, elimination of this redundancy requires a simplification of the base component, and this is precisely what the projection principle makes possible. As it requires syntactic representations to be projections of lexical properties, it allows the base component to be reduced to a small universal skeleton, known as **X-BAR THEORY**, and relegates language-specific properties of deep structures to the lexicon and to a set of word-order **PARAMETERS**.

The projection principle also implies that syntactic representations that are the result of **MOVEMENT** must contain **TRACES** that function as place holders for categories that have undergone this operation. It is easy to see why this should be so. As stated earlier, the lexical entry for the verb *put* must state that this verb is followed by a noun phrase and a prepositional phrase. However, in the question in (1a), the selectional requirements of this verb appear not to be met, since the noun phrase that usually follows it has undergone movement. Satisfaction of the projection principle, therefore, requires that movement leave behind a trace – shown as t_{NP} in (1b) – so that the selectional properties of *put* are also expressed in the structure that results from movement.

(1) a. I wonder [[NP what] Jack has [VP [V put] [PP in the oven]]]
b. I wonder [[$_{NP}$ what] Jack has [$_{VP}$ [$_{V}$ put] t_{NP} [$_{PP}$ in the oven]]]

– Hans van de Koot

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PROPOSITION

As used in the philosophy of language and logic, a proposition is *what* is believed and/or asserted. The prima facie case for the

existence of propositions is that they make sense of the fact that from

> Terry believes that cats are cute.

we can infer that

> There is something that Terry believes.

Propositions, while often thought to be what is expressed by a sentence, are said to be distinct from sentences. One sentence (e.g., "Fred put the money in the bank") can express more than one proposition (in this case, depending on the meaning of "bank"); and one proposition can be expressed by two different sentences (e.g., "snow is white" and *neige est blanc*).

Proponents of propositions typically treat them as the primary bearers of **TRUTH** and falsity, but they disagree over their nature and structure.

– Michael P. Lynch

PROPOSITIONAL ATTITUDES

Propositional attitudes are mental relations – believing, desiring, hoping, and so on – between an individual and a **PROPOSITION.** The sentence "Amie believes that 1 + 1 = 2" is a propositional attitude report, where Amie stands in the belief relation to the proposition that 1 + 1 = 2. The proposition specifies the *content* of the attitude (see INTENTIONALITY). Propositional attitudes play a central role in ordinary psychological explanations. We explain why Elia presses the doorbell by saying that he hopes someone will answer the door, and he believes that this will happen if he presses the bell.

The Nature of Propositional Attitudes

One controversy about propositional attitudes concerns their relationship to the mental **REPRESENTATIONS** investigated in psychology and cognitive science. The **LANGUAGE OF THOUGHT** theory says that propositional attitudes correspond to language-like mental representations – their combinatorial syntax allows them to form propositional attitudes with new contents.

A second controversy about propositional attitudes concerns their purported social or environmental dependency. For *internalists*, whether one has a certain propositional attitude depends only on one's internal physical brain state (Searle 1983). However, *externalists* (McGinn 1977; Burge 1979) argue that mental relations to propositions are mediated through linguistic conventions and the external environment. Two physically identical individuals can possess different propositional attitudes if they are embedded in different environments (see MEANING EXTERNALISM AND INTERNALISM).

The Semantics of Propositional Attitudes Reports

The analysis of propositional attitude reports is a particularly thorny problem for **SEMANTICS**. There is no consensus as to the right approach, and the resolution of the problem depends on many other issues in semantics, such as the nature of a proposition. Under **POSSIBLE WORLDS SEMANTICS**, a proposition is a set of possible worlds. The proposition that pigs fly is the set of worlds where pigs fly. But a serious problem is that necessarily equivalent propositions would then have to be identical. The necessarily true proposition that 1 + 1 = 2 is identical to the proposition that 60,375 is divisible by 3 (both identical to the set of all possible worlds). But intuitively, one can believe the first proposition without believing the second.

Many take this to show that a proposition must be more fine-grained than simply a set of worlds. On the *Russellian* approach, a proposition expressed by a *that-clause* is constructed from the normal referents of the expressions contained in the clause. The number 2 is a constituent of the proposition that 1 + 1 = 2, but it is not part of the proposition that 60,375 is divisible by 3. Since the propositions are distinct, we can believe one without believing the other.

Unfortunately, the Russellian approach has difficulties accounting for an observation by Gottlob Frege ([1892] 1948). Frege famously pointed out that identity statements can differ in cognitive value. Intuitively, "Amie believes that Mark Twain is Mark Twain" can be true while "Amie believes that Mark Twain is Samuel Clemens" is false. But on the Russellian approach, this is impossible. Since Mark Twain *is* Samuel Clemens, the two that-clauses refer to the same proposition. In response, Nathan Salmon (1986) insists that the two belief reports are indeed equivalent. Our contrary intuition reflects only a difference in **PRAGMATICS**.

A Fregean alternative is to postulate that the proper names "Mark Twain" and "Samuel Clemens" have different senses (see SENSE AND REFERENCE) for Amie, that she represents the same person in two different ways. In addition, these names do not have their customary referents within the context of "believe." Instead of referring to the same famous author, the two names actually refer to their associated senses within propositional attitude contexts. Consequently, the that-clauses in the two belief reports refer to distinct propositions, which is why the two reports are not equivalent. However, one objection to the Fregean approach is that proper names do not change their referents in propositional attitude contexts (Davidson 1968). Another objection is that people can believe the same proposition even if they associate different senses with the same name. "These children all believe that Santa exists" can be true even if the children represent Santa in different ways.

Rudolf Carnap (1958), W. V. O. Quine (1956), and Donald Davidson (1968) analyzed propositional attitudes as relations to sentences, rather than language-independent propositions. "Michelle believes that 1 + 1 = 2" is true if and only if Michelle stands in a certain relationship to the sentence 1 + 1 = 2. This avoids the need to postulate propositions, but there are new problems to resolve. For example, the sentence "Delman believes something profound." can be true, even if Delman does not speak English, or if there is no English sentence that captures the content of his profound belief.

Other authors, such as Mark Richard (1990) and Richard Larson and P. Ludlow (1993), have sought to develop *hybrid* approaches, where a proposition combines language-independent entities with linguistic items or mental representations. A more radical approach is to deny that propositional attitudes are binary relations. Mark Crimmins (1992) argues that although a propositional attitude verb like *believe* is syntactically a two-place predicate, it actually expresses a three-place relation

among a subject, a proposition, and a "way of believing." A way of believing is supposed to be similar to a Fregean sense, but it is contextually specified and does not correspond to any explicit referring item in the report.

– Joe Lau

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PROTOTYPES

Prototypes refers to one of the ways in which psychology has attempted to account for the nature of **CONCEPTS** and conceptual categories (see CATEGORIZATION). In the prototypes view, conceptual categories form around and/or are represented in the mind by salient, information-rich ideas and images that become prototypes for the category. Other members of the conceptual category are judged in relation to these prototypes, thus forming gradients of category membership.

The importance of prototype theory needs to be seen in its historical context. Prior to this work, concepts and conceptual categories were assumed from philosophy to be arbitrary logical sets with defining features and clear-cut boundaries. All members of the conceptual category were considered equivalent with respect to membership. This is now called the *classical view*. Psychological research on concept learning used artificial sets of stimuli, structured into microworlds in which these assumed characteristics of categories were already built in. Mainstream linguistics was constructed on similar assumptions; **PHONOLOGY, SEMANTICS**, and **SYNTAX** all sought to decompose the subject matter of their domains (speech sounds, **WORD MEANING**, and grammar) into sets of abstract binary defining features, a procedure called *componential analysis*. In contrast, in the prototype view, there need be no defining attributes that all conceptual category members have in common; category boundaries need not be definite (sometimes called *fuzzy* boundaries), and category membership is graded with respect to how good a member is judged to be.

The prototype view was first proposed by Eleanor Rosch (1973) as a general framework encompassing her cross-cultural work on **COLOR** and form categories, and then elaborated into a programmatic body of empirical research challenging the classical view (Rosch 1978, 1999). The theory was that categories form around perceptually, imaginally, or conceptually salient stimuli, then, by stimulus generalization, spread to other similar stimuli; such prototype stimuli serve as the conceptual and imaginal reference points by which the category as a whole is represented and understood. Empirically, all categories do show gradients of membership; that is, subjects easily, rapidly, and meaningfully rate how well a particular item fits their idea or image of the category to which the item belongs. Note that these are not probability judgments but judgments of degree of membership. Gradient of membership judgments apply to diverse kinds of categories: perceptual categories such as *red*, semantic categories such as *furniture*, biological categories such as *woman*, social categories such as *occupations*, formal categories that have classical definitions such as *odd number*, and **AD HOC**, goal-derived categories such as *things to take out of the house in a fire*. In contrast, subjects cannot list criterial attributes for most categories (Rosch and Mervis 1975).

Gradients of membership must be considered psychologically important because such measures have been shown to affect virtually every major method of study and measurement used in psychological research (Rosch 1975, 1978, 1999):

1. *Association*: When asked to list members of the category, subjects produce better examples earlier and more frequently than poorer examples. Association is taken as the key to mental structure in many systems; for example, in approaches as diverse as British empiricist philosophy, **CONNECTIONISM**, and **PSYCHOANALYSIS**.

2. *Speed of Processing*: The better an example is of its category, the more rapidly subjects can judge whether or not that item belongs to the category. Reaction time has been considered a royal road to the study of mental processes in cognitive psychology.

3. *Learning*: Good examples of categories are learned by subjects in experiments and acquired naturalistically by children earlier than are poor examples, and categories can be learned more easily when better examples are presented first – findings with implications for education (see Markman 1989; Mervis 1980).

4. *Expectation*: When subjects are presented a category name in advance of making rapid judgment about the category, performance is helped (i.e., reaction time is faster) for good and hindered for poor members of the category. Called **PRIMING** or set in psychology, this finding has been used to argue that the mental **REPRESENTATION** of the category is in some ways more like the better than the poorer **EXEMPLARS**.

5. *Inference*: Subjects infer from more to less representative members of categories more readily than the reverse, and the representativeness of items influences judgments in formal logic tasks, such as syllogisms (see also Smith and Medin 1981; cf. **VERBAL REASONING**).

6. *Probability Judgments*: Representativeness strongly influences probability judgments (Kahneman, Slovic, and Tversky 1982), which is important because probability is thought by many philosophers to be the basis of inductive inference and, thus, of the way in which we learn about the world.

7. *Natural Language Indicators of Graded Structure*: Natural languages themselves contain various devices that acknowledge and point to graded structure, such as hedge words like *technically* and *really* (see also Lakoff 1987; Taylor 2003).

8. *Judgment of Similarity*: Less good examples of categories are judged more similar to good examples than vice versa. This violates the way similarity is treated in logic, where similarity relations are symmetrical and reversible (Tversky 1977).

What determines the items that will be prototypical of categories in the first place? Some are based on statistical frequencies, such as the means or modes (or **FAMILY RESEMBLANCE** structures) for various attributes; others appear to be ideals made salient by such factors as physiology (good colors, good forms), social structure (president, teacher), culture (saints), goals (ideal foods to eat on a diet), formal structure (multiples of 10 in the decimal system), causal theories (sequences that "look" random), and individual experiences (the first learned or most recently encountered items or items made particularly salient because they are emotionally charged, vivid, concrete, meaningful, or interesting). Note that particular exemplars can be prototypes if they serve as reference points for the category; thus, prototype and exemplar theories are not necessarily contradictory. Note also that it is a misapprehension to take prototypes to mean only one kind of prototype and to critique prototype theory on that basis.

The prototype view has spread beyond psychology to many fields, including linguistics and **NARRATOLOGY**. Gradients of exemplariness are ubiquitous in linguistic phenomena, even in phonology where actual speech is less clear-cut than would appear in an abstract componential analysis. In semantic and syntactic analyses (particularly in **COGNITIVE GRAMMAR** and the understanding of **METAPHOR**), prototype effects, as well as providing specific case studies are often used as evidence that formal analysis is insufficient of itself and that world knowledge must be part of one's theory (Lakoff 1987; Langacker 1990; Taylor 2003).

There are societal implications of prototype theory. For example, social **STEREOTYPES** are a type of prototype; it is called a stereotype when it applies to a group of people and has social consequences. Another example: Anglo-American case law is based on prototypes; precedent cases provide the reference points in arguing present cases (see LEGAL INTERPRETATION). Further examples: Political arguments are often about conflicting prototypes (e.g., different images of welfare mothers) even when goals (care for children) may be quite similar, while scholarly debates are frequently about attempts to draw clear-cut boundaries where there are none when the participants actually agree on central prototypes (e.g., agreement on clear cases of what we mean by *language* or *religion* but disagreement about borderline phenomena and about criteria). Many such issues could be clarified by understanding the principles of prototyping.

Although prototype effects are now acknowledged as empirically established, there have been many criticisms of prototypes as an account of concepts and categorization. The main objections fall into two camps: In the first, prototypes and graded structure violate the classical requirement that the real meaning of a concept (that to which it refers) must be the identifiable necessary attributes of a classical definition. One argument for this view is that prototype and graded structure effects can be found for conceptual categories that have a formal classical definition, such as *odd number* (Armstrong, Gleitman, and Gleitman 1983), another that prototypes do not form componential combinations as do the elements of classical definitions (e.g., a good example of *pet fish* is neither a prototypical pet nor a prototypical fish; Osherson and Smith 1981). Both findings are taken to indicate that prototypes are something other than and irrelevant to a concept's meaning. One solution is a dual model in which prototypes are assigned the function of rapid recognition of conceptual referents, whereas the true meaning is provided by a classically defined core (Osherson and Smith 1981; Smith, Shoben, and Rips 1974). In the second camp, prototypes change with context – for example, prototypical animals in the context of a zoo differ from those in the context of a farm (Barsalou 1987). Such findings are taken to indicate that it is theories that determine concept meaning (Medin 1989). (For a review of more philosophical objections to prototypes – and all other accounts of concepts – see Fodor 1998 and Laurence and Margolis 1999.)

In conclusion, prototype and graded structure effects are well established; the debate concerns what they mean for our understanding of concepts, categorization, thinking, decision making, the meaning of words and word combinations, and innumerable other aspects of human functioning. The prototype view is not necessarily incompatible with other approaches if the different views are seen at a level deep enough that their complementarity can be appreciated. Prototype effects do not deny that under some circumstances we explicitly think in terms of **NECESSARY AND SUFFICIENT CONDITIONS**, nor does the essentialist intuition that there are nonobvious realities behind outer appearances (Gelman and Wellman 1991) exclusively require the form of classical definitions for its implementation. Furthermore, prototypes, like any other mental or cultural process, only function within the ever-shifting contexts of partially organized forms of encyclopedic knowledge and belief – the sort of understanding toward which the theories view points. What prototype research uniquely points out is that there is a level of organization of the mind in which concepts appear to be represented by information-rich, imagistic, sensory-based, often emotion-linked wholes that are used in thinking and communicating without reference to definitions, category boundaries, or even **TRUTH CONDITIONS**.

– Eleanor Rosch

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PROVERBS

Proverbs in the Humanities and Cognitive Science

The humanities treat proverbs as repositories of wisdom about everyday life. This premise motivates religious, literary, practical, and cultural–folklore approaches that capitalize on the fact that proverbs can be pithy, express a moral or precept, sound authoritative, perform various pragmatic functions (e.g., exhortation), and serve as indirect **SPEECH-ACTS**, in which what is intended encompasses more than what is actually said.

The cognitive science perspective examines how proverbs both illuminate and are illuminated by knowledge about the mind. Ultimately, the humanities and cognitive science views are complementary. The former is represented in Mieder (1994) and the journal *Proverbium*, the latter in Honeck (1997), and both views in Mieder (2003).

The Cognitive Science of Proverbs

Proverbs are best considered not in isolation but as members of a larger family or category that includes the proverb, pictorial renderings of the proverb's literal meaning, verbal and pictorial interpretations of the proverb's figurative meaning, and verbal and pictorial instances of the proverb's figurative meaning. Theoretically, the proverb's figurative meaning serves as the conceptual glue that connects the family members.

For example, the family for the proverb "Great weights hang on small wires," might include a picture of barbells hanging on a thin wire, an interpretation such as "The outcome of important events often depends on seemingly minor details," and verbal instances such as "The shortstop tripped on a pebble and the game was lost" and "The nurse accidentally bumped the surgeon's hand and the patient died." Crucially, and except for the proverb–literal picture connection, the family members share no literal similarity, either of a linguistic or imagistic sort.

Psychological research with proverbs has contributed to issues in several areas of cognitive science (see Honeck 1997), as follows:

MENTAL REPRESENTATION. Because research shows that people can reliably connect the family members, a case can be made for the role of an abstract, amodal, nonlinguistic, nonimagistic mental **REPRESENTATION** in cognitive processes such as remembering and **CATEGORIZATION**.

For example, proverbs are remembered better if they are first presented along with related as opposed to unrelated, interpretations. And related interpretations, and even verbal instances, serve as effective prompts for recall of a proverb. Indeed, people judge a good interpretation to be the best way to represent the meaning of a proverb family. Moreover, if people fixate on the literal imagery evoked by a proverb, they are unable to recognize verbal instances of its figurative meaning. These several results strongly suggest that the knowledge that guides memory and categorization can be quite abstract and theory-like, and that imagery is best construed as the outgrowth of a particular level of understanding.

ON-LINE PROCESSING. Must the literal meaning of a trope be deciphered before its figurative meaning can be constructed? The answer from reaction-time research on proverbs is in the affirmative, although the literal primacy effect reduces with proverb familiarity. Providing advance markers (e.g., "proverbially speaking") reduces processing time for unfamiliar proverbs, but event-related potential (brain wave) measures indicate that the words in proverbs used figuratively, versus literally, are harder to integrate with the discourse context (Schwint, Ferretti, and Katz 2006). Moreover, since proverbs almost always function as indirect speech-acts, these results also indicate that such acts can be dependent on prior literal access.

CEREBRAL ASYMMETRY. Research on brain damage indicates that the **RIGHT HEMISPHERE** is better than the **LEFT HEMISPHERE** at processing nonliteral meanings, the kind involved in **METAPHORS**, connotation, **VERBAL HUMOR**, sarcasm, the point

of a story, gist, and proverbs. The right brain appears to process inputs in a more flexible, open, contextualist, and holistic way, propensities that would facilitate proverb comprehension.

DEVELOPMENTAL TRENDS. Proverb comprehension improves slowly over time, beginning at about age seven. Comprehension is facilitated by supporting context (e.g., pictures), proverb concreteness and familiarity, and reduced information-processing load, as well as by the child having a better vocabulary, metacognitive awareness of nonliteral meanings, a formal education, and a good social knowledge base. The cognitive processes subserving improvement are unclear, although **ANALOGY** has been implicated.

Theories of Proverb Comprehension

The *extended conceptual base theory* (Honeck 1997) is a cognitive psychological, laboratory-derived approach. It claims that proverbs are distinguished by form and function, are variably familiar, and are understood via several phases of problem solving that are nonautomatic, heavily inferential, and error prone. The *great chain metaphor theory* (Lakoff and Turner 1989), a **COGNITIVE LINGUISTICS** cultural approach, makes antithetical claims. To date, almost all of the empirical research has been done in conjunction with, and is supportive of, the conceptual base theory (Honeck and Temple 1996).

– Richard P. Honeck

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PSYCHOANALYSIS AND LANGUAGE

Psychoanalysis is, first, a "talking cure," a verbal treatment for mental illness. As such, it has been bound up with speech, meaning, and **INTERPRETATION** from the outset. In keeping with this connection, psychoanalytic theorists and scholars examining psychoanalysis have repeatedly addressed the intertwining of psychoanalysis and language. Some scholars have explored the place of language and/or language science in Freudian thought and practice (see, for example, Forrester 1980 and Loewald 1978). Others have drawn on specific theories of language in order to alter, reorient, enhance, or reunderstand Freudian principles. The most famous case of the latter was Jacques Lacan, who drew on **STRUCTURALIST** ideas to revise psychoanalytic accounts of the unconscious, symptoms, dreams, etc. Some later writers, such as Marshall Edelson (1975) and Bonnie Litowitz (1978), drew on **TRANSFORMATIONAL GRAMMAR** to rethink psychoanalytic ideas. (See also Ricoeur 1978 on both approaches.)

Function and Architecture

As the preceding cases may already begin to suggest, it is valuable to distinguish functional accounts of mental phenomena in psychoanalysis from specific, explanatory architectures. Put very simply, functional accounts treat what mental operations accomplish (e.g., fear causes us to flee predators); a particular architecture defines the causal organization that enables the functions (e.g., fear is produced when certain perceptual stimuli produce convergent arousal in the **AMYGDALA**). In psychoanalysis, the functional idea of repression is separable from any particular account of how repression occurs and where it is located in a set of mental structures. When Lacan drew on structuralism to theorize the unconscious, he was preserving the basic functional idea of Freud while altering the precise way in which the mental structures – thus, the *implementation* of those functions – were specified. The same point holds for Litowitz and the Freudian idea of *overdetermination* (roughly, the multiple interpretable meanings and causal sources of a dream image or symptom).

Unfortunately, these uses of specific linguistic theories seem highly problematic. First, they often presuppose the fundamental principles of Freudian architecture and try to graft a very different theory onto them. It is not clear that the theories being combined are compatible. Moreover, the initial Freudian architecture often seems ill-defined and not particularly well supported by more recent research. Second, the linguistic theories may not apply literally to the psychoanalytic functions anyway (e.g., the relation between **UNDERLYING STRUCTURE** and the Freudian unconscious is, at best, only analogical). Finally, when not used in a loose, metaphorical way, the linguistic theories have sometimes been taken up in specific forms that were subsequently bypassed in linguistics, leaving the psychoanalytic redevelopments outdated.

There may be a more productive way of revising Freudian architecture, however, while preserving basic functional principles of psychoanalysis, including those that bear on language. Specifically, we might begin with the relatively well-established architecture that has emerged from cognitive neuroscience in recent years. From here, we might seek to reformulate some central functional principles of psychoanalysis in that architecture. (This is roughly the program of *neuropsychoanalysis*.) In the remainder of this entry, I set out one possible account of this sort.

Before going on to language, however, we should briefly consider the general relation between some key functional divisions in psychoanalysis – primarily the conscious/unconscious, or repression – and neurocognitive architecture.

Repression and the Brain

Different readers of Freud and different psychoanalysts will characterize psychoanalysis differently. For our purposes, we may consider a few elements of psychoanalytic theory to be central and distinctive. I would first of all list the dynamic unconscious, thus, mental contents that are not available to conscious

knowledge even though they are the *type* of contents that are ordinarily available to consciousness. In other words, some aspects of the mind – for example, grammatical principles – are the sorts of things we can only infer; we cannot know them directly. However, other aspects of the mind –for example, memories, beliefs, and desires – are the sorts of things that we ordinarily seem to know directly. When we do not know memories, beliefs, and desires, they are unconscious, as are grammatical principles. But the reason for their unconsciousness is different. It is a matter of *repression* (hence, the "dynamic" part of *dynamic unconscious*). Repression begins with mental conflict that gives rise to emotional pain. To take a simple example, one might experience conflict between one's desires and one's moral aspirations, leading to feelings of guilt. In certain circumstances, we respond to this pain by making one element of the conflict inaccessible to conscious thought – in this case, presumably, the desires. This can occur at any age. However, classical psychoanalysis posits that *primary repression* occurs in early childhood. In adulthood, *secondary repression* takes place when a conflict is assimilated to primary repressed material.

This simplified picture of repression is at least broadly consistent with current neurocognitive architecture. We often experience emotional conflict due to the different imperatives of our various (largely subcortical) emotion systems. Research suggests that the anterior cingulate cortex (ACC) monitors conflicts in task performance (see, for example, MacDonald et al. 2000, 1835). When the ACC recognizes painful conflict, it activates the dorsolateral prefrontal cortex, which engages inhibitory processes (see Ito et al. 2006; Preston and de Waal 2002; Lieberman and Eisenberger 2006). More generally, our brains operate to reduce emotional conflicts, producing valenced outcomes from ambivalent inputs (Ito and Cacioppo 2001, 69). Psychoanalysis adds two things to this model. First, it isolates a class of feelings and ideas so thoroughly inhibited that they do not, then or subsequently, enter **WORKING MEMORY**. Second, it gives special importance to early childhood experiences – though this is broadly in keeping with the cognitive neuroscientific idea of **CRITICAL PERIODS** in childhood when certain aspects of cognition (e.g., knowledge of language) are shaped in crucial ways.

The problem with repression is that the motivational force of the unconscious elements continues to have consequences in one's behavior. One part of this fits in a general way with current neurocognitive accounts of memory, which distinguish explicit episodic and semantic/factual memories from implicit emotional memories (see LeDoux 1996, 182). It is well established that we are not consciously aware of emotional memories, though they affect our behavior. Emotional memories are commonly associated with episodic and semantic/factual memories that allow us to explain our feelings. One way in which the two may be dissociated is through brain damage. Psychoanalysis suggests that another way they may be separated is through repression of the relevant episodic and semantic/factual memories. Such repression would presumably allow the emotional memories to operate motivationally without our awareness, awareness normally guided by the (now repressed) explicit memories. In any case, the behavior affected by consciously unavailable motives prominently includes one's verbal behavior – which brings us to language.

Language and the Unconscious

Since language in psychoanalysis necessarily involves components, I organize my discussion (somewhat loosely) by reference to Roman Jakobson's influential sixfold analysis of the speech situation into speaker, hearer, context, medium of contact, message, and code.

SPEAKER. The psychoanalytically crucial idea here, developed most famously by Lacan, is the difference between the subject as speaker and the subject as object of speech. When I describe myself, there is necessarily a difference between the "I" that does the describing and the "myself" that is described. The latter is linguistic in two senses. First, my account of myself – sometimes called my **SELF-CONCEPT** – is largely given in verbal descriptions. These include not only descriptions that I have formulated on my own but also those that I have taken up from others (e.g., from student evaluations of my teaching). More generally, language provides me with the categories by which I identify myself – as a teacher or a scholar, as boring or interesting, clear or obscure (see MEANING AND BELIEF). According to Lacan and others, it is this necessary division between the (largely verbal) self-object and the (speaking) subject that allows there to be an unconscious. Put very simply, the unconscious occurs in that motivationally consequential part of me that is excluded from my self-concept. The very idea of such a division may seem counterintuitive, as we ordinarily imagine our self-knowledge to result directly from introspection. However, it is well established outside of psychoanalysis that this is not the case. For example, drawing on an extensive body of research, Richard Nisbett and Lee Ross explain that "[k]nowledge of one's own emotions and attitudes, though commonly believed ... to be 'direct' and certain, has been shown to be indirect and prone to serious error. Such knowledge is based in large part on inferences about causes of behavior" (1980, 227).

HEARER. The crucial feature of the hearer in psychoanalysis concerns not the hearer per se but, rather, one's implicit imagination of the hearer. In psychoanalysis, the unconscious has both emotional and cognitive consequences. Among the most crucial are those that define the *transference*. Transference is, roughly, unconsciously basing one's response to someone in one's current environment on repressed memories of, attitudes toward, or ideas about some earlier figure (e.g., one's father). It is well established in **PRAGMATICS** that speakers engage **COOPERATIVELY** with addressees, not only in following general principles but also in making specific adjustments for the likely knowledge, interests, attitudes, and so on of their addressees. In all conversations, these adjustments will be partially guided by cognitive structures, such as **PROTOTYPES** and **EXEMPLARS**. For example, I may avoid making a particular sort of joke with a colleague because I have a strong memory of such a joke flopping in the past. That memory would be a salient exemplar, guiding my expectations about my addressee. One might understand transference as the unconscious reliance on a particular exemplar for one's addressee. Moreover, this reliance bears on motivationally crucial aspects of the interaction (e.g., trust). Finally, it operates even when incompatible with individual or situational information (e.g., about the addressee's

trustworthiness, as when my unconscious exemplar fosters unwarranted trust).

CONTEXT. The context of a given speech event might be understood to encompass not only such matters as the social and material situation but also the array of ideas and feelings that accompany speech on the part of both the speaker and the hearer. This includes what psychoanalysts refer to as *fantasy*, which is bound up with transference. Specifically, my thoughts about an addressee are embedded in a series of often fleeting ideas and imaginations that are connected with that addressee, the larger situation, and other matters. This fantasy structure is likely to give rise to ephemeral emotional ambivalences in any circumstances. When transference is involved, it is likely to generate more sustained conflict that repeatedly inflects my motivational and cognitive responses to the addressee. Such fantasy may be understood, first, as the complex of images, memories, feelings, and, of course, words and meanings that are continually produced in association with speech and action through **PRIMING**. These primed contents are partially activated but have not reached a threshold where they draw attentional focus in working memory. In some cases, psychoanalysts would add, they *cannot* draw attentional focus. Nonetheless, they undoubtedly affect our action, including our speech production – guiding choices of, for example, lexical alternatives.

MEDIUM OF CONTACT. Many aspects of the "physical channel" (Jakobson 1987, 66) of communication are psychoanalytically consequential, including visual and aural aspects of both linguistic and paralinguistic action (see PARALANGUAGE). One important aspect of psychoanalytic interpretation is that linguistic and paralinguistic features may contradict one another such that the paralinguistic features may partially express the unconscious attitudes and ideas that are inhibited in the verbal statement. This is connected with our relatively limited control over the expressive component of emotions. Specifically, our prefrontal control of our expressions usually cannot convincingly replicate the expressions produced by the emotion systems themselves – a point familiar to anyone who has tried to smile for a photograph. This division allows us to recognize many sorts of insincere expression in ordinary life. Psychoanalysis adds that paralinguistic features may reveal inhibited ideas or feelings with strong motivational force, even when we are unaware of those ideas or feelings. Moreover, certain *symptomatic acts* may have the same function. In one case, one of Freud's patients repeatedly moved her finger in and out of a small purse as she spoke. Freud took this to be a masturbatory action ([1905] 1981, 75). Whether or not he was right in this case, in principle it is possible for this sort of thing to occur. One form of implicit memory involves procedural schemas, prominently motor routines for various habitual actions. It is possible to activate a motor routine without self-conscious monitoring. If there are repressed motivations, it may be possible for those to manifest themselves in at least certain schemas of this sort.

MESSAGE. One aspect of expression stressed by Freud is its determinacy. This is most famously (or notoriously) the case in errors, which Freud explained by reference to unconscious impulses. But the generation of ordinary speech is no less determinate, and it is not determined solely by one's self-conscious purposes. At any given moment, there are many ways in which I might phrase what I wish to say. However, I say things in one way only. For example, in speaking of a particular object, I might refer to it as a p.c., a computer, a laptop, and so on. But I choose one. In a **CONNECTIONIST** *model*, we would say that a range of factors has given the greatest activation to a particular phrasing. In some cases, this is just the **BASIC LEVEL** term. In other cases, there is some contextual or other reason for the choice. It might be a matter of repetition (I just saw a copy of **PC** *Computing*, so I say "p.c."); alternatively, it might involve a more complex **LEXICAL RELATION** (someone just mentioned desktops, so I say "laptop"). Psychoanalysis adds a series of circuit activations from dynamically unconscious motivational contents. For example, Ernst Lanzer (Freud's "Rat Man") tells Freud about someone who flattered and deceived him. He identifies the person as a medical student. There are many ways in which Lanzer could have introduced this person. What caused the specifically *medical* detail to be activated? One possibility is that Lanzer had a transferential relation to Freud in which he feared that Freud would flatter and deceive him in the treatment. Circuits connecting Freud with this student (and presumably with parental figures from the period of primary repression; see Hogan 1996, 148–50) would then have shaped this speech – specifically, the choice of medicine as an identifying characteristic – separately from Lanzer's self-conscious intentions.

CODE. Various features of a linguistic code – particularities of the lexicon, **MORPHOLOGY,** grammar – may allow the expression of unconscious ideas and impulses beyond the straightforward semantics of lexical selection. This may occur most obviously through **AMBIGUITY** or puns, a point stressed particularly by Lacan. For example, James Gorney (1990) reports a case in which someone reported conscious anxiety over a bill and thereby expressed unconscious anxiety over someone named "Bill." This is most readily understood in terms of **LEFT HEMISPHERE** versus **RIGHT HEMISPHERE** processes. Neurocognitive research shows us that the right hemisphere generates multiple meanings, some of which are inhibited by the left hemisphere, which selects the contextually relevant meanings (see Chiarello 1998, 145; Faust 1998, 180). For example, in the semantic context of references to a restaurant, and the linguistic context of following a determiner, left hemisphere interpretive processes will limit the meanings of *bill* to "a list of charges." However, right hemisphere interpretive processes will briefly generate "beak" and "William" also. Psychoanalysis once again adds to this well-established architecture a dynamic unconscious component. Specifically, it adds the idea that in some cases, a particular word (e.g., *bill*, rather than *check*) may be produced due to unconscious activations (see SPREADING ACTIVATION) that are motivational, though inaccessible to the working memory of the speaker.

Conclusion

The relation between psychoanalysis and language has been explored by many writers using many approaches. In the preceding sections, I have tried to show that central functional principles of psychoanalysis as they relate to language may be

integrated with current cognitive neuroscientific architecture. Some psychoanalytic principles seem plausible in this architecture, and they enrich our understanding of human psychology and language use in that context, though they do not alter the architecture per se. The question that remains open is whether there a function of repression and, if so, precisely how it operates in neurocognitive architecture. For example, as the Nobel laureate and prominent neuroscientist Gerald Edelman explained, referring to "the Freudian unconscious and the notion of repression," it is "conceivable that the modulation of value systems" in the brain "could provide a basis for the selective inhibition of pathways related to particular memories" (2004, 95; Edelman suggests that subcortical involvement, particularly in relation to focal attention, is crucial to this inhibition). If Freud was right to posit such a functional principle, then psychoanalysis may alter our understanding of cognitive neuroscientific architecture by introducing new processes or structures – or at least new systemic consequences resulting from previously unrecognized interactions of already posited processes and structures. If he was not right about this functional principle, it remains the case that many principles of psychoanalysis may be accommodated, in altered form, in cognitive neuroscience, including many principles of psychoanalysis and language.

– Patrick Colm Hogan

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PSYCHOLINGUISTICS

Psycholinguistics studies the relationship between the mind and language. Its concern is with the cognitive processes that underlie the acquisition, storage, and use of language and their correlates in observable neurological processes in the brain. The field is thus heavily reliant upon principles and research methods adopted from cognitive psychology. However, it is essentially multidisciplinary, drawing also upon linguistics, speech science, **PHONETICS**, computer modeling, neurolinguistics, **DISCOURSE ANALYSIS (LINGUISTIC)** and **SEMANTICS**.

Psycholinguistic inquiry is driven by the premise that language has developed in ways that reflect the structure of the human mind. Certain shared cognitive routines are assumed to underpin the production and reception of language, despite variations between individuals in terms of level of vocabulary and powers of self-expression. Research thus tends to be normative in direction, though due allowance is made for the characteristics of the language being examined, the task being undertaken, and the population under investigation. A favored approach is to investigate small-scale components of a processing system in order to gradually build up a picture of the system as a whole.

An interest in the psychology of adult language emerged during the nineteenth century, with initiatives such as Paul Pierre Broca's work (1863) on the location of language in the brain and Francis Galton's (1883) on word association. A parallel interest in child language acquisition had developed earlier from the Enlightenment debate between *rationalist* followers of Descartes, who believed that much human knowledge was innate, and *empiricists* such as Hume and Locke, who asserted that it was entirely acquired.

The term *psycholinguistics* probably dates from the 1930s, but progress during the first half of the twentieth century was discouraged by the dominant behaviorist view that the human mind is unknowable. The field did not emerge as a discipline in its own right until the mid-1950s. An impetus was given by a series of essays in which George Miller mapped out possible areas of inquiry. A major landmark was then Noam Chomsky's 1959 rebuttal of the behaviorist assumptions expressed by B. F. Skinner in his *Verbal Behavior*. Citing the speed with which an infant masters a linguistic system and the poverty of the evidence available, Chomsky concluded that language is a genetically acquired faculty. His nativist stance (see INNATENESS AND INNATISM) stimulated modern studies of child language and began a controversy that continues to the present day.

Much early psycholinguistic inquiry was closely allied to linguistic theory. It explored aspects of Chomksy's early **GENERATIVE GRAMMAR** on the assumption that the rules represented *psychological reality*: that is, that they provided a model of the operations of the mind, as well as a linguistic account of grammatical structure. The findings were mainly negative or inconclusive, and the paths of linguistics and psycholinguistics began to diverge, although a body of "psychological linguists" continues today to work within a framework of Chomskyan theory.

In its current form, psycholinguistics falls into a number of distinct areas, but considerable overlaps between them give the discipline coherence.

Language Processing

Processing research seeks to characterize the four language skills of **READING**, writing, speaking (**SPEECH PRODUCTION**) and listening (**AUDITORY PROCESSING**, **SPEECH PERCEPTION**) in terms of the cognitive operations that underlie them. It also investigates how vocabulary is retrieved from the mind (**WORD RECOGNITION**) and how **SYNTACTIC** structures are assembled or interpreted. Its findings have important applications for the teaching of literacy (see TEACHING READING and TEACHING WRITING), for language therapy, and for second language learning (see SECOND LANGUAGE ACQUISITION).

Drawing upon an *information-processing* precedent, accounts often depict language users as taking linguistic material through a series of *levels of* **REPRESENTATION**. For example, a listener might be seen as building sounds into **SYLLABLES**, syllables into **WORDS**, words into clauses, and clauses into abstract meanings. In fact, the process is not necessarily a sequential one, as the language user is capable of operating at all these levels simultaneously. What is more, there is evidence that higher-level knowledge influences processing at a lower level (knowledge of the existence of a particular word might assist the recognition of a string of sounds in a *top-down* way). Opinion continues to be divided as to whether the relationship between the levels is fully *interactive* or whether each level operates with a degree of independence (in a **MODULAR** way). The benefit of the former is that all sources of information become available at once; the benefit of the latter is that rapid decision making is enabled.

The receptive skills of listening and reading entail two distinct operations. In the first, visual or auditory information is *decoded,* a process that entails *mapping* from strings of sounds or letters to known words. The user relies partly upon perceptual evidence but is also influenced by the expectations created by context. Groups of words are parsed into syntactic structures (see PARSING, HUMAN), and a **PROPOSITION** is extracted from the utterance. The second phase, *meaning construction,* requires the user to elaborate on the literal meaning of the utterance by inferring details that have been left unexpressed by the speaker/writer. The user then adds the new information to the *meaning representation* or **MENTAL MODEL** built up so far in the discourse and checks for consistency.

The productive skills of speaking and writing proceed in the opposite direction: from idea to language. An abstract representation of the planned **SENTENCE** is created, and linguistic form is then conferred upon it. While the sentence is being produced, it has to be stored in a mental *buffer*, in the form of a set of instructions to the articulators or the fingers. The user *monitors* performance and self-corrects if necessary. An important difference between most writing events and most speech events lies in the time available for planning, self-monitoring, and review.

Accounts of language processing rely upon constructs from cognitive psychology, such as *attention,* **MEMORY**, and *automaticity*. An important principle is that human **WORKING MEMORY** is limited in capacity. The language user minimizes the demands made upon memory by transferring information into a more permanent store (*long-term memory*) or by establishing highly *automatic* routines for speech assembly or word recognition that do not require focused attention. In addition, **SCHEMA** *theory* helps to explain how a listener/reader enriches a message by the addition of external knowledge and how a speaker/writer is able to abridge a message, relying upon the recipient to fill in missing details.

The methods used to study language processing include observation and verbal report, but an experimental approach tends to predominate. The tasks employed are often small in scale, tapping into *on-line processes*; those that enable the researcher to measure *reaction time* (e.g., time taken to recognize a word) are especially favored. Increasingly, researchers also draw upon findings from brain imaging (see NEUROIMAGING) that map the neurological effects of different types of language activity.

Language Representation

A closely allied area of enquiry considers how linguistic knowledge is stored in the mind in a way that enables rapid matches to be made. Words are said to be stored as *lexical entries*, containing information about the item's orthographical form and pronunciation, **WORD CLASS**, inflections, and combinatorial possibilities. There has been discussion of whether there are separate entries for affixes such as *un-* in the word *unhappy* or whether words of this type have their own entries. Also much discussed has been the question of category membership: how a language user manages to classify an item of crockery as a *cup* rather than a *mug* or *bowl*. The entries in a user's mental lexicon are massively interconnected, enabling a process known as **SPREADING ACTIVATION**, in which it becomes easier to locate (e.g.) the words *nurse, hospital*, or *patient* after recently hearing or seeing the word *doctor*. The connections vary in strength, favoring words of high frequency and words with a high probability of occurring together.

Traditional linguistic accounts assume that syntax is represented in the mind as a set of rules, but recent psycholinguistic

thinking has swung toward the notion that speakers can only produce language as rapidly and accurately as they do if they make extensive use of stored *chunks* of language already assembled syntactically. The human mind appears better adapted for the storage of enormous amounts of information than for rapid processing. **EXEMPLAR THEORY** suggests that linguistic knowledge derives from multiple memory traces of individual language episodes. The attraction of the theory is that it accounts not only for the speaker's ability to retrieve chunks but also for the listener's ability to deal with a range of voices and accents and to recognize the many forms that a single word can take in connected speech. Instead of mapping back to one idealized template for a **PHONEME** or word, the listener draws upon vast numbers of traces laid down by earlier encounters.

Language Acquisition (Developmental Psycholinguistics/ Child Language Development)

Those who adopt a Chomskyan line examine the productions of infants for evidence of universal linguistic principles or of the setting of parameters to incorporate features specific to the target language (see PRINCIPLES AND PARAMETERS THEORY AND LANGUAGE ACQUISITION). Others prefer a data-driven approach that analyzes the speech of the developing child with no pretheoretical assumptions. Some 30 years of research has produced evidence that input to infants (child-directed speech) is more informative than Chomsky once asserted. Developmental patterns have been traced in the child's phonology (**PHONOLOGY, ACQUISITION OF**) and vocabulary (**LEXICAL ACQUISITION**). There has been research into how an infant builds up lexical categories such as "dog" or "flower," *overextending* them in some instances and *underextending* them in others. Issues in **MORPHOLOGY** and syntax include whether there is a fixed order for the acquisition of inflections and how infants manage to derive semantic relationships from cues such as **WORD ORDER**.

It has long been recognized that the timing and rate of language acquisition varies enormously from one child to another. It is customary, therefore, to mark development not by the child's age but by the average number of **MORPHEMES** in a child's utterances, a measure known as *mean length of utterance* (MLU). Gradual increases in MLU reflect changes in the child's cognitive capacity and in its ability to articulate groups of words.

Alongside longitudinal observation in the form of recordings and diaries, language acquisition is also studied experimentally. Children are asked to perform linguistic or perceptual tasks designed, for example, to elicit plural forms or to demonstrate phonological awareness. Methods have also been devised that provide insights into the mental processes of preverbal children by tracking shifts in the direction of their attention (see COMMUNICATION, PRELINGUISTIC). Computer simulation also plays a part. A recent challenge to nativism comes from **CONNECTIONIST** modeling, which has shown, on a limited scale, that a computer program is capable of acquiring language rules by exposure to repeated examples.

Further insights into language acquisition are achieved by studying children who grow up in *exceptional circumstances*. The most extreme cases are those of children who have been deprived of human company through being abandoned in the wild or confined to their rooms for long periods. There are also studies of the course of language development in twins, **BLIND** children, the children of deaf parents, and children acquiring a **PIDGIN** language.

Brain and Language

Interest in the location of language in the brain was stimulated by the discoveries of Broca and Carl Wernicke, which showed that damage to two small areas of the **LEFT HEMISPHERE** was associated with the loss of speech. Later research supported the view that the left hemisphere was the dominant one for language in nearly all right-handers and the majority of left-handers. A number of children who suffered damage or surgical intervention to the left hemisphere before the age of five appeared to relocate their language operations in the right one (see RIGHT HEMISPHERE), an effect that was less evident in adults. From these findings grew a theory that the brain was plastic in the early years of life, and that language became lateralized to the left hemisphere around the age of five. The conclusion was that brain lateralization corresponded to a **CRITICAL PERIOD** for acquiring one's first language.

Views have now changed in the face of evidence that the brain continues to manifest flexibility into adulthood. Research suggests that some areas are more heavily involved than others in particular aspects of language use but that language processing as a whole cannot be localized. It is widely distributed across the brain and supported by massive neural interconnections that enable information to be transmitted extremely rapidly. It has also become apparent that the right hemisphere of the brain has an important role in language, dealing broadly with larger units, such as prosody, discourse structure, and so on.

Neuroscience contributes increasingly to psycholinguistics, with brain-imaging technology enabling researchers to locate and track the electrical impulses or blood flows associated with different types of linguistic behavior.

Language as a Human Faculty

Here, two central concerns dominate. The first is the extent to which language can be regarded as restricted to the human race. Current evidence suggests that it is, though pigmy chimpanzees have shown themselves capable of acquiring large sets of symbols and using them in quite elaborate ways (see ANIMAL COMMUNICATION AND HUMAN LANGUAGE and PRIMATE VOCALIZATIONS). The second issue concerns how and when language first evolved (see ORIGINS OF LANGUAGE). It is suggested that its emergence was dependent both upon the evolution of an appropriate vocal apparatus (see SPEECH ANATOMY, EVOLUTION OF) and upon changes in the human brain. A problematic issue for nativists is to explain how language first entered the human gene pool; a *catastrophic* account has been proposed, in which a sudden change in brain infrastructure coincided with increased communicative demands. A weakness of the theory is that the brain evolves very slowly, whereas language changes quickly. A number of leading commentators have, therefore, concluded that language initially developed in a way that accorded with the processing capabilities of the brain, rather than vice versa, and that the functions of the brain have since adapted to accommodate it through coevolution.

Language Impairment

Psycholinguistics also studies the psychological factors that contribute to *language disorders*. One type of difficulty investigated is *developmental*: It includes problems of speech production, such as stammering, as well as **DISORDERS OF READING AND WRITING,** such as **DYSLEXIA** and *dysgraphia*. Another type is *acquired* as a result of accident, stroke, or surgery and includes **APHASIA**, an impairment of the ability to produce and/or understand speech. Also investigated are the effects of **AGING** upon language. In all of these areas, an important distinction has to be made between loss of language from the mental store and disruption of the processes by which language is accessed.

Besides supporting the work of clinicians and therapists in treating disorders, the study of language impairment feeds back into other areas of psycholinguistics. Firstly, it sheds light on the skills and cognitive processes that are essential to normal language operations but are absent or obstructed in the patients studied. Secondly, it affords possible insights into the process of language acquisition. Research into cases of **SPECIFIC LANGUAGE IMPAIRMENT** (SLI) has sought evidence as to whether language is or is not genetically transmitted. Research into the linguistic competence of sufferers from syndromes such as Down's, Williams, and **AUTISM** has sought evidence as to whether language forms part of general cognition or is independent of it.

Second Language Acquisition (SLA)

As with first language acquisition, there are two distinct branches of inquiry. One group of researchers takes linguistic theory as a point of departure, while the other draws its guiding principles from cognitive psychology. The linguistic group employs models of language (predominantly Chomskyan) on the premise that they correspond to internalized rules in the mind of the user. Their research seeks evidence of the resetting of Chomskyan **PARAMETERS** or compares the components of the second language (L2) grammar with those of a native speaker. Research in this tradition concerns itself with **COMPETENCE,** rather than performance; thus, there is considerable reliance upon **GRAMMATICALITY JUDGMENTS** as a source of evidence.

A more cognitive approach views the ability to perform in a second language as an acquired skill and draws upon cognitive theory relating to problem solving and to the development of *expertise*. On this analysis, language learners begin with *declarative* rule-based knowledge, which gradually becomes *proceduralized*. Separate steps in the process become combined, and access to the rules becomes less and less subject to conscious control and increasingly automatic. Recent thinking in SLA has also been influenced by **EMERGENTISM**, leading to a theory that L2 proficiency derives not from internalized rules but from multiple stored exemplars of linguistic encounters.

Researchers in SLA draw increasingly upon psycholinguistic constructs such as memory, attention, and automaticity when considering the cognitive demands imposed upon the L2 user. Another approach employs psycholinguistic models of language processing as descriptors of skilled L1 behavior and, thus, as targets for those teaching language skills.

There has been extensive psycholinguistic study of **BILINGUALISM**, focusing especially upon how a bilingual's two languages are stored: whether they are kept entirely apart, subserved by a single semantic system, or completely integrated. Other issues concern the extent to which one language influences the use of the other and whether there are cognitive costs and benefits in growing up bilingual.

Language and Thought

The relationship between language and thought was much discussed in the early days of psycholinguistics. Major issues were the extent to which one is dependent upon the other and the extent to which language shapes our perceptions of reality. Developmental studies include accounts by Jean Piaget of the impact of cognitive development upon language acquisition and by Lev Vygotsky of how egocentric speech becomes internalized as thought. There have been attempts by psycholinguists to put the *Sapir-Whorf hypothesis* to the test, especially in the area of **COLOR** terms.

Conclusion

Research is active in all the areas of psycholinguistics that have been profiled. The methodologies employed are diverse and (as noted) include experimentation, observation, elicited response, verbal report, and grammaticality judgments. However, the future direction of research will be greatly influenced by technological advances. The most important recent innovation has been the use of brain imaging to validate psycholinguistic theories about the operations underlying language performance. Researchers are able to identify different types of brain event, distinguishing, for example, one associated with syntactic functions from one associated with semantic. A second development lies in the increased use of eye-tracking equipment – not only to study reading but also to record the way in which a language user's attention is attracted to an object by semantic cues. Computer science also makes a contribution. Psycholinguistics employs computer modeling of linguistic performance, including neural networks that simulate spreading activation, connectionist word-recognition models based upon *competition* between items, and connectionist learning models. It also draws upon ongoing research into artificial intelligence, for example, studies of expertise, artificial speech recognition, or automatic translation.

– John Field

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PSYCHONARRATOLOGY

Definition

This term was first coined by P. Dixon and M. Bortolussi in 2001 in their chapter "Prolegomena for a science of psychonarratology" and developed further by Bortolussi and Dixon in their book *Psychonarratology: Foundations for the Empirical Study of Literary Response* (2003). It designates an interdisciplinary, empirical approach to the study of literary response (see LITERATURE, EMPIRICAL STUDY OF) and the processing of narrative. Generally, as the term suggests, it brings together two very diverse fields: psychology and literary studies. However, while in literary studies *psychology* typically refers to **PSYCHOANALYSIS**, psychonarratology draws on cognitive psychology and discourse processing for its methodology. Within literary studies, it looks to **NARRATOLOGY** for its conceptual and theoretical insights about narrative prose but also draws on related fields, such as reception and reader response theories.

Theoretical Background

The conjoining of cognitive psychology and narratology has two theoretical motivations. On the one hand, literary studies in general, and narratology in particular, seemed to have reached an impasse from which the traditional stock of methods provided no means of escape. Numerous scholars had understood that texts are just collections of letters, words, sentences, and paragraphs, that meanings emerge in the interaction between texts and readers, and that these interactions could be varied and complex. For example, from within the phenomenological tradition, Roman Ingarden conceived of literary texts as schematic structures that needed to be "concretized" or completed by the reader, and W. Iser, following in his footsteps, regarded literary texts as indeterminate objects that elicit gap-filling strategies on the part of the reader. However, without appropriate methodologies for assessing the cognitive processes of real readers, literary scholars were restricted to making intuitive and purely speculative assumptions about the effects of particular aspects of literature on its readers. This gave rise to notions of an *ideal reader*, a timeless, homogenous entity possessing the ideal **COMPETENCE** required to process texts in some ideal fashion. Variants of this ideal entity were expressed through a host of related terms: the model reader, the super reader, and so on. Various branches of literary studies, regardless of their specific goals or scope, inevitably came up against the same roadblock, namely, the need to account for the effect(s) of texts on readers, without the required tools for advancing beyond the purely hypothetical.

On the other hand, empirical research in discourse processing generally neglected to address the processing of complex, real-world narratives and literary narratives in particular. Moreover, to the extent that cognitive psychology has investigated such questions, that research has typically not been informed by the body of scholarship in literary studies on narrative structure and form. Thus, psychonarratology is an attempt to bring the empirical methods and analytical style of cognitive psychology to the problems and domain of narratology.

Psychonarratology builds on previous research in the empirical study of literature, a field first designated by Sigfried Schmidt (1981), who developed some of its theoretical and philosophical foundations. Pioneering empirical work in this effort included research by A. C. Graesser et al. (1999), Willie van Peer and Max Louwerse (2002), D. S. Miall and D, Kuiken (1995), R. J. Gerrig (1992), and D. Vipond and R. A, Hunt (1984). Current research in the general area includes not only psychonarratology but also research on a wide range of other topics, such as genre, emotion, aesthetics and aesthetic appreciation, and film and media, as well as evolutionary and intercultural approaches.

Main Tenets of Psychonarratology

As developed in *Psychonarratology* by Bortolussi and Dixon, four cascading proposals are made for the empirical study of reader response to narratives. The first is a conceptual distinction between textual features and reader constructions that allows a suitable framing of empirical questions. The second is the application of statistical models for conceptualizing the nature of the reader. The third is a preference for the methodology of the *textual experiment*. And the fourth is a hypothesis concerning readers' representation of a *conversational* narrator.

FEATURE/CONSTRUCTION DISTINCTION. Psychonarratology makes a crucial distinction between textual *features*, that is, those properties of the text that can be objectively identified, and reader *constructions*, or the mental **REPRESENTATIONS** of the reader. Features are objective and can, in principle, be reliably identified by trained observers. Ideally, a textual feature could be specified by an explicit algorithm operating on the text. As a minimum, there should be some consensus about an explicit definition of a feature and clear examples. In contrast, constructions are subjective and can vary across readers as a function of specific goals, reading context, expectations, literary experience, and individual reader characteristics. Logical and conceptual analysis is sufficient for understanding the former, but in order to draw inferences about the nature of constructions, one requires empirical evidence on real readers reading. According to the analysis of the authors, many of the difficult controversies in literary studies arise from a failure to carefully distinguish features and constructions and to apply appropriate methodologies to each.

THE NATURE OF THE READER. One of the greatest challenges facing scholars interested in literary reception, regardless of their particular orientation, is the reconciliation of the need to make general claims about readers (such as those entailed by the concept of an ideal reader) with the fact that reader response is seemingly variable and idiosyncratic. In psychonarratology, this resolution is accomplished by applying the statistical concepts of population and measurement distributions, an approach that the authors refer to as the *statistical reader*.

A "population" is a particular group of people about which one hopes to draw interesting conclusions, for example,

undergraduate students in Alberta and California or all graduates of a community college who have taken no more than one literature course. One of the main tenets of psychonarratology is that scientific claims can only be made about a clearly delimited population of readers. However, any given group of readers need not be homogenous and uniform; rather, each group may consist of any number of overlapping subgroups that may or may not differ with respect to interesting aspects of narrative response.

Because populations are potentially heterogeneous, there is no necessity that general statements about reader response apply equally to all individuals. Nevertheless, this does not mean that it is impossible to describe reader response. The solution is to describe measurement distributions. With respect to any given empirical measurement, one can describe the *central tendency* – that is, what the measurements have in common – and the variability – that is, how the measurements vary over individuals. There are standard statistical and analytical techniques for developing these kinds of descriptions, not only for numerical measurements (such as reading time or rating scales) but also for more open-ended responses. The scientific goal is, thus, to generate theories that relate the description of measurement distributions to the observed characteristics of readers and texts.

THE TEXTUAL EXPERIMENT. The textual experiment provides a methodology for understanding the relationship between textual features and reader constructions by systematically varying those textual features. The essence of this approach is to measure reader constructions using, for example, questionnaires and rating scales, and to assess how those constructions vary as a function of the features of the text. When a particular reader construction (e.g., the perceived justification of a character's actions) covaries with a particular textual feature (e.g., the use of free indirect speech style, a mode of representing some of the form of a character's enunciated speech or thought without direct quotation), then one can conclude that the feature causally contributes to the reader construction. An alternative to textual experiments (in which the nature of the text is manipulated) is to assess reader constructions of different texts sampled from extant materials. However, any two sampled texts will differ in a wide range of characteristics. As a consequence, it is difficult to draw causal inferences about which features are related to particular reader constructions. Such inferences are much more sound in a textual experiment in which features are manipulated. In order to apply this method properly, though, it is essential that only a single feature be varied, and that other, potentially causal, features are not inadvertently changed at the same time.

THE CONVERSATIONAL NARRATOR. A theoretical hypothesis that unifies many of the authors' research results is the idea that readers represent the narrator as a conversational participant. This follows from the theoretical advances of B. Bruce and others in narratology in which the narrative is conceptualized as a communicative transaction between a narrator and a narratee. In the psychonarratological version of this idea, readers are hypothesized to develop a mental representation of an individual that could have produced the words of the narrative and, in many circumstances, treat that representation much as they would the representation of a conversational participant. In particular, readers may draw inferences about the nature and mental state of the narrator that are licensed by the assumption that the narrator is rational and cooperative. Such inferences are analogous to the **CONVERSATIONAL IMPLICATURES** of H. Paul Grice and may be referred to as *narratorial implicatures* by extension.

Research Findings of Psychonarratology

Although psychonarratology is intended primarily as a framework in which to develop a scientific understanding of literary response, the extant work provides some evidence for the hypothesis of the conversational narrator. Two examples are briefly described here.

In one study, Dixon and Bortolussi manipulated the narrative technique used in the story "Rope" by Katherine Ann Porter. In this story, virtually all of the narrative consists of an argument between a husband and wife related in free indirect speech. Different versions of the story were created in which the speech of the man or the wife was changed to tagged direct speech. For example, the following passage: *Had he brought the coffee? She had been waiting all day long for coffee. They had forgot it when they ordered at the store the first day* was changed to: *She asked him, "Did you bring the coffee? I've been waiting all day long for coffee. We forgot it when we ordered at the store the first day."* When groups of readers read these different versions, they tended to assume that the gender of the (absent) narrator was the same as the character whose speech was related in the free indirect style. Moreover, that character was seen as more reasonable and rational in his or her arguments. The results were interpreted as demonstrating that the free indirect speech style closely associates a character with the narrator and that the narrator is, by default, assumed to be rational and cooperative, just as a conversational participant would be.

In another study, different versions of the story "The Office" by Alice Monroe were constructed. This story begins with several paragraphs describing the first person narrator's attitudes and sensibilities, prior to any description of the story plot events. In Dixon and Bortolussi's analysis, this material appeared to have a number of narratorial implicatures that might lead readers to make assumptions or inferences regarding the nature of the narrator. Moreover, because readers make such inferences by drawing on their own experiences and knowledge, they may come to see the narrator as more like themselves, in effect identifying with the narrator. When material was added to the story in order to make such inferences unnecessary, readers were less likely to identify with the narrator and less likely to see the narrator as reasonable and justified in his or her actions. These results were seen as supporting the view that readers treat narrators much as they would a conversational participant.

– Marisa Bortolussi and Peter Dixon

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PSYCHOPHYSICS OF SPEECH

The psychophysics of speech describes an interdisciplinary approach to the understanding of **SPEECH PERCEPTION**. The approach considers speech as a complex acoustic signal sharing much in common with other complex perceptual events and posits that, as such, speech may be studied in the broader context of general perceptual, cognitive, and sensorineural systems. This approach is distinguished from those that consider speech to be a special signal processed in a manner distinct from non-speech sounds. The essence of a psychophysical approach is to determine the extent to which speech perception makes use of general cognitive and perceptual processes before postulating mechanisms specialized to the speech signal. Thus, understanding the psychophysics of speech may include the utilization of animal models of auditory behavior and physiology to examine how much of speech perception may be accounted for by general rather than specialized mechanisms, and the relation of speech perception to neural coding at peripheral and central levels of processing.

Psychophysics often connotes bottom-up or peripheral processing, and, in fact, a great deal of research of the psychophysics of speech can be characterized this way. However, the term is perhaps an unfortunate moniker for describing this approach because auditory memory, attention, object recognition, cross-modal processing, learning, plasticity, and development all play important roles in processing complex auditory signals, and these processes relate to speech processing as well. The psychophysics of speech might be more broadly described as an auditory cognitive neuroscience approach to speech perception that considers the richness of the acoustic (and, in fact, cross-modal) perceptual environment, the influence of long-term experience, and the effects of higher-order knowledge and processing.

Adherence to a general cognitive/perceptual account of speech perception has meant that the psychophysical approach to speech perception has played a central role in the theoretical debate about whether speech is perceived in a mode distinct from other acoustic signals. A major contribution of the approach, apart from this theoretical debate, has been its insistence on attention to the precise spectrotemporal characteristics of the speech signal and to the neural mechanisms of **AUDITORY PROCESSING** involved in representing these signals.

An application of the psychophysical approach is observed in the study of phonetic context effects. A great deal of early research in **ACOUSTIC PHONETICS** documented the considerable variability inherent in the acoustics of speech. To summarize this broad literature, there do not appear to be acoustic signatures that uniquely specify **PHONETIC** categories. Thus, listeners are faced with the perceptual challenge of mapping highly variable acoustic signals onto speech in a many-to-one manner. Behavioral studies demonstrate that listeners appear to meet this variability in speech acoustics by perceiving speech in a wholly context-dependent manner. Many studies have reported phonetic context effects in which physically identical acoustic signals are judged by listeners to be different speech sounds as a function of the phonetic context in which they are presented.

Phonetic context effects are ubiquitous in speech perception and have been documented for many speech segments. Of interest in understanding the mechanisms that give rise to such effects, Japanese quail (*Coturnix coturnix japonica*) that were trained to peck a lighted key in response to presentation of /g/ endpoints of a /ga/ to /da/ stimulus series pecked more vigorously to novel ambiguous midseries speech stimuli when they were preceded by /l/. A second set of birds trained to peck in response to /d/ responded more robustly to the same novel stimuli when they were preceded by /r/. The directionality of the effect is the same as for human listeners. The extension of phonetic context effects to a nonhuman species suggests that general auditory processing may assist in accommodating the complex variability present in speech.

To pose the results in a general way, context sounds with higher-frequency acoustic energy (like /l/) shift perception of the following syllable toward the category alternative with greater low-frequency energy, /g/. Thus, contrastive processes by which the auditory system exaggerates change in the acoustic signal may be sufficient to explain phonetic context effects. This conclusion is supported by research demonstrating that adult human listeners shift phonetic categorization responses not only as a function of neighboring speech contexts but also as a function of non-speech tones, chirps, and noises that precede or

follow speech. In the case of human and non-human perception of speech and non-speech contexts, speech perception appears to be relative to and contrastive with the acoustics of context sounds, whether speech or non-speech.

This portfolio of research findings is indicative of a psychophysical approach to speech perception in that it pays careful attention to the spectrotemporal information available to listeners, it makes use of nonhuman animals as a means of examining the generality of the mechanisms available to speech processing, and it examines the extent to which complex non-speech signals may give rise to some of the same patterns of perception as speech. Research relating the context-dependent coding of acoustic signals to neural response (see PHONETICS AND PHONOLOGY, NEUROBIOLOGY OF) adds to the understanding of how phonetic context effects may arise from general characteristics of the perceptual system. The constellation of available results suggests that general perceptual mechanisms play a role in phonetic context effects.

In other domains, the psychophysical approach has contributed to the understanding of auditory representation, auditory learning, and cross-modal processing as they relate to speech processing. There remains much potential for understanding the perceptual, cognitive, and neural underpinnings of speech communication from a general perceptual/cognitive perspective.

– Lori L. Holt

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Q

QUALIA ROLES

Qualia structure is a system of relations that characterizes the semantics of a lexical item or phrase. The notion of qualia structure is derived in part from the Aristotelian theory of explanation (Moravcsik 1975). An important semantic concept within *generative lexicon theory* (GL), qualia roles are the major building blocks for constructing word and phrasal meaning in a language compositionally.

GL (Pustejovsky 1995) is a theory of linguistic semantics, which focuses on the distributed nature of compositionality in natural language. On this view, there are four computational resources available to a lexical item as part of its linguistic encoding: *lexical typing structure*, *argument structure*; *event structure*; and *qualia structure*. There are four possible qualia roles associated with a word:

(a) *Formal*: the basic category distinguishing the meaning of word within a larger domain;

(b) *Constitutive*: the relation between an object and its constituent parts;

(c) *Agentive*: the factors involved in the object's origins or coming into being;

(d) *Telic*: the purpose or function of the object, if there is one.

There are two general points that should be made concerning qualia roles: 1) Every category expresses a qualia structure, and 2) not all lexical items carry a value for each qualia role. The first point is important for the way a generative lexicon provides a uniform semantic representation compositionally from all elements of a phrase. The second point allows us to view qualia as applicable or specifiable relative to particular semantic classes.

In effect, the qualia structure of a noun determines its meaning in much the same way as the typing of arguments to a verb determines its meaning. The elements that make up a qualia structure include such familiar notions as container, space, surface, figure, or artifact. One way to model the qualia structure is as a set of constraints on types (cf. Copestake and Briscoe 1992; Pustejovsky and Boguraev 1993). The operations in the compositional semantics make reference to the types within this system. The qualia structure, along with the other representational devices (event structure and argument structure), can be seen as providing the building blocks for possible object types.

Consider, for example, the qualia structure for the nouns *beer* and *sandwich*, with formal (F), agentive (A), telic (T), and constitutive (C):

a. **beer**. x:[F = liquid A = brew T = drink]

b. **sandwich**. x:[F = physical A = make T = eat C = bread,...]

From qualia structures such as these, it now becomes clear how a sentence such as "Mary enjoyed her sandwich" receives the default interpretation it does, namely, that of Mary enjoying eating the sandwich. Similarly, for "Mary finished her beer," the composition of the event-selecting aspectual verb *finish* and its object involves a rule that retrieves a possible event interpretation of "drinking the beer." These are examples of type coercion, where the compositional rules in the grammar make reference to values such as qualia structure, if such interpretations are to be constructed on-line and dynamically.

The qualia structure of verbs characterizes the general role of the subpredicates of a verb's event structure (as in Dowty 1979). It also interacts with the aspectual category of the predicate. For example, *run* and *bake* are process verbs, where the process predicate is assigned to the agentive role, as in "John ran" and "Mary baked the potato."

a. **run(x)** P:[A = run_act(x)]

b. **bake(x)** P:[A = bake_act(x)]

They can both, however, be coerced to accomplishments (transitions) by specifying a termination predicate, assigned to the formal role (cf. Pustejovsky 1995), for example, "John ran to the store," "Mary baked a cake."

Recently, researchers in computational linguistics and lexicography have adopted the notion of qualia roles as one organizing principle in the process of building resources for lexical knowledge bases.

– James Pustejovsky

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QUANTIFICATION

Quantification has been a central concern in **LOGIC AND LANGUAGE** at least since Aristotle, who systematized all valid and invalid syllogisms involving the forms *All/ some/ no/ not all A's are B's* (see Kneale and Kneale 1962). In linguistics, quantificational phenomena played a role in upsetting the architecture of "standard" **TRANSFORMATIONAL GRAMMAR** (Chomsky 1965) in which deep structure determines semantic interpretation. Many transformations that were meaning-preserving on sentences involving referential terms were not so when applied to quantifiers:

(1) John wanted [John win] ⇒ John wanted to win

(2) Everyone wanted [everyone win] ⇒ (?) Everyone wanted to win

The semantic inappropriateness of derivations such as (2) helped to ignite the so-called linguistic wars (Newmeyer 1980).

Quantification and the Syntax-Semantics Interface

Quantification raises issues for the syntax-semantics interface concerning scope **AMBIGUITY**, **BINDING**, and **ANAPHORA**. Theories differ sharply in the treatment of scope-ambiguous sentences like (3), which challenge the otherwise plausible assumption that every ambiguity involves a lexical ambiguity or an ambiguity of syntactic structure; (3) on the face of it has neither.

(3) At least two students read every book.
  i. Wider scope for *at least two*: There are at least two who read the whole lot.
  ii. Wider scope for *every*: Every book got at least two readings.

The problem illustrated in *transformation* (2) is a problem of binding and anaphora. It was soon recognized that pronouns and *null* anaphors whose antecedent is a quantifier behave like logical variables, as in (4), and not like "repetitions" of the antecedent noun phrase (NP).

(4) Everyone wanted (Ø) to win: For every person x, x wanted [x win]

The same phenomenon appears in (5a) and (5b).

(5) a. John rescued himself = John rescued John
  b. Someone rescued himself = For some x, x rescued x ≠ Someone rescued someone

Thus, whereas anaphora with referential antecedents may involve *coreference*, anaphora with quantificational antecedents involves *binding*; anaphora and binding remain a major topic in syntax and semantics.

The Semantics of Quantification

The rise of **FORMAL SEMANTICS** brought investigations into the model-theoretic semantics of NPs and determiners. In **MONTAGUE GRAMMAR**, all English NPs, even proper names, are *generalized quantifiers* (Montague 1973), denoting sets of properties of individuals. This uniform treatment launched the study of the semantic properties of NPs and determiners (Barwise and Cooper 1981; Keenan and Stavi 1986), leading to progress on semantic universals of determiner meanings (see SEMANTICS, UNIVERSALS OF), the semantics of existential sentences and "weak" NPs (those that can occur in existential sentences: *a, some, three, no, many*, but not *the, every, both, most*), the semantics of determiners like *any* that can occur in negative and certain other contexts but not in simple affirmative sentences (the *negative polarity* phenomenon), and other topics in quantification.

In the early 1980s, Irene Heim ([1982] 1989) and Hans Kamp (1981) independently argued against Richard Montague's uniform treatment of NPs, distinguishing *definite* and *indefinite NPs* (with determiners such as *a, the, three, the three, some, several*) from *essentially quantificational NPs* (*every, all, most*). On their approaches, an indefinite introduces a *discourse referent* into the context, bringing context into semantics proper (see SEMANTICS-PRAGMATICS INTERACTION); only the essentially quantificational NPs are treated as generalized quantifiers. Barbara H. Partee (1986) reconciled Montague's uniform semantics with the Kamp-Heim theory through type-shifting mechanisms such that all NPs *can* have generalized quantifier-type meanings, but many NPs have referential and/or predicative meanings as well. *The king*, for instance, may have a quantificational meaning (roughly, "whoever is the one and only king," with no presuppositions), a referential meaning (referring to the unique king if there is one, failing to refer if existence and uniqueness presuppositions are not satisfied), or a predicative meaning in *is the king*, asserting of its subject that he is the one and only king.

Other topics in the semantics of quantification include the semantics of distributive, collective, and cumulative quantification; the semantics of the mass-count distinction; event quantification and tense logic; generic sentences; implicit quantification; and the binding of implicit variables. There is also active research on children's acquisition and adult processing of the syntax and semantics of quantification.

Logicians have continued to make progress on the logic of quantification, including work in game-theoretical semantics (Hintikka and Sandu 1997; Clark 2007), where the foundations of

notions of scope, variable binding, and variable dependence are being reexamined.

Typology of Quantification

Jon Barwise and Robin Cooper (1981) hypothesized that all languages use NPs interpreted as generalized quantifiers. Research reported in Bach et al. (1995) identified several languages that falsify that hypothesis. Other ways of expressing quantification include *adverbs of quantification* like *usually, mostly* (Lewis 1975), adjectives (*numerous,* Russian *mnogie* "many"), nouns (*majority, lot, dozen*), and verbal prefixes (Evans 1995).

Cross-linguistic studies show that languages differ with respect to syntactic positions and strategies for expressing different quantificational notions (Szabolcsi 1997), with respect to the degree to which surface structure constrains semantic quantifier scope, with respect to the range of meanings a "bare NP" like *horses* can have, in the variety and interpretation of indefinites (Haspelmath 1997; Chung and Ladusaw 2003), in interactions between nominal quantification and verbal aspect, and in other ways that are still being explored.

– Barbara H. Partee

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QUANTITATIVE LINGUISTICS

While the formal branches of linguistics use the qualitative mathematical means (algebra, set theory) and logics to model structural properties of language, quantitative linguistics (QL) studies the multitude of quantitative properties as the essential basis for the description and understanding of the development and functioning of linguistic systems and their components. The objects of QL research do not differ from those of other linguistic disciplines. The difference lies, rather, in the ontological points of view (do we consider a language as a set of **SENTENCES** with their structures assigned to them, or do we see it as a system that is subject to evolutionary processes in analogy to biological organisms, etc.) and, consequently, in the concepts that form the basis of the disciplines.

Differences of this kind enable researchers to perceive new phenomena in their area of study. A linguist accustomed to thinking in terms of set theoretical constructs is not likely to find the study of such properties as length, frequency, age, degree of polysemy, and so on interesting or even necessary. *Zipf's Law* is the only quantitative relation that almost every linguist has heard about, but for those who are not familiar with QL, it appears to be a curiosity more than a central linguistic law, which is connected with a large number of properties and processes in language. From a quantitative point of view, however, it is quite natural to detect features and interrelations that can be expressed only by numbers. There are, for example, dependences of length (or complexity) of **SYNTACTIC** constructions on their frequency and on their **AMBIGUITY**; of homonymy of grammatical **MORPHEMES** on their dispersion in their paradigm; and of the length of expressions on their age, the dynamics of the flow of information in a text on its size, the probability of change of a sound on its articulatory difficulty, and so on. In short, in every field and on each level of linguistic analysis, phenomena of this kind are significant. They are observed in every language in the world and at all times. Moreover, it can be shown that these properties of linguistic elements and their interrelations abide by universal **LAWS OF LANGUAGE**, which can be formulated in a strict mathematical way – in analogy to the laws of the natural sciences. Emphasis has to be put on the fact that these laws are stochastic; they do not capture single cases (this would be neither expected nor possible) but, rather,

predict the probabilities of certain events or certain conditions in a whole. It is easy to find counterexamples with respect to any of the examples cited above. However, this does not mean that they contradict the corresponding laws. Divergences from a statistical average are not only admissible but even lawful – they are themselves determined with quantitative exactness. This situation is, in principle, not different from that in the natural sciences, where the old deterministic ideas have been replaced by modern statistical/probabilistic models.

The role of QL is to unveil corresponding phenomena, to systematically describe them, and to find and formulate the laws that explain the observed and described facts. Quantitative interrelations have an enormous value for fundamental research and can also be used and applied in many fields, such as **COMPUTATIONAL LINGUISTICS** and natural language processing, **TEACHING LANGUAGE**, optimization of texts, and so on.

Historical Background

The first scientific counts of units of language or text were published in the nineteenth century. The first theoretical insight, after many years of merely descriptive counts of various kinds, was offered by the Russian mathematician A. A. Markov, who created the base of the theory of Markov chains in 1913. This mathematical model of the sequential (syntagmatic) dependence among units in linear concatenation in the form of transition probabilities was – despite its mathematical significance – of only little use for linguistics. In modern natural language processing, however, (hidden) Markov models are a central component of many methods in language technology.

Later, quantitative studies of linguistic material were, in the first place, a consequence of practical demands: Efforts to improve second language training (see BILINGUAL EDUCATION) and optimization of stenographic systems are examples. The unveiled interrelations between frequency of **WORDS** and the ranks of the frequency class (alternatively: between frequency and the number of words in the given frequency class) were systematically investigated by the aforementioned George Kingsley Zipf. He was the first to set up a model in order to explain the observations and to find a mathematical formula for the corresponding function – the famous Zipf's Law. Among his publications, his books ([1935] 1968 and 1949) are considered the most important. Zipf formulated (in different terms) innovative thoughts on self-organization, the principle of language economy, and fundamental properties of linguistic laws long before modern systems theory arose. His ideas, such as the "principle of least effort" and the "forces of unification and diversification," are still important today (even if they suffer from certain shortcomings). Later, his model was conceptually and mathematically improved by Benoît Mandelbrot (cf. Rapoport 1982), the originator of fractal geometry. Zipf's body of thought inspired various scientific disciplines and enjoys increasing exposure again.

C. E. Shannon and W. Weaver (1949) applied information theory to linguistics without much success. Physicist Wilhelm Fucks (1955) was responsible for a turn toward theoretical considerations in German QL. He studied, among others, word-length distributions and various phenomena of language, literature, and music. In France, Charles Muller (1973, 1979) created a novel approach for studying the vocabulary of a text. In Russia, Zipfian linguistics was conducted in particular by Michail V. Arapov (Arapov 1988; Arapov and Cherc 1974), who based his models of text dynamics and of language development on the analysis of rank order. In Georgia, a group around Jurij K. Orlov established a tradition of studies into the statistical structure of texts based on the Zipf-Mandelbrot Law. The Estonian researcher Juhan Tuldava (1995, 1998) is famous for his mathematical methods of analysis of numerous text phenomena.

Objectives and Methods

The fact that language cannot adequately be analyzed without quantitative methods follows from a number of principal considerations (cf. also Altmann and Lehfeldt 1980, 1 ff).

EPISTEMOLOGICAL REASONS. The possibilities of deriving statements about language(s) are seriously limited. Direct observation of language is impossible. Introspection cannot provide more than heuristic contributions and does not possess the status of empirical evidence (even if the contrary is often claimed in linguistics). As a source of scientific data, only linguistic behavior is available – in the form of oral or written **TEXT**, in the form of **PSYCHOLINGUISTIC** experiments, and so on.

Furthermore, the situation is aggravated by the fact that we never dispose of complete information on the object under study. On the one hand, only a limited part or aspect of the object is accessible (because it is principally infinite, such as the set of all texts or all sentences, or because it cannot be described in full for practical reasons). On the other hand, very often we lack the complete information about the number and kinds of all factors that might be relevant for a given problem and are, therefore, unable to give a full description.

Only mathematical statistics enables us to find valid conclusions in spite of incomplete information and, indeed, with objective, arbitrary reliability.

HEURISTIC REASONS. One of the most elementary tasks of any science is to create some order within the mass of manifold, diverse, and unmanageable data. Classification and correlation methods can give indications to phenomena and interrelations not known before. A typical example of a domain where such inductive methods are very common is **CORPUS LINGUISTICS**, where huge amounts of linguistic data are collected and could not even be inspected with the bare eye.

METHODOLOGICAL REASONS. Any science begins with categorical, qualitative concepts, which divide the field of interest into delimited classes as clearly as possible. A linguistic example of this kind of concept is the classical category *parts of speech* (see WORD CLASSES). It is possible to decide whether a word should be considered as, for example, a noun or not. Every statement based on categories can be reduced to dichotomies (having exactly two values, such as {true, false}, {1, 0}, {yes, no}). This kind of concept is fundamental and indispensable but insufficient for a deeper insight.

The possibility of gradual statements is provided by comparative (ordinal-scale) concepts. They allow us to determine that an object possesses more or less of a given property than another one or the same amount of it. A linguistic example is the grammatical acceptability of sentences.

The highest degree of order is achieved with the help of metrical concepts, which are needed if the difference between the amounts of a given property possessed by two objects plays a role. In this case, the values of the property are mapped to the elements of a set of numbers in which the relations between these numbers correspond to the relations between the values of the properties of the objects. In this way, specific operations, such as subtraction, correspond to specific differences or distances in the properties between the objects. This enables the researcher to establish an arbitrarily fine conceptual grid within his or her field of study. Concepts of this kind are called interval-scale concepts. If a fixed point of reference is added (e.g., zero), ratio-scaled concepts are obtained that allow the operation of multiplication and division. Only the latter scale enables a formulation of how many times object A has more than B of a property.

The Objectives of Quantitative Linguistics

In contrast to other branches of linguistics, QL emphasizes the introduction and application of additional, advanced scientific tools. Principally, linguistics tries, in the same way as other empirical sciences do in their fields, to find explanations for the properties, mechanisms, functions, development, and so on of language(s). Due to the stochastic properties of language, quantification and probabilistic models play a crucial role in this process. In the framework of this general aim, QL has a special status only because it makes special efforts to care for the methods necessary for this purpose. We can characterize this endeavor by two complementary aspects:

1. On the one hand, the development and application of quantitative models and methods are indispensable in all cases where purely formal (algebraic, set-theoretical, and logical) methods fail, that is, where the variability and **VAGUENESS** of natural languages (see LANGUAGE, NATURAL AND SYMBOLIC) cannot be neglected, where gradual changes debar the application of static/structural models. Briefly, quantitative approaches must be applied whenever the dramatic simplification caused by the qualitative yes/no scale is inappropriate for a given investigation.

2. On the other hand, quantitative concepts and methods are superior to the qualitative ones on principled grounds. The quantitative ones enable a more adequate description of reality by providing an arbitrarily fine resolution. Between the two extreme poles *yes/no, true/false, 1/0*, as many grades as are needed can be distinguished up to the infinitely many "grades" of the continuum.

Generally speaking, the development of quantitative methods aims at improving the exactness and precision of the possible statements on the properties of linguistic and textual objects. They help us derive new insights that would not be possible without them: Subjective criteria can be made objective and operationalized (e.g., in **STYLISTICS**); interrelations between units and properties can be detected, remaining invisible to qualitative methods; and workable methods for technical and other fields of application can be found where traditional linguistic methods fail or produce inappropriate results due to the stochastic properties of the data or to the sheer mass of them (e.g., in natural language processing).

– Reinhard Köhler and Gabriel Altmann

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R

RADICAL INTERPRETATION

Radical interpretation is one of the central concepts in the work of the American philosopher Donald Davidson (1917–2003). For Davidson, to interpret speakers means to understand their linguistic utterances (cf. [1975] 1984, 157), to assign meanings to their words and, in a slightly extended usage, assign contents to their propositional attitudes. Radical interpretation takes place in a specific scenario in which a person encounters the speakers of a completely unknown language *L*. The radical interpreter has the task of devising a formal semantic theory (see SEMANTICS) for *L* on the basis of data of a very specific kind: His or her evidence consists entirely of (all available) data about the linguistic and nonlinguistic behavior of the speakers of *L* in its observable circumstances. According to Davidson's method, radically interpreting a language automatically includes systematic ascriptions of belief to its speakers.

Background

The basic scenario of a "field linguist" trying to understand a radically foreign language *L* on the basis of purely behavioral data is introduced in W. V. O. Quine's seminal work *Word and Object* (1960). Here, the task is to construe a translation manual for *L,* and Quine uses radical translation to "consider how much

of language can be made sense of in terms of its stimulus conditions, and what scope this leaves for empirically unconditioned variation in one's conceptual scheme" (Quine 1960, 26). Among other things, he uses radical translation to argue for the **INDETERMINACY OF TRANSLATION**. This is the claim that on the basis of the evidence available in radical translation, different but equally correct translation manuals can be set up between two languages L_1 and L_2, manuals diverging in a number of places by translating a sentence of L_1 into sentences of L_2 "which stand to each other in no plausible sort of equivalence however loose" (p. 27). Davidson subscribes to indeterminacy for analogous reasons, even though in a more limited form (cf. Davidson [1973] 1984, [1974] 1984).

The radical interpretation scenario derives its significance for the theory of meaning, both in Quine and in Davidson, from the foundational claim that meaning is entirely determined by observable behavior (cf. Quine 1960, ix; Davidson 2005, 56). According to this weak semantic behaviorism, the data available in radical interpretation are the data ultimately and entirely determining the meanings of the expressions of the language interpreted. In contrast to Quine, this determination remains nonreductive to Davidson, but it is nevertheless both epistemic and metaphysical in nature: The data available in radical interpretation are not only the ultimate evidence on the basis of which meanings can be known; they are what (metaphysically) determines or constitutes linguistic meaning. According to Davidson, this is an individualistic affair not essentially involving social convention or a shared language; even though there cannot be such a thing as a solitary speaker, one who never had contact with other speakers, what a speaker means by his or her words on an occasion of utterance is determined solely by his or per own (dispositions to) behavior (cf. [1975] 1984, [1982] 1984, [1992] 2001).

According to semantic behaviorism, meaning is determined on a nonsemantic basis by data that can be described without using semantic concepts, such as meaning or propositional content. Davidson motivates his particular version of semantic behaviorism partly by appeal to the essential publicness of language: "The semantic features of language are public features. What no one can, in the nature of the case, figure out from the totality of the relevant evidence cannot be part of meaning" ([1973] 1984, 135). According to Davidson, the relevant evidence is evidence "plainly available to an observer unaided by instruments" (1994, 127). This restriction on the evidence stems from the claim that terms like *meaning* and *language* are theoretical terms deriving their significance from occasions of successful linguistic communication (which do not, typically, involve the use of any instruments).

Davidson thus transforms the basic question of the philosophical theory of meaning, the question "What is it for words to mean what they do?" (1984, xiii), into two others: Given that we can interpret the linguistic utterances of a speaker, "what could we know that would enable us to do this? How could we come to know it?" ([1973] 1984, 125). Radical interpretation addresses the second of these questions and is supposed to show that there is a method by which we can know meaning on the basis of the nonsemantic evidence that, according to Davidson, determines it (cf. 1994, 127).

Task, Method, and Procedure

Davidson's answer to the first question, the question of what we could know that would allow us to interpret a language, is an Alfred Tarski–style theory of truth (*T-theory*). Such a theory, Davidson argues, can be used as a formal semantic theory for a natural language *L* ([1967] 1984). He is one of the main advocates of **TRUTH CONDITIONAL SEMANTICS**, and a correct T-theory *T* for *L* compositionally specifies the meanings of the sentences of *L*: For every sentence *S* of *L*, a T-sentence specifying its truth conditions can be derived from the axioms and rules of *T*. For instance, a correct T-theory for German would allow derivation of the following T-sentence from the axioms for the simple expressions *Schnee* and *ist weiss*:

(S) *Schnee ist weiss* is true-in-German if and only if snow is white.

T-theories can be constructed for significant parts of natural language (for a list of problems such as belief sentences or counterfactuals, see Davidson [1973] 1984, 132). They are supposed to theoretically model semantic competence, but need not be objects of knowledge for the speakers in any psychologically realistic sense.

According to Davidson, the radical interpreter can devise a T-theory for an unknown language *L* in two steps. On the basis of their behavior, the interpreter can determine the sentences of *L* that the speakers *hold true* in particular circumstances. This amounts to detecting a propositional attitude: Holding a sentence true is having a *belief*, but so long as the sentence held true remains uninterpreted, no meaning-theoretical question is begged. In the second step, the radical interpreter uses data about the circumstances under which speakers hold sentences true to determine their truth conditions.

Holding a sentence true, however, is a product of two factors: what the sentence means and what the speaker believes to be the case (cf. Davidson [1973] 1984, 134). Assigning a meaning to a sentence held true is ascribing a belief to the speaker. Because of this "interdependence of belief and meaning" (p. 134), the ascription of belief needs to be restricted in relevant ways if there is to be any evidence relation between holding true and T-theory; so long as there is no such restriction, so long, that is, as beliefs can be as absurd as the interpreter pleases, any meaning can be assigned to any sentence. To establish such an evidence relation is one of the main functions of the principle of charity (see CHARITY, PRINCIPLE OF) (cf. Glüer 2006, 340). It tells the radical interpreter to assign truth conditions to the sentences of *L* such that the speakers of *L* have true and coherent beliefs so far as that is plausibly possible. Since this can be done only according to the interpreter's own view of what is true, application of charity amounts to **AGREEMENT MAXIMIZATION** or, as Davidson prefers, agreement optimization between speaker and interpreter. The idea here is that some mistakes are more destructive for understanding than others; an interpretation that avoids ascribing flagrant logical errors or very basic, inexplicable perceptual mistakes is prima facie better than one that does not. Ultimately, charity tells the interpreter to pick that T-theory that stands in the relation of "best fit" (Davidson [1973] 1984, 136) to the totality of his or her data. In this way, the principle of charity fulfills its second main function: It allows for a *ranking* of T-theories in terms of how well they fit the totality

of the data, a ranking such that the best theory is the correct one (cf. Glüer 2006, 342). This amounts to a form of semantic holism; the principle of charity determines all the meanings of the expressions of *L* together, and on the basis of the totality of the evidence (cf. Pagin 1997, 13, 18). **INDETERMINACY,** then, is the claim that there can be more than one "best" T-theory for any given natural language *L*.

Davidson provides what he calls a "crude outline" ([1973] 1984, 136) for the process of devising a T-theory on the basis of data about holding true attitudes. It has three steps: First, the **LOGICAL FORM** of the sentences of *L* is determined. Use of a T-theory as a formal semantic theory requires paraphrasing the expressions of L in the language of first-order quantified **LOGIC** (plus identity). The relevant evidence for this first step consists of sentences that are held true (or false) under all circumstances (candidates for logical truth or falsity) and of patterns of inference, that is, sentences held true on the basis of other sentences held true.

The second step focuses mainly on sentences containing **INDEXICALS**, expressions whose interpretation depends on features of the context, such as "I" or "here." Take the sentence "It is raining" or its German equivalent *Es regnet*. Their truth value varies with easily observable circumstances in the environment of the speaker. The idea (according to Davidson [1973] 1984, 135) is to take data of the form

(E) Kurt belongs to the German speech community and Kurt holds true *Es regnet* on Saturday at noon and it is raining near Kurt on Saturday at noon as evidence for a T-sentence of the form

(R) *Es regnet* is true-in-German when spoken by *x* at time *t* if and only if it is raining near *x* at *t*.

Together, these two steps significantly limit the possibilities for interpreting the predicates of *L*. The third step deals with the remaining sentences of *L*.

Questions and Criticism

Over the years, there has been extensive discussion of radical interpretation and the underlying Davidsonian philosophy of language. Davidson's views on meaning determination have been criticized as verificationist (see also VERIFIABILITY CRITERION) or idealist, charges he was keen on refuting. His semantic individualism and holism have been issues of debate. With respect to the principle of charity, such questions as whether it overrationalizes empirical speakers or illegitimately imposes our logic on alien speakers have been raised. The most important philosophical issues here concern the epistemic and metaphysical status of the principle, and the questions of whether and how it can be justified. Whether radical interpretation is possible, what kind of argument is required for its possibility, and the precise role it plays in Davidson's philosophy of language, as well as its wider significance, are topics on which there is no general consensus among the commentators. Today, many philosophers of mind and language are of the opinion that the basic semantic behaviorism characterizing both Davidson's and Quine's philosophy of language has been superseded by the (social and physical) **MEANING EXTERNALIM** currently dominating the theory of meaning and content. However, foundational issues such as these remain insufficiently explored; because of the role the shared environment plays in radical interpretation, Davidson thought of himself as a social and physical externalist, though clearly not of the mainstream kind (cf. 2001). So long as a systematic comparison of these competing accounts of meaning determination is lacking, it remains premature to simply write off semantic behaviorism; prima facie, it is not even clear that Davidsonian semantic behaviorism and mainstream (physical) externalism are incompatible.

– Kathrin Glüer

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READING

Reading is the process of decoding and comprehending written language. Decoding, the conversion of written forms into linguistic messages, is central to this definition to the extent that the comprehension of written language shares its features with the comprehension of spoken language.

Reading connects printed information conveyed in a **WRITING SYSTEM** with the reader's knowledge of the language encoded by that system. Writing systems vary in their mapping principles, in their implementation in a particular language (the orthography), and in their visual appearance (the script). Alphabetic writing systems map graphic units to **PHONEMES**. Syllabary systems,

represented by Japanese Kana, map graphic units to spoken language syllables. Chinese is usually classified as logographic because its graphic units (characters) correspond primarily to **MORPHEMES**. However, the fact that characters have components that provide syllable-level pronunciation information justifies an alternative designation of morpho-syllabic (DeFrancis 1989).

Written Word Identification

Visual processing of a letter string results in the activation of the *grapheme units* (individual and multiple letters) of words. In representational (or symbolic) models of reading, words are represented in the reader's mental *lexicon*. Successful word reading is a match between the graphic input and the corresponding word representation. *Phonological units* are also activated and play an important role in securing identification.

In *dual route models* of reading, identification occurs along two pathways, a direct route to the word identity and an indirect route through phonological units (Coltheart et al. 1993). The direct pathway must be used for "exception words" (e.g., *iron)* for which an indirect phonological route would fail and may also function for any word that becomes highly familiar. The phonological route must be used to read pseudowords (e.g., *nufe*) for which there is no lexical representation and may be used for words with regular grapheme-to-phoneme patterns. Single-route **CONNECTIONIST MODELS** simulate these two pathways with a single mechanism that learns how to read letter strings on the basis of experience (Plaut et al. 1996). Alternative models use dynamic resonance mechanisms to capture interactions between existing states and new inputs (Van Orden and Goldinger 1994). In a resonance model, the patterns of graphic-phonological activation stabilize more rapidly than do patterns of graphic-**SEMANTIC** activation, simulating a word-identification process that brings rapid convergence of orthography and phonology, with meaning slower to exert an influence.

In studies of nonalphabetic reading, research has overturned the idea that reading Chinese involves only meaning and not phonology (Perfetti, Liu, and Tan 2005). Even when single-character words are read silently for meaning, the pronunciation of the character appears to be activated. This role of phonology, where the writing system does not require it, may reflect a universal phonological principle (see PHONOLOGY, UNIVERSALS OF*)* that is grounded in spoken language. Nevertheless, **NEUROIMAGING** studies of the brain's implementation of word reading show differences as well as similarities between alphabetic and nonalphabetic reading (Siok et al. 2004; see also WRITING AND READING, NEUROBIOLOGY OF). It is interesting to note that English-speaking adults learning to read Chinese show brain activation patterns that partly overlap those shown by native Chinese speakers, suggesting that properties of the writing system recruit specific brain areas (Perfetti et al. 2007).

Individuals with word-identification problems are said to have a specific reading disability, or **DYSLEXIA,** provided they also show a discrepancy between reading and achievements in other domains. However, the processes that go wrong in a specific disability may not be much different from those that go wrong for an individual who also has a problem in some other area (Stanovich and Siegel 1994).

Dual route models allow two different sources of word-reading difficulties: Either the direct route or the indirect phonological route can be impaired (Coltheart et al. 1993). Surface dyslexics have trouble with exception words, explained as selective damage to the direct route. Phonological dyslexics have trouble with regular words and pseudowords, explained by selective damage to the indirect phonological route. A different view from single mechanism models is that only phonological dyslexia is the result of a processing defect. Surface, or orthographic, dyslexia is a delay in the acquisition of word-specific knowledge (Harm and Seidenberg 1999), which comes through experience.

Reading Comprehension

Reading comprehension shares linguistic and cognitive processes with spoken language and correlates highly with it among adults (Gernsbacher 1990). Because this correlation is based on the use of equivalent texts across listening and reading, it may miss the differences between ordinary spoken language and typical written texts that arise from their divergent syntactic structures, lexicons, and other aspect of their different registers. While reading comprehension strongly depends on listening comprehension, reading and speech each place specific demands on comprehension processes**.**

Reading comprehension processes begin with word identification and include context-relevant selection of **WORD MEANINGS** and parsing (see PARSING [HUMAN]), the basic process of extracting grammatical relations among words in a **SENTENCE**. Beyond these word- and sentence-level basics, higher-level comprehension involves readers' constructions of **MENTAL MODELS** of text information. One mental model is based closely on the language of the text, and another, the situation model, reflects what the text is about (van Dijk and Kintsch 1983). The reader builds a situation model from the linguistically based model (the text base) by combining knowledge sources through additional inference processes. A situation model may contain nonlinguistic representations, including spatial imagery (Glenberg, Kruley, and Langston 1994) and the temporal organization of events (Zwaan 1996), among others. Reading multiple texts that refer to the same situation challenges the construction of a single situation model (Perfetti, Rouet, and Britt 1999) and requires additional comprehension skills in document use and evaluation (Rouet 2006).

Because texts are never fully explicit, comprehension research has had an enduring interest in inferences. Inferences that link **ANAPHORA** (e.g., pronouns) with their antecedents to establish coreference are a routine part of comprehension. The extent of elaborative and predictive inferences (Graesser, Singer, and Trabasso 1994) is more in doubt (McKoon and Ratcliff 1992). For example, the sentence "The American tour group went to London for its annual holiday" may evoke an inference that the group traveled by airplane, but whether a reader actually makes this inference appears to be highly variable. Inferences about cause–effect relations may be more likely than other kinds of elaborative inferences (Trabasso and Suh 1993).

Comprehension skill is highly variable. Some children appear to have a comprehension-specific problem (i.e., without

a decoding problem) that is general across reading and spoken language (Nation and Snowling 1999; see also DISORDERS OF READING AND WRITING). The potential causes for comprehension problems include failures to make inferences during reading (Oakhill and Garnham 1988) and limitations in **WORKING MEMORY** functions, among other factors (Nation 2005). Unstable knowledge of word form and meaning (low *lexical quality*) also contributes substantially to comprehension problems (Perfetti and Hart 2001).

Learning to Read

In an alphabetic writing system, a child learns that letters and strings of letters correspond to speech segments. For English, this process is complicated by inconsistent orthography at the letter-phoneme level, for example, the contrasts between *choir* and *chore* and *head* and *bead*. Most European languages tend to be coded by orthographies that more consistently map graphemes to phonemes, and learning to read reflects this fact; for example, children's errors reflect letter-to-phoneme decoding procedures more than in English (Wimmer and Goswami 1994; see also CHILDREN'S GRAMMATICAL ERRORS).

Important for the alphabetic principle is phonemic awareness (see PHONOLOGICAL AWARENESS), the explicit understanding that the speech stream can be segmented into a set of meaningless units (phonemes). Children's phonemic awareness correlates with early reading success, and phoneme segmentation instruction produces gains in reading. However, alphabetic **LITERACY** experience itself affects awareness of phonemes, as shown by studies of adults without exposure to alphabetic writing (Morais et al. 1979) and of Chinese who learned to read prior to the introduction of the alphabetic Pinyin system (Read et al. 1986) as well as by longitudinal results that show a bidirectional relation between phonological sensitivity and literacy (Perfetti 1992).

Theories of learning to read have usually referred to a series of stages (Ehri 1991, 2005; Frith 1985; Gough and Hillinger 1980). Alternative theoretical accounts emphasize the incremental acquisition of decodable lexical representations and the role of phonology to establish word-specific orthographic representations (Perfetti 1992; Share 1995; see also WRITING AND READING, ACQUISITION OF).

– Charles Perfetti

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REALIZATION STRUCTURE

This term was coined by Keith Oatley (2002) to indicate how one experiences a piece of literature. One does not just receive or interpret it but realizes it, bringing it into being. The idea that fiction involves such a realization or mental performance of the piece by the reader or audience member was discussed in philosophy by Wolfgang Iser (1974) and in psychology by Richard J. Gerrig (1993). Russian Formalists proposed that a literary work has aspects of *fabula* and *siuzhet*, often translated as "story" and "plot." The *fabula* is a story structure: time-ordered events in the story world. William Brewer and Ed Lichtenstein (1981) suggested that the *siuzhet* may best be called the *discourse structure*: the ordered set of **SPEECH-ACTS** of the writer to the general reader or listener to prompt the story mentally into being. Oatley suggested that two further aspects are necessary: One is the **SUGGESTION STRUCTURE**, the associations set off by the story idiosyncratically in individuals. The other is the realization structure, the complete mental performance as realized in the mind of the reader or audience member. The matter was well put by Virginia Woolf (1957, 174):

> Jane Austen is thus a mistress of much deeper emotion than appears upon the surface. She stimulates us to supply what is not there. What she offers is, apparently, a trifle, yet is composed of something that expands in the reader's mind and endows with the most enduring form of life scenes which are outwardly trivial.

The relationship among the four aspects of a piece of literary prose or poetry can be illustrated by the diagram in Figure 1 (from Oatley 2002, 45). The implication of the layout of the diagram is that the *event structure* starts off a story, usually by means of a setting, that the discourse structure and suggestion structure occur simultaneously, and that the realization structure is a resultant of the other processes.

– Keith Oatley

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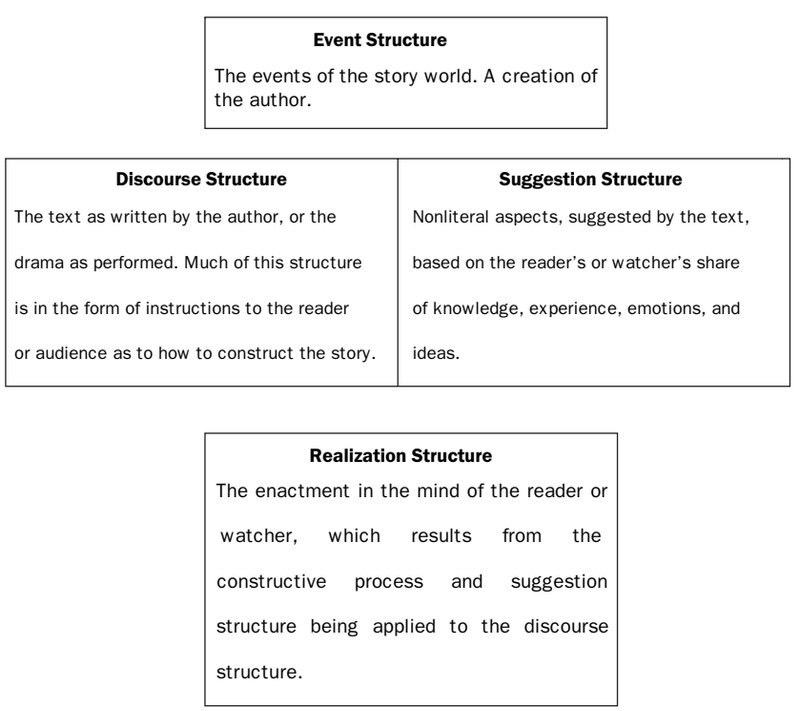

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RECTIFICATION OF NAMES (*ZHENG MING*)

The rectification of names is the adjustment of language to fit the world, specifically insofar as this bears on action. It is an important concept in traditional Chinese philosophy. In the *Analects*, Confucius established the place of this concept in political thought in particular. Tzu-lu asked Confucius what he would "put first" if he took over state administration. Confucius responded that it would be the rectification of names, stressing the ill consequences if "names are not correct" (xiii.3). (This is not to say that all schools of thought shared this view. Some downplayed the importance of language; see Zhang 2002, 475–8).

There has been considerable disagreement among writers in the Chinese tradition as to just what the rectification of names involves (see Zhang 2002, 461–74). Approaching the topic from the Western philosophical tradition, the obvious interpretation is that meanings should be in accord with essences (see ESSENTIALISM AND MEANING). For example, *water* should be used to refer to H_2O. There is an element of this in the various Chinese schools that have debated the topic. Specifically, a range of writers suggest that a rectified term is in accord with *li*, or "principle." Unfortunately, there is no greater agreement on the meaning of *li* than on the meaning of *zheng ming*. Abstracting somewhat from the debates, however, we may infer that a principle is what underlies and unifies a set of otherwise apparently diverse phenomena. Put differently, it is what manifests itself in the phenomenal patterns. This is related to the Western notion of essence. However, it is not identical. For example, the rule complex governing plural formation in English should count as a principle in this sense. It produces a patterned set of apparently diverse phenomena ("cats," "dogs," "bushes," and so on), defining the unity of those phenomena. Moreover, understood in this way, a principle may apply not only to real objects but also to ideals. When a principle underlies an ideal, it defines a norm.

This normative part is crucial. Consider, for example, the presence of U.S. troops in Iraq. Some speakers, such as representatives of the U.S. government, characterize this as *liberation* (Chomsky 2006, 131). Others, including most Iraqis, characterize it as *occupation* (Chomsky 2006, 163). These terms differ not only descriptively but also evaluatively. They differ in the way they apply norms to the situation, and thus in their implications for appropriate response to that situation. In a case such as this, the use or misuse of a term is significant because it has practical consequences. Specifically, it bears on our acceptance or rejection of a particular structure of authority and of particular representatives of authority.

Such a relation to authority is often the sort of case that writers on *zheng ming* had in mind. In his famous treatment of the rectification of names, Hsün Tzu (Xunzi) lamented the result of verbal confusions wherein "the distinction between the noble and the humble is not clear and similarities and differences are not discriminated." When this occurs, "ideas will be misunderstood and work will encounter difficulty or be neglected" (1963, 125). A similar practical concern is found in Mozi (Mo Tzu), but with different political consequences. Thus, Mozi wrote against "those who distinguish names in the world" in such a way as to promote "distinctions" and "discriminations." He favored "those who distinguish names in the world" in such a way as to "love others and benefit others" by advocating "no discrimination" (quoted in Zhang 2002, 327).

The practical, political consequences of the rectification of names are connected with the "eight steps" set out in the classic "Great Learning." The steps explain how to manifest one's virtue by bringing order to a state. One brings order to one's state by bringing order to one's family. One accomplishes this by developing oneself. That, in turn, results from rectifying one's mind/heart, which derives from integrating one's thoughts. To do the latter, one must extend one's knowledge, which is itself effected by research. (On the eight steps, see "Great Learning" and Zhang 2002, 452. Note that the list of steps inverts their order in practice, with research, therefore, being the first step.) Knowledge is at least in part a matter of knowing the right words and applying them properly. Thus, research is itself in part a matter of the rectification of names. In research, one should seek the relevant principles and connect them with names so that they will be understood. Moreover, these principles, and our knowledge of these principles, are not solely a matter of conceptualization. As Zhang writes, names "should match the reality," and "reality includes the actual use of the object" (2002, 424). Zhang is referring to a Mohist idea. But the link between principle and practice is much more widespread.

The eight steps also suggest the manner in which *zheng ming* has consequences. In a given situation, our application of a particular name affects our knowledge of the situation (Step 2). Moreover, it brings our understanding of the situation into a complex of relations with other ideas and names (or words) in such a way as to change the way our thoughts are integrated (Step 3) and our heart or feeling is oriented (Step 4). We may return here to the previous example. If I follow the lead of the U.S. government and characterize the U.S. presence in Iraq as liberation, then I understand its consequences in certain ways. I also integrate this idea with other aspects of my thought – about the insurgents, about U.S. foreign policy, and so on. This, in turn, has consequences for my emotional response to the U.S. presence in Iraq, to the U.S. government, and so on – ultimately with consequences for my support of that government. The consequences are very different if I follow the lead of most Iraqis and categorize the presence as occupation. Determining which is correct, and using that term consistently in public discussion, is an instance of research leading to the rectification of names, then to the integration of thought and orientation of feeling.

– Patrick Colm Hogan

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RECURSION, ITERATION, AND METAREPRESENTATION

Some researchers pinpoint recursion as our species' key computational ability, making humans cognitively unique (e.g., Hauser, Chomsky, and Fitch 2002; Corballis 2003). It may give us many abilities hypothesized to be uniquely human: language, theory of mind, complex problem solving, mathematics, and mental time travel (episodic memory/future planning) (Hauser, Chomsky, and Fitch 2002; Corballis 2003; Parker 2006; Stone and Gerrans 2006).

Within psychology and linguistics, *recursion* is understood as a property of certain types of representations. Whether internal to the mind or external, representations that can contain other representations of the same type are recursive. Language, mental states, mathematical formulas, and spatial representations all have this property. One can have a thought about someone else's belief about another person's thoughts, or one can have a picture of a picture of a picture: Both are *recursive representations*. *Recursive processing* requires that recursive representations be unpacked in a systematic way, from the highest to lowest level, in order to produce some output.

Recursion is distinct from the related concept, *iteration*, but the two are often confused. Both involve repetition. In programming, iteration is the repetition of a process within a computation, with a top-level control structure that "sees" all the steps involved (Anderson 2007). In recursion, however, the number of steps is unknown to the highest level of the function; all that is known to that level is whether an end condition has been satisfied or whether the problem needs further breaking down (Anderson 2007; Suh 2007). In language, we can construct infinitely long sentences by iterating elements, for example, "I have lived in the U.S. and England and Australia and …" Each iterative phrase is independent, not requiring reference to the other phrases, only to the top-level clause containing the phrases (Parker 2006). We can also construct infinitely long sentences by using recursively embedded elements, for example, "The blogger said that Bush thought that Cheney thought that Libby believed that the reporter did not know that Plame was a spy." These elements are not independent, requiring full unpacking of each embedded level to understand the full meaning of the sentence. Each level of embedding *refers to* another level: One cannot know the semantic value of "Cheney thought that … " without knowing the semantic value of the clauses it includes.

Recursion should also be distinguished from the related concept *metarepresentation*. Some use the terms interchangeably, using *metarepresentation* to mean a representation of a representation (e.g., Corballis 2003). It means being able to represent the relationship between the representation and what it refers to: to understand that a picture of Niagara Falls *stands for* that visual scene, or that someone's belief that Santa Claus exists *represents* that potential state of the world, or that *rocks*, the noun, *refers to* a set of stone objects. Metarepresentation requires recursive embedding of representational relationships, but it is not identical to recursive embedding (Stone and Gerrans 2006). Metarepresentation may also be uniquely human (Suddendorf 1999).

Marc Hauser, Noam Chomsky, and W. T. Fitch (2002) have offered the hypothesis that recursion is the defining feature of language, making it uniquely human. Other features of language, however, do not follow directly from recursion and also seem to be uniquely human, such as words, fine phonemic discriminations, and motor control of mouth, larynx, and so on. (enumerated in Pinker and Jackendoff 2005; Parker 2006, Chapter 5).

Whether recursion is the single defining feature of language or not, it might be uniquely human. Testing for recursive capacity directly is difficult. Instead, researchers rely on demonstrations of animals' ability to do tasks dependent on explicit recursion. Some claim that animals do implicit recursion in certain tasks, for example, ants doing dead reckoning, but this is difficult to substantiate. Although recursion is an efficient solution to many problems, unless one can test for the explicit content of the recursive steps in a computation, it is always possible that animal brains solve problems using some other, nonrecursive computational technique. Thus, comparative research uses tasks believed to depend on explicit recursion: mathematics, theory of mind, problem solving involving interdependent steps, mental time travel, or certain kinds of syntax (Corballis 2003; Parker 2006). So far, no study has demonstrated that our closest relatives, great apes, can do any of these tasks with the range and flexibility of humans (Corballis 2003; Hauser 2005; Suddendorf 2006). For now at least, recursion can join a set of *possibly* unique human cognitive capacities: other aspects of language, flexible control of attention and inhibition, expanded working memory capacity, and metarepresentation (Suddendorf 1999; Kawai and Matsuzawa 2000; Hauser 2005; Pinker and Jackendoff 2005; Stone and Gerrans 2006). Recursion may not be *the* key to unique human cognition, but it is no less worthy of study for being one of many keys.

– Valerie Stone

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REFERENCE AND EXTENSION

Extension and *reference* are technical terms in the philosophy of language, formal semantics, and pragmatics. We outline their roles in three types of theoretical effort – compositional semantic theories (which make use of both terms), various *theories of reference*, which purport to tell us what it is for a word to have a certain referent, and views that understand reference as something people do with words. The first two are semantic accounts; the last conceives of reference as a matter of language use, so of pragmatics.

Reference and Extension in Compositional Semantics

We begin with the use of reference and extension in compositional semantic theories. In this domain a *referent* is generally a thing that a proper noun "refers to" or "names," and an extension a set of objects to which a predicate applies (the term *denotation* is sometimes used interchangeably with both reference and extension). However, compositional semanticists often generalize one or the other notion so that almost any kind of expression, including a sentence, can be said to have a referent or an extension.

With few exceptions, compositional semantic accounts are versions of **TRUTH CONDITIONAL SEMANTICS** – attempts to specify the meanings of sentences in terms of their truth conditions. Since natural languages allow for infinitely many sentences, the truth conditions of sentences must be specified recursively in terms of the semantic values of their parts, and referents and extensions are semantic values that enable us to do just this. For example, we can specify the truth condition of the sentence "John smokes" in terms of the referents and extensions of its parts as follows: "John smokes" is true if and only if the referent of "John" (namely, John himself) is a member of the extension of "smokes" (the set of things that smoke).

The primary historical source for compositional semantics along these lines is Gottlob Frege's ([1892] 1997) account of *Bedeutung* – often translated as "reference" (also as "denotation"). In it, a referent is assigned to every meaningful expression. Frege assumed that each complex expression is the result of combining a functional expression (such as a predicate) with one or more arguments (such as names) (see PREDICATE AND ARGUMENT). Further, he assumed that the referent of a functional expression *F* is always a function *f,* and that the referent of any expression *X* that *F* accepts as an argument is the sort of object that is among the arguments of *f.* Specifically, if *F* is a functional expression and *X* an expression that *F* accepts as an argument, the referent of *F* is the function that maps the referent of *X* onto the referent of *F*(*X*). Thus, the referent of a complex expression is always the result of applying the referent of one of its constituents, as a function, to the referents of its other constituents, taken as arguments. The referent of a sentence as a whole is identified with its truth value. Thus, the referent of "Chomsky" is Chomsky, the referent of "is clever" the function that maps each object *x* onto *truth* if *x* is clever and onto *falsehood* otherwise, and the referent (truth value) of "Chomsky is clever" is truth if and only if Chomsky is clever.

It may seem surprising that the referent of a sentence is its truth value, but it should be kept in mind that *reference* is used as a technical concept within compositional semantics. Given the use to which the concept is put, this is not an unnatural assumption: Frege was interested in a compositional semantics that would tell us how the truth values of sentences are determined by the referents of their parts, and all natural languages have fragments in which, when a sentence has *other sentences* as parts, the truth value of the whole depends only on the truth values of the constituent sentences. Fragments of languages in which this is the case, and in which the referent of a complex expression in general depends only on the referents of its parts, are called *extensional.* Thus, in an extensional fragment, expressions having the same referent can be substituted in any sentence without altering its truth value (contexts in which such substitutions preserve truth value are also called extensional). Frege was primarily interested in constructing a semantics for the language of mathematics, which is extensional, and so choosing truth values as referents of sentences was natural. However, natural languages as wholes are not extensional. In contexts involving **PROPOSITIONAL ATTITUDES, MODALITY**, and counterfactuals, the substitution of clauses having the same truth value may alter the truth value of the whole sentence. To account for such contexts, Frege held that each sentence or other expression has, in addition to a referent, another kind of semantic value, which he called the expression's *sense* (*Sinn*). The sense of a sentence is what he called a *thought*, or, in contemporary terms, a **PROPOSITION**. In order to maintain a version of the principle of **COMPOSITIONALITY**, he held that the truth values of nonextensional sentences are determined in part by the senses of their constituents (see SENSE AND REFERENCE).

For various reasons, Frege's approach is now considered antiquated. Most recent work in formal semantics for natural languages is inspired by Alfred Tarski's work on the definability of *TRUTH* for formal languages. Richard Montague (1974) was the first to apply Tarski's work productively to (fragments of) natural languages. Here, *extension* is the preferred term. The extension of a predicate is, again, the set of things to which it applies. Although terminology varies, in this framework, too, one can speak of the extension of almost any expression, including a sentence, so that one identifies a sentence's extension with its truth value. Applying Tarski's approach, the aim is to recursively characterize not only the truth conditions of sentences but also the entailment (logical consequence) for a language using the notion of extension: A sentence S_1 is said to entail a sentence S_2 in language L if and only if there is no assignment of extensions to the semantically simple expressions of L (no "model of L") under which S_1 is true and S_2 false. On this approach, the logical constants differ from other

expressions in that they are not assigned extensions/referents (see LOGIC AND LANGUAGE).

Montague's approach differs notably from Frege's: It does not assign senses to expressions to account for nonextensional contexts. Instead, it employs the tools of **POSSIBLE WORLDS SEMANTICS** to this end. One can, however, within Montague's framework define objects corresponding roughly to Frege's senses: The sense of an expression could be thought to correspond to the function that maps each possible world onto the extension that the expression has in that world. Such functions are often called *intensions* (see INTENSION AND EXTENSION).

Theories of Reference, New and Old

The second set of theories (often called theories of reference) in which the terms *reference* and *extension* are found appear in the works of philosophers of language who aim to describe and explain the word–world relations that compositional semantic theories of the sort discussed previously take for granted.

In this area, too, a classical source is Frege. According to Frege, a word has a specific referent because its users associate it with a particular sense – something like a conceptual representation of its referent. Applied to proper names, his view was that a name, say, "George W. Bush," is associated by its users with a certain descriptive condition, say, *being the 43d president of the United States*, and that its referent is that object (if any) which uniquely satisfies this condition.

Another view, the so-called new theory of reference (in vogue since the 1970s), maintains that at least some expressions do not have senses, but simply refer. Proper names are paradigm examples. According to the approach, what cements the relation between a name and its referent is not a mediating conceptual representation in the speaker's mind but a causal and historical relationship between the name's user and its referent. The idea, articulated by Kripke (1972), is that a name is introduced by an initial "baptism," which involves a causal interaction between a speaker and the referent itself, and reference for all other speakers is preserved in chains of communication in which each speaker intends to use the name to refer to the same object as those from which he or she acquired the name. Extending Kripke's view in ways suggested by Kripke himself, Hilary Putnam (1975) proposed baptism + history as an account of how **NATURAL KIND TERMS** come to have and maintain their extensions (see ESSENTIALISM AND MEANING).

Reference as Action

The third view we discuss maintains that reference depends essentially on individual speakers (and possibly interpreters) with variable interests: An appropriate slogan might be "Words don't refer; people do." One root of this view is found in the work of the later Ludwig Wittgenstein, another in Descartes. Those who defend it point out that it is difficult to find cases of uniform word–world relationships in the use of natural languages. They grant that the practices of mathematicians display uniformity, but these practices aside, reference varies with time, context, speaker's interests, and so on. They also grant that some who offer theories of reference, such as Kripke (1972), acknowledge a role for speaker intentions. But Kripke and others incorrectly assume that ordinary speakers desire to maintain uniformity – to ensure "rigidity" in reference. In fact, speakers – paraphrasing Wittgenstein – play all sorts of games with language.

In taking reference as a form of action and treating *refer* as a verb, we come closest to the commonsense idea of a person "referring to" or "talking about" an object. Critical work on Bertrand Russell's analysis of **DEFINITE DESCRIPTIONS** by P. F. Strawson (1950) and Keith Donnellan (1966), as well as H. Paul Grice's work on the semantics/pragmatics distinction, inspired a distinction between *speaker's reference* and *semantic reference*, the latter being central to both compositional semantics and theories of reference of the sorts considered in the previous section. The speaker's reference of an expression, on an occasion, is whatever object that speaker uses the expression to pick out, typically in order to assert (query, etc.) something about that object. You may use the phrase "the man drinking a martini" to refer to a certain person, although the person you have in mind is, unbeknownst to you, drinking water: He is not, then, the semantic referent of the phrase.

Some writers hold that semantic reference either does not exist (Strawson 1950 can be read this way), or – if it is to sustain theoretical investigation – must be reconceived (Chomsky). Chomsky points out that natural language use (not in-house use of the symbols of mathematics or natural science, where practitioners constrain their actions) displays "creativity," where this is thought of in terms not only of the uncaused production of novel expressions but also of their free use for any number of purposes ("appropriateness"). Because referring is a form of free action and cannot sustain naturalistic study, Chomsky proposes the elimination of the semantic study of natural languages as usually conceived (offering theories of word–world relationships), placing the study of reference in a part of pragmatics that resists theoretical investigation, and placing the study of what he calls "meaning" (a psycholinguistic version of Fregean senses) in syntax broadly conceived as the study of the intrinsic properties of the mind/brain. The study of meaning – semantics reconceived – becomes a psycholinguistic enterprise focusing on the natures of mind-internal elements, such as lexical items, their "semantic features," and the computations in which they figure. Chomsky (2000, 38 f) points out that this kind of study might employ a theoretical device called "relation R," construed as a postulated relationship between theoretically defined expressions and objects in some introduced, stipulated domain. Relation R is not reference "outside the head" that is not apt for naturalistic study. Relation R and the domain D are, rather, construed to be part of syntax – theoretical devices aiding the naturalistic study of syntax conceived as "language in the head." The members of D could be stipulated to be semantic values. This might allow Chomsky to absorb the insights of Montague and other developing theories within **FORMAL SEMANTICS** into syntax. It would also emphasize a view Chomsky maintains for other reasons: Semantic compositionality is syntactic computation. Whether absorbing formal semantic accounts of compositionality in this way suits the intuitions and aims of those who want their semantic efforts to provide explications of truth conditions is another matter.

– James McGilvray and Juhani Yli-Vakkuri

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REFERENCE TRACKING

Reference tracking, or **ANAPHORA** resolution, concerns how language users track who or what the speaker is referring to in discourse. Because everyday language use generally concerns who does what to whom, reference tracking is important in studying human language and cognition.

Anaphora devices include noun phrases (NPs), pronouns, and zero anaphora, whose identities depend on their antecedents in discourse. In the example "Isabel went to China, and this volunteer/she helped with midwifery training," "This volunteer" is an NP that refers back to its antecedent Isabel. It could be replaced by the pronoun *she* or by an empty slot (zero anaphora) as in the sentence "Isabel went to China and ____ helped with midwifery training."

Pronouns and zero anaphora give less explicit information than full NPs. Still, the reader/hearer benefits from the efficiency of these devices in conveying information that has been introduced/given in the prior discourse or can be accessed/inferred from the context. These devices are crucial for global cohesion and local coherence in discourse. Experimental studies find that without a specific need, replacing a pronoun with an NP for given information may hinder understanding.

A discourse topic provides a basic means for tracking the identity of a pronoun or zero anaphora because the topic tends to recur as given information continuously. Cross-linguistic studies find that people can track the identity of a pronoun or zero anaphora even when its referent is not in the immediately preceding clause but in the prior context. Therefore, although language production may be linear due to human physical limitations, language processing and reference tracking are hierarchical cognitive processes.

Reference tracking requires the hearer to make inferences from world knowledge about likely events, especially for languages that have no **MORPHOLOGICAL** markings (Chinese) yet allow abundant zero anaphora, as in "He grew only one plant, but ___ blossomed well." Many languages make reference tracking easier with specific grammatical markings, such as agreement morphology: subject-verb **AGREEMENT**, **PERSON**, **NUMBER**, and gender (see GENDER MARKING agreement (French, German, and Turkish); the switch-reference system (Amele); or topic/subject markers (Japanese). Discourse analysis (see DISCOURSE ANALYSIS [LINGUISTIC]) finds that reference usage follows the constraints of information flow: The grammatical subject of a transitive clause tends to be coded with a pronoun in English, or zero anaphora in Chinese or Japanese, to present given or accessible information (*the light subject constraint*), for instance, "He" in the example, whereas the grammatical object tends to be an NP carrying new information (e.g., one plant). This allows easy processing of accessible information early in an utterance, while the rest of the utterance introduces the new referent, thus facilitating reference tracking and discourse processing.

Experimental studies find that the discourse pattern of a language engenders specific reference tracking strategies in its native speakers. Therefore, speakers of different languages may develop different cognitive strategies to track reference during discourse processes.

– Liang Tao

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REGISTER

Speakers of a language use different words and grammatical structures in different communicative situations. For example, we do not use the same words and structures to write an academic term paper that we would use when talking to a close friend about weekend plans.

Researchers study the language used in a particular situation under the rubric of *register*: a language variety defined by its situational characteristics, including the setting, interactiveness, the channel (or mode) of communication, the production and processing circumstances, the purposes of communication, and the topic.

Although registers are defined in situational terms, they can also be described in terms of their typical linguistic characteristics; most linguistic features are functional and, therefore, they tend to occur in registers with certain situational characteristics. For example, first and second person pronouns (*I* and *you*) are especially common in conversation. Speakers in conversation talk a lot about themselves, and so they commonly use the pronoun *I*. These speakers also interact directly with another person, often using the pronoun *you*.

There are many studies that describe the characteristics of a particular register, such as sports announcer talk (Ferguson 1983), note taking (Janda 1985), classified advertising (Bruthiaux 1996), and scientific writing (Halliday 1988). Other researchers

take a comparative approach, studying the patterns of *register variation*, which seems to be inherent in human language.

CORPUS LINGUISTICS has been an especially productive analytical approach for studying register variation. For example, the *Longman Grammar of Spoken and Written English* (Biber et al 1999) applies corpus-based analyses to show how any grammatical feature can be described for both its structural characteristics and its patterns of use across spoken and written registers. In the *multidimensional* approach to register variation, corpus-based analysis is combined with sophisticated statistical analysis to analyze the patterns of linguistic variation that distinguish among registers (see, e.g., Biber 1988, 2006; Conrad and Biber 2001).

Some studies have distinguished between registers and genres. In these studies, the term *register* refers to a general kind of language associated with a domain of use, such as a *legal register*, *scientific register*, or *bureaucratic register*. Register studies have usually focused on lexico-grammatical features, showing how the use of particular words and grammatical features vary with the situation of use. In contrast, the term *genre* has been used to refer to a culturally recognized "message type" with a conventional internal structure, such as an affidavit, a biology research article, or a business memo. Genre studies have usually focused on the conventional discourse structure of texts or the expected sociocultural actions of a discourse community.

– Douglas Biber

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REGULARIZATION

Regularization is the process of becoming more regular or rule governed. In a general sense, it implies that events in the world (or in individuals) become more predictable and orderly. Regularization in language is one of many kinds of language change. It occurs when forms in the language are under pressure to be consistent with a common pattern. The patterns that speakers use in the regularization of the existing language are typically the same as those that are used with new forms that enter the language and are referred to as *productive*. Thus, the past **TENSE** *-ed* (with its allomorphs) is productive in English, not just because it is frequent and ordered, but because it is the internalized pattern that speakers automatically employ when a new verb, such as *supersize* enters the language. We all agree that the past is *supersized* and not, for instance, **supersoze*. Regularization is studied diachronically (see SYNCRHONY AND DIACHRONY) as well as in contemporary settings; and **PSYCHOLINGUISTIC** research investigates and attempts to account for regularization processes, particularly for paradigmatic regularization (the regularization of inflectional paradigms), in the language of individual speakers. It is easier to agree on what has happened in the language than on the underlying psycholinguistic processes in the minds of speakers.

There is controversy among linguists as to whether speakers rely on abstract morphophonological algorithms or on more general analogical processes when they inflect or derive words. Differing models of mental representation and cognitive functioning can explain the productivity that ultimately makes regularization both possible and likely.

Diachronic Evidence of Regularization

HISTORICAL LINGUISTICS reveals ways that regularization occurs over time. Modern English reflects regularization in the inflectional system that started hundreds of years ago. Over time, English changed from a highly inflected language to a more analytic language, and the inflections that remained were largely regularized, with some notable exceptions in the verb system. Old English had different inflectional paradigms for strong verbs (verbs that changed their vowels to form a past) and weak verbs (verbs that maintained their stem and added a past tense suffix). A typical kind of paradigmatic regularization occurred in Middle English when many strong verbs like *helpan* "to help," which had various past forms (*healp, hulpe, hulpon, hulpen*), began to follow the pattern of the more regular weak verbs, leading to just one past form, *helped*. Much of this took place in Middle English between the years 1150 and 1500 (Baugh 1957, 189). In early Middle English, plurals formed with *-s* were common, but there were also many plurals formed with *-en*. During the fourteenth century, the *-s* pattern became the regular plural, and today, of the tens of thousands of nouns in Modern English, we can point to very few (*children, oxen, brethren)* that form the plural with *-en*. Many irregular words became regularized during this period or fell into disuse, thus making English a more transparent and consistent language in general. In particular, many Old English strong verbs simply disappeared while some others were changed into weak or regular verbs. Thus, over a period of several hundred years, various kinds of regularization took place in English. Regularization was not omnipresent, however: The most frequent verbs in English (such as *to be, to have,* and *to do*) have roots in Old English and are irregular. Highly frequent words tend to resist regularization in other languages as well as in English.

Social Forces That Contribute to Regularization

The historical and societal forces that contribute to change in spoken language are usually out of the awareness of speakers, except when those in power exert control through **STANDARDIZATION** or some other kind of **LANGUAGE POLICY**. A standardized language is usually one particular variety designated

the "official" or preferred language, and it does not follow that the chosen **DIALECT** will be any more regularized than less valued varieties. Standardized **SPELLING**, by contrast, is typically a move to simplify and regularize spelling conventions (Wijk 1977). There are cases, however, where official bodies are delegated to choose or change words or expressions in order to provide conformity with the rules of a language: For instance, the Academy of the Hebrew Language in Israel is charged with replacing words borrowed from other languages with words based on Hebrew **SEMANTICS** and **MORPHOLOGY**, in this way providing a kind of regularization of the lexicon of contemporary Hebrew. The French Academy (l'Académie française) compiles a dictionary of the French language and makes recommendations as to the admissibility of loan words, usually in favor of words that are more French – for instance, *courier électronique* instead of *e-mail*. These attempts to control language by decree are often not successful, especially in keeping out loan words that are pervasive and international. In any language, loan words themselves are subject to regularization that brings them into conformity with the morphology and phonotactics of the target language. For example, the English word *baseball* has been incorporated into Japanese as *beisuboru*, and the umpire's call to "play ball" is rendered as *purei boru*.

A powerful regularizing force in a language is the communication pressure that results from becoming more cosmopolitan, whereas an insular language is more likely to remain irregular and complex. When a society becomes more multiethnic, there is often language **CONTACT**. In addition, a rapidly changing society may have new technologies and terminologies, a mobile population carrying language to new communities, and many speakers who do not know the language well. All of these factors lead to linguistic economy, simplification, and regularization. When new words are coined, their inflections are regular. Loan words from contact languages are regularized. And, like first language learners, second language learners (see SECOND LANGUAGE ACQUISITION) of whatever age tend to regularize the language they are acquiring. It is very common for learners of French, for instance, to regularize the irregular second person plural of *dire* ("to say"), producing *vous disez* instead of *vous dites*. This regularized form is not permissible in standard French, but it occurs in various nonstandard dialects and is the norm in Louisiana Cajun French. When a language is spoken in a homogeneous, isolated community with few non-native speakers and little outside contact, there is apparently a greater tendency for complexity to remain in the inflectional system. A comparison of modern Icelandic and Norwegian provides a good example of this tendency: Both have Old Norse beginnings, but the relatively isolated Icelandic has preserved complex morphology, including many of the strong verbs of Old Norse, whereas comparatively cosmopolitan Norwegian shows more regularization, with simpler inflectional morphology and many fewer Old Norse strong verbs (Kusters 2003).

Psycholinguistic Studies

Some of the best evidence we have for the processes of paradigmatic regularization has come from psycholinguistic studies of both children and adults. We know that adult speakers of English, for instance, are able to produce appropriate inflectional endings for new words, following a complex set of morphophonological rules. In order to form a plural, one must observe the ending of the stem of the word, and then add */-s/* or */-z/* or */-iz/* depending on whether the stem ends in a voiceless sound, a voiced sound, or a sibilant *(backs, bugs, busses*). When new words such as *hardscape*, *abdominoplasty*, and *riffage* recently entered English, they were all treated as regular plurals. At some point, adults appear to have acquired the *rules* for making plurals, making it possible to apply them to new words or to regularize existing words. Adults are also able to produce appropriate irregular forms in English, for instance, the past tenses of words like *sing, keep,* and *catch*. An adequate psycholinguistic model must account for both regular and irregular inflections.

Studies of children's acquisition of morphology provide some insights into the development of these mental representations (see MORPHOLOGY, ACQUISITION OF). It has also long been observed that young children acquiring language make typical errors of **OVERREGULARIZATION**: They regularize words that are irregular and say things like "my foots," "two mousses," and "My teacher holded the baby rabbits and we patted them," clearly not as imitations of adult models (Gleason 1966). These errors are overgeneralizations that children make as they acquire the linguistic system. Overregularized words are evidence that the child has knowledge about language that goes beyond the memorization of heard forms. Studies of spoken language have shown a U-shaped curve in children's acquisition of irregular words. In the first stage, young children produce correct irregular forms along with uninflected regular words. Somewhat later, at about the same time that children begin to produce correct regular pasts and plurals, the overregularized forms appear, and finally both regular and irregular inflections are used (Marcus et al. 1992). One explanation is that initially, they produce the irregulars correctly as rote unanalyzed forms, but when they begin to acquire the rules for the regular inflections, they overapply those rules, unaware of the exceptions. Only later are they able to handle both the regular forms and the irregular ones.

Experimental studies have shown that children as young as four have systematic knowledge about the inflectional system. When presented with pictures of creatures with novel names and told "This is a wug. Now there is another one. There are two ___?" they accurately produced the plural *wugs* (Berko 1958). When given novel verb forms ("This is a man who knows how to spow. Yesterday he ___?"), the children uniformly produced the regular form *spowed*. Children were remarkably consistent in producing the most frequent, productive, and uncomplicated inflections of nouns and verbs.

There are several theoretical explanations for these phenomena. Some researchers contend that speakers operate with abstract higher-order rules when inflecting regular forms (Pinker 1991). According to this view, the inflectional algorithm allows speakers to deal with any regular word, whether it is familiar or not. Irregular words, however, must be committed to memory. Other scholars disagree in the interpretation of how it is that speakers are able to handle new words, and whether activation of internalized *rules* adequately characterizes the process. **CONNECTIONIST** approaches to language do not rely on rules, nor do they divide the lexicon into two groups of words, regular and irregular. In connectionist models, the mental processor

relies on **EXEMPLARS** or **ANALOGIES**: Speakers hear a variety of words over time, some more than others, and their mental representation reflects the weight of these frequencies, the features of the words, and the circumstances of their use. Frequently encountered features are recognized and associated, and ultimately the learner produces language that matches the language that has been heard.

Regardless of the theoretical model, it is clear that individuals are sensitive to the characteristics of the language around them and are able to generalize those characteristics to new instances. By the time children are of preschool age, they have sufficient knowledge of the most regular features of language to be able to extend them to words they have never heard before. This kind of knowledge underlies both productivity and regularization, and it has implications for language change in general. Languages everywhere are moved to become more regular in response to communicative pressure. Speakers carry within themselves the linguistic tools of regularization, which is a process that reveals a fundamental characteristic of the way humans organize information.

– Jean Berko Gleason

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RELEVANCE THEORY

Relevance theory (RT) is best known for its account of verbal communication and comprehension, which is employed by people working in **PRAGMATICS**. It also sets out a broad picture of the principles driving the human cognitive system as a whole, and this plays a crucial role in underpinning the particular claims made about **COMMUNICATION** (Sperber and Wilson [1986] 1995a; Wilson and Sperber 2004).

Relevance and Cognition

According to the RT framework, human cognitive processing quite generally is geared toward achieving as many improvements to its representational contents and their organization as possible, while ensuring that the cost to its energy resources is kept as low as reasonably possible. At the center of the theory is a technically defined notion of *relevance*, where relevance is a potential property of any input to any perceptual or cognitive process. An input may deliver a variety of different types of *cognitive effects* to the system: It may, for instance, combine inferentially with existing assumptions to yield new conclusions (known as *contextual implications*), it may provide evidence that strengthens existing beliefs, it may contradict and eliminate already held information, or it may rearrange the way information is stored. Such effects may or may not be beneficial to an individual; that is, they may increase or decrease the accuracy of the cognitive system's information about the world and may make useful information easier or harder to access. An input is relevant to a cognitive system only if it benefits that system, that is, only if it has *positive* cognitive effects. The other crucial factor affecting the degree of relevance of an input (whether an external stimulus or an internal mental representation) is the *processing effort* it requires: Deriving effects from any given input requires a mobilization of cognitive resources, including attention, memory, and various processing algorithms and heuristics. Thus, the relevance of any input is a trade-off between the positive cognitive effects it yields and the processing effort it requires: The greater the ratio of effects to effort, the greater the relevance of the input.

The basic claim of the framework is that human cognition is oriented toward maximizing relevance (known as the *cognitive principle of relevance*). The evolutionary idea underlying this claim is that as a result of constant selection pressure toward increasing cognitive efficiency, humans have evolved procedures to pick out potentially relevant inputs and to process them in the most cost-effective way (Sperber and Wilson [1986] 1995b). Human communicative behavior, including verbal communication and comprehension, exploits this prevailing cognitive drive for relevance in a particular way.

Relevance and Linguistic Communication

The starting point for a pragmatic theory (that is, an account of how speakers and their addressees manage to converge on a shared interpretation) is the question concerning how hearers are able to bridge the gap between the encoded linguistic meaning and the speaker's intended meaning. The most obvious manifestations of this gap are nonliteral uses of language, such as metaphor, metonymy or irony, and cases where the speaker communicates, in addition to the proposition explicitly expressed, a further proposition known as a **CONVERSATIONAL IMPLICATURE**, exemplified by speaker Y's utterance in (1).

(1) X: We need your written report now.
Y: I've been very busy recently.
Implicating: Y hasn't written the report.

There is also a range of tasks involved in determining the proposition explicitly expressed, including disambiguation, assignment of referents to **INDEXICALS**, and filling in missing constituents, as in (2), and various other enrichments or adjustments of encoded content, as indicated in the examples in (3): (3b) involves a narrowing down of "take time," and (3c) a loosening of the concept encoded by "boiling." In each case, of course, the particular proposition explicitly expressed is just one of indefinitely many other possibilities:

(2) He has taken enough from her.
Expressing: Jim has endured enough abusive treatment from Mary.

(3) a. I've eaten.
Expressing: I've eaten dinner tonight.
b. Your knee will take time to heal.
Expressing: The knee will take a substantial amount of time to heal.
c. The water is boiling.
Expressing: The water is very hot [not necessarily strictly at boiling point].

How, then, is an addressee able to infer the intended meaning from the encoded linguistic meaning, which is just a schematic guide or set of clues? According to RT, the answer lies with a special property of overtly communicative acts, which is that they raise certain expectations of relevance in their addressees, that is, expectations about the cognitive effects they will yield and the mental effort they will cost. Quite generally, an utterance comes with a presumption of its own *optimal relevance*; that is, there is an implicit guarantee that the utterance is the most relevant one the speaker could have produced, given his or her competence and goals, and that it is at least relevant enough to be worth processing. This is known as the *communicative principle of relevance* and it follows from the cognitive principle of relevance in conjunction with the overtness of the intention that accompanies an utterance: The speaker openly requests effort (attention) from the addressee, who is thereby entitled to expect a certain quality of information requiring no gratuitous expenditure of effort.

That utterances carry this presumption licenses a particular comprehension procedure, which, in successful communication, reduces the number of possible interpretations to one. According to the *relevance-theoretic comprehension procedure*:

(a) Follow a path of least effort in computing cognitive effects: Test interpretive hypotheses (disambiguations, reference resolution, lexical adjustments, implicatures, etc.) in order of accessibility.

(b) Stop when your expectations of relevance are satisfied.

This procedure is automatically applied in the on-line processing of verbal utterances: Taking the schematic decoded linguistic meaning as input, processes of pragmatic enrichment at the explicit level occur in parallel with the derivation of the implications of the utterance.

Central to the working of the procedure is a subprocess of *mutual adjustment* of explicit content and contextual implications, a process guided and constrained by expectations of relevance. Here is a brief example involving the adjustment of explicit content in response to expected implications and where the outcome is a narrowing down of a lexically encoded meaning:

(4) X (to Y): Be careful. The path is *uneven*.

Given that the first part of X's utterance warns Y to take care, Y is very likely to expect the second part of the utterance to achieve relevance by explaining or elaborating on why, or in what way, he should take care. Now, virtually every path is, strictly speaking, uneven to some degree or other (i.e., not a perfect plane), but given that Y is looking for a particular kind of implication, he or she will enrich the very general encoded concept UNEVEN so that the proposition explicitly communicated provides appropriate inferential warrant for such implications of the utterance as: Y might trip over, Y should take small steps, Y should keep an eye on the path, and so on. The result is a concept, which we can label UNEVEN*, whose denotation is a proper subset of the denotation of the lexical concept UNEVEN.

A distinctive RT claim in this context is that metaphorical and hyperbolic uses of words involve a kind of concept broadening ("loose use"), and so fall within this single process of lexical meaning adjustment. For instance, an utterance of the sentence in (5) could be taken as an ordinary broadening (if, say, the run referred to was a little less than 26 miles) or as hyperbolic (if it was considerably less than the length of a marathon) or as metaphorical for a long, arduous, exhausting experience, whether physical or mental:

(5) It was a *marathon*.

(For much more detailed exemplification of the RT-based account of lexical adjustment, resulting in concept broadening, or narrowing, or a combination of the two, see Carston 2002; Wilson and Sperber 2002; Wilson and Carston 2007).

As these examples indicate, on the RT view, the contribution of pragmatics to the proposition expressed by an utterance (i.e., its **TRUTH CONDITIONAL** content) is very wide-ranging, going well beyond the role of simply providing contextual values for indexicals. So, unlike the standard view of **SEMANTICS** and pragmatics in the philosophy of language, the RT position on the semantics/pragmatics distinction is that it does not coincide with the distinction between explicit utterance content and implicature but, rather, with the distinction between context-free linguistically encoded meaning and what is communicated.

Relevance Theory in a Broader Perspective

The output of pragmatic interpretation is a conclusion about speakers' communicative intentions, and the inferential process may rely on assumptions about other mental states of speakers (their beliefs and desires). So there is a close relationship between utterance comprehension and the **THEORY OF MIND** capacity, both of which depend on a metarepresentational ability – an ability to represent representations and attribute them to others. Dan Sperber and Deirdre Wilson (2002) argue that the pragmatic capacity is a subsystem of the mental system responsible for interpreting people's behavior in terms of the underlying mental states that cause it. They further argue, in line with current views in **EVOLUTIONARY PSYCHOLOGY** on **COGNITIVE ARCHITECTURE**, that it is an autonomous domain-specific system, operating just on ostensive stimuli (in particular, utterances), and has its own dedicated procedures, as outlined here. Thus, it is a modular system, a submodule of the more general theory-of-mind module.

There is currently a strong emphasis on spelling out the empirical predictions of relevance theory, comparing them with other theories of cognition and/or pragmatics and subjecting them to experimental testing. There are three broad areas of such empirical work. The first involves using familiar psycholinguistic techniques (e.g., measuring participants' reaction times in a range of on-line tasks) to investigate the time course of processing and the relative allocation of time/effort to different aspects of pragmatic interpretation (see, for instance, Noveck and Sperber 2004). The second is research into the development

of communicative competence in children and its relation to their linguistic maturation, on the one hand, and to their developing theory-of-mind capacity, on the other. There is evidence of a close relation between mature pragmatic competence (e.g., ability to interpret nonliteral uses of language, such as metaphor and irony) and mature theory of mind (e.g., ability to attribute to others beliefs that one knows to be false). But it is also clear that children can communicate ostensively from around the age of two years, and so this early ability does not depend on a full-fledged metarepresentational capacity, which comes some years later, but perhaps on some earlier emerging component of theory of mind, such as a capacity for joint attention. Finally, there is empirical investigation of people with atypical or impaired communicative capacities, including those with **AUTISM**, Williams syndrome, or schizophrenia. The results so far provide tentative support for RT predictions about the differences in the processing of literal, metaphorical, and ironical uses of language (see Wilson 2005; Carston and Powell 2006).

– Robyn Carston

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RELIGION AND LANGUAGE

The topic of religion and language could potentially fill a book. In order to make it more manageable, this entry concentrates mainly on theistic, especially Judeo-Christian, usage.

Descriptive Religious Language

In speaking and writing of God, or however they conceptualize the ultimate, religious people attempt to portray a mystery that transcends empirical reality by using language that is normally applied to things or (particularly) human beings. Islam in particular emphasizes the transcendence of God.

Figurative forms of language draw on the associations of language in its home in the mundane world to highlight similarities with this mysterious divine world. Using **METAPHORS**, people speak about God "in language suggestive of" (Soskice 1985, 51) a father, mother, master, king, shepherd, rock, fire, or wind but without intending these references to be taken literally. To assist reflection and argument, religions sometimes develop more stable, extended, systematic (and often complementary) linguistic models from such illuminating metaphors – for example, God as "personal"; the death of Christ as a "victory" or "sacrifice." Traditional accounts argue that such models can truly represent, although they do not literally describe, divine reality, but more radical thinkers treat them as no more than imaginative fictions whose purpose is to motivate and direct people's spiritual and moral lives and experiences.

Religious **ANALOGIES** are sometimes regarded as different only in degree from religious metaphors, but many insist that they apply to God literally and function as legitimate extensions of their normal application. So God is really wise, merciful, and living, but in a stretched sense appropriate to God's very different nature when compared with humans. (The same may be said of the meaning of "clever" when applied to dogs or computers.) It is possible partly to specify – and thus partly replace – analogical religious language, providing that we know the ways in which (say) God's love is similar to that of a loving person and the ways it is different. It is only when analogies are specified that they can be reliably used in argument; metaphors are frequently too vague to allow inferences to be drawn from them.

Extended metaphors in narrative form are used to speak of the actions of divinities. In myths, God or the gods are pictured as interacting with this world; in **PARABLES**, this activity is said to be "like" a wholly human situation (many are explicit similes). In both cases, the stories are often self-involving and possess considerable emotional power and salience.

Performative Religious Language

In addition to this cognitive ("fact-asserting") function, religious language is also used to perform many noncognitive tasks through **SPEECH-ACTS** in which attitudes or feelings are expressed, commitments, vows and requests are made, or obligations prescribed. J. L. Austin distinguished this **ILLOCUTIONARY FORCE** from an utterance's consequences (**PERLOCUTION**). In worship, religious persons expresses their trust, gratitude, awe, and longing and makes prayerful requests and promises. This language is intended to affect God, but it often also evokes and deepens the faith of other worshippers – as well as producing a reinforcing effect on the language users themselves. In many religions, especially nontheistic faiths, the language of meditation – including the repetition of mantras – serves to evoke mystical experiences or spiritual illumination of various kinds: for example, the realization of the oneness of the self with absolute *Brahman* in Hinduism or the enlightenment experience that releases from *dukkha* (the "unsatisfactoriness" or suffering of life) in Buddhism.

Religious Language and Religious Life

According to Ludwig Wittgenstein, all language is rooted within human activity, as part of a **FORM OF LIFE**. Some argue that religion itself is a form of life, or at least that some of its distinctive activities – for example, its rituals – are examples of this category. Much of the language used in these contexts may be thought of

as religious LANGUAGE-GAMES, such as praying or confessing, that possess a particular set of rules or logical "grammar" very different from that operating in some other language-games. (Thus, predestination is said to be "less a theory than a sigh, or a cry" [Wittgenstein 1980, 30e]). For Wittgenstein, the forms of life are given, for this is what people do, and the justification of a language game lies in "our acting." The meaning of religious belief, therefore, may be thought of as thoroughly grounded in religious behavior.

Christian theologians influenced by Wittgenstein sometimes treat Christianity as a learned cultural-linguistic system, with doctrine as the rules of its grammar; others have developed his reflections into a wholly noncognitive view, in which belief in God is nothing more than allegiance to a set of spiritual values.

Religious Readers and Religious Writers

Hermeneutics (the theory of interpretation; see PHILOLOGY AND HERMENEUTICS) is key to understanding how sacred texts are read. Friedrich Schleiermacher saw the reader's task as that of uncovering the author's intended meaning, but many insist that writing distances the author from the text and that the reader has his or her own part to play. Certainly, readers are always interpreters of the text and never approach it with "innocent eyes" (without their own preconceptions and worldview). For Hans-Georg Gadamer, the text's "horizon" of meaning does not swamp that of the reader; rather, the two interact and fuse, resulting in a new interpretation that goes beyond them both.

While religious conservatives seek to preserve a single understanding of the meaning of a text (and sometimes insist on its "literal" interpretation), more liberal and radical scholars regard it as perfectly legitimate for religious readers to find other meanings there that go beyond what the original author consciously intended, even if that can be recovered. This second perspective works well for some sacred poetry, and it fits the claim that religious responses are at their most authentic when they are most personal. It is more difficult to sustain, however, for religious history and biography and wherever readers care about what the author meant to say in using this language. Such considerations raise theological questions about the divine inspiration of the text and its role as a medium of revelation, in which God "speaks" through sacred scripture (whether by infallible dictation or more generally – perhaps by superintending its writing, or merely by authorizing or appropriating the fallible authors' language).

– Jeff Astley

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REPRESENTATIONS

Definition

The core concept of a representation is made up of two distinguishable ideas.

(1) Any representation, *r*, must be *about*, or *mean*, or have as its *content*, some distinct item *s*;

(2) *r* must be employable, in the absence of *s*, to guide the behaviors of the *consumers* of *r* – organisms or systems that use *r* – with respect to *s*.

To say that these ideas are distinguishable is not to say that they are separable. On some accounts of representation, (1) is a function of (2). That is, a representation can have a distinct item as its content only because of the way it is utilized by its consumers. The relation between (1) and (2) is, however, disputed.

Original and Derived Representations

It is common to distinguish *original* and *derived* representations. The distinction is intuitively clear, but its application less so. The distinction pertains to *how* representations acquire their content. Some seem to acquire their content in virtue of intentional, hence representational, states of subjects. Many people think this is true of language: A form of words has content only because of the intentions and understanding of its users (see INTENTIONALITY). When persons use a form of words – in a context that is not metaphorical, ironic, or sarcastic – they *intend* their words to be taken in a certain way, and hearers/readers of their words *understand* that they intend their words to be taken in this way, and so on (Grice 1957; see COMMUNICATIVE INTENTION). Language, then, would consist in derived representations: representations whose content derives from the intentional states of its users. Intentional states, on the other hand, would be original representations: representations whose content is not similarly derived.

The Problem of Representation

This conception of the relation between original and derived representation has exerted an immense influence on the way the concept of representation has been developed in recent decades. It entails that if we want to understand representations, then our focus must be on intentional states. If we understand the content of derived representations as issuing from original representations, then we must understand how the latter can have their content. All representation ultimately reduces to *mental* representation. The difficulties inherent in this project were identified by Ludwig Wittgenstein (1953).

Wittgenstein argued that the content of an intentional state cannot be determined by any fact – conscious or unconscious – about the state's subject. Consider, first, an imagistic conception of content. One might suppose, for example, that when I use the word *dog* an image of a dog must somehow "flash before my mind." However, as Wittgenstein showed, such an image

is neither *necessary* nor *sufficient* for content. It is not necessary because, typically, when I use the word *dog*, no such image appears to me. It is not sufficient because the image is, itself, just *another* symbol, and its content needs to be interpreted no less than that of the word. An image of a dog can "stand for" many things – dog, furry creature, creature with four legs, and so on – and so the image can have content only if there is a further act of **INTERPRETATION** on the part of its subject: an act that serves to disambiguate the image. However, an act of interpretation is itself an intentional state. Therefore, we have made no progress in understanding how an intentional state has content; we have simply replaced one intentional state with another.

These problems remain when we shift to more sophisticated accounts of content. In one such account, content is understood in terms of the following of *rules*: In using a sign, I – consciously or unconsciously – follow a rule, a rule that determines how the sign is to be applied in particular cases. Wittgenstein argued that there is no fact about an individual that determines that he or she is following one rule rather than another. Any behavior in which I engage is compatible with an indefinite number of rules. In continuing the mathematical sequence 2, 4, 6, 8, I could be following the "n + 2" rule or the "n + 2 if and only if n is less than 32, if so n + 4" rule. And so on for an infinite number of *n*s. Similarly, in applying the word *dog*, I could be following the "Apply 'dog' to all and only dogs" rule, or the "Apply 'dog' to all and only dogs unless the dog is first seen after 2020 in which case apply 'cat,'" and so on for an infinite number of permutations (see PROJECTIBILITY OF PREDICATES). Crucially, this point also extends to *mental rehearsals* of a rule – themselves just more subtle forms of behavior. It would be implausible to suppose that whenever I apply a rule I must mentally rehearse all the possible situations in which the rule might apply – for this would entail that whenever I followed a rule, I must be simultaneously thinking an infinite number of thoughts.

These examples are outlandish but are merely ways of making graphic a simple point: Any rule is, logically, no different from a word. The rule is just another *symbol* and, as such, stands in need of interpretation if it is to have content. But interpreting is a representational state. And so, in our attempt to understand original representation, we have merely substituted the problem of understanding the content of one representation with that of understanding the content of another.

Wittgenstein's response to this **RULE-FOLLOWING** paradox turns on the appeal to *practice*. This response is, however, deeply problematic – at least if understood as a *constructive* attempt to explain the foundations of meaning. A practice is, as he put it, what we *do*. But doing seems to be a form of *acting*. And actions are essentially connected to, and presuppose, prior intentional states of a subject. That is, both the *status* of an event as an action and its *identity* as the particular action that it is depend on its relation to a subject's intentional states. Therefore, the appeal to action seems to presuppose representational states and so cannot explain what representations are (McDowell 1992; Hurley 1998; Rowlands 2006).

Naturalizing Representation

Wittgenstein's legacy, therefore, is a convincing account of what representation is *not*, coupled with a highly questionable account of what representation *is*. One prominent response to this legacy is the attempt to *naturalize* representation – to explain what makes something a representation by appealing only to states that are nonintentional or less than fully intentional. These attempts can be divided, roughly, into *informational* and *teleological* approaches.

Fred Dretske (1981) argued that representation can be explained in terms of *information*: An item qualifies as representational only if it carries information about some item extrinsic to it. Information reduces to relations of *conditional probability* – though precisely which relations is a matter of dispute. According to the stringent version, defended by Dretske, information requires a conditional probability of 1. That is, for *r* to carry the information that *s*, the probability of *s* given *r* must be 1 (i.e., given *r*, *s* must be certain). Other versions (e.g., Lloyd 1989) identify information only with an *increase* in conditional probability, though not necessarily to the level of 1. On this view, *r* will carry information about *s* if the probability of *s* given *r* is greater than the probability of *s* given not *r*.

The primary drawback with the informational account is its well-documented problems accommodating an essential feature of representations: *normativity* (Dretske 1986; Fodor 1990) Consider the mental representation of a dog – DOG. If DOG occurs, then the world *should*, in an appropriate way, contain a dog. The representation, therefore, makes a normative claim: a claim about the way the world *should* be, given that the representation is instantiated. However, it is likely that DOG can be caused by things that are not dogs – foxes in the distance or cats on a dark night, for example. So, what DOG is most reliably correlated with is not dogs but a disjunction of dogs *or* foxes-in-the-distance *or* cats-on-a-dark-night. But relations of conditional probability – the core of the concept of information – are a function of reliable correlation. So, the pure informational account of representation cannot distinguish between the way the world *should* be when DOG is instantiated and the way the world in fact is. Representation is normative in a way that information is not.

Central to *teleological* approaches is the concept of *proper function* (Millikan 1984, 1993; Papineau 1984). This is a normative concept: The proper function of a mechanism, trait, or state is what it is *supposed* to do, what it has been *designed* to do, what it *ought* to do. It is not what that mechanism generally *does* or is *disposed* to do. What something does or is disposed to do is not always what it is supposed to do. First, any mechanism, trait, or process will do many things, not all of which are part of its proper function. Secondly, a mechanism, trait, or process can have a proper function even if it never, or hardly ever, performs it. Third, a mechanism, trait, or process may have a proper function and yet not be able to perform it properly.

The normativity of proper functions is grounded in their *history*. The proper function of a heart is to pump blood because it is their doing this in the past that explains why hearts proliferated and exist today. They did not proliferate because of their ability to make noise or produce wiggly lines on an electrocardiogram. Thus, the proper function of an item is determined not by the present characteristics or dispositions of that item but by its *history*: Proper function is essentially historical.

The core idea of the teleological approaches to representation is that the mechanisms responsible for mental representation are

evolutionary products, and that we can therefore understand representation in terms of the concept of proper function. Suppose we have a representational mechanism M capable of going into a variety of states or configurations. The *direct* proper function of mechanism M is, let us suppose, to enable the organism to track various environmental contingencies – for example, the presence of predators. In the event that a predator is present, M goes into a particular configuration, F. This state F of the mechanism has the *derived* proper function – deriving from the proper function of the mechanism M – of indicating the presence of a predator. That is, it has the content, roughly, "*predator, there!*"

One strength of the teleological approach is the elegant manner in which it satisfies the normativity constraint. Another is that it does not rely on the questionable assumption that all representation derives from mental representation. The historical-normative account of representation can be applied directly to linguistic forms independently of their connection to the intentional states of subjects. However, all attempts to naturalize representation are controversial, and their success or failure is a matter of continuing debate. The worries surrounding these attempts can be divided into *technical* and *foundational*. With respect to teleological approaches, for example, one technical worry would be whether the approach can capture the *fineness of grain* of certain content attributions, for example, whether it can distinguish between the content of "predator!" and "tiger!" and "thing that will eat me!" There is every reason to think that with sufficient ingenuity, answers to these sorts of technical worries will be (or, indeed, already have been) forthcoming.

Foundational worries are more serious. These concern whether the sorts of natural relations invoked by these accounts are the *right sorts of things* to explain the nature of representation. Even if we were to identify items that satisfied one's preferred naturalistic model of representation, it is argued, it would still be an open question whether these items were, in fact, representations. Thus, some (e.g., McGinn 1991) argue that naturalistic accounts provide only a *criterion* of representational content – a criterion that allows us to determine when one thing is about another, and what thing it is about. But they fail to explain what representation actually *is*. More positively, if we are to properly understand representation, we also need to understand **CONSCIOUSNESS**. And the prospects for a naturalistic interpretation of the former are, therefore, tied to a naturalistic interpretation of the latter.

– Mark Rowlands

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RHETORIC AND PERSUASION

Rhetoric is traditionally a discursive skill, either written or oral, used to produce a desired effect on an audience. Alternatively, it is a study that focuses on the techniques a person should optimally employ in given contexts to produce such an effect. This second sense echoes Aristotle's emphasis, set out in his *Art of Rhetoric*, pertaining to the "detection" of the persuasive aspects of each matter (1991, 69–70).

From an etymological perspective, the English noun *rhetoric* is derived from the Greek word *rhēma* ("a word"), which is linked to *rhētor* ("a teacher of oratory"). Both are ultimately derived from the Greek verb *eirō* ("I say"). The notion of rhetoric, therefore, is grounded in language. The English noun *persuasion* is as much grounded in cognition as it is in language. Even though the "suade" element of the word goes back to the Latin *suādēre* "to advise," the Greek word for persuasion derives from the cognitive verb "to believe."

The formal codification of rhetoric as a heuristic-like system is something that was first written down in circa 475 B.C. by Corax of Syracuse and involved a simple but effective four-part structure: introduction, background, arguments, and conclusion. Rhetoric can only operate when individuals are given the opportunity to speak and persuade in a public forum. In ancient societies that had tyrannical, royal, aristocratic, or oligarchic systems, freedom of speech was either restricted or nonexistent, and as a result, rhetorical practice was very limited. It was only with the advent of democracy, championed by Cleisthenes in the city-state of Athens around 510 B.C., that individuals were given the opportunity to practice persuasive oratory for their own ends. Three distinct genres developed from circa 500 B.C. through to the formal end of Athenian democracy around 320 B.C. These were **FORENSIC** oratory (the rhetoric of the law courts), *deliberative* oratory (the rhetoric of the political arena), and *epideictic* oratory (the rhetoric of praise or blame). Each of these genres had its own separate focus expressed in their *means* and *topics*. Some of the great orators of the time were Gorgias (an epideictic, sophist orator), Lysias and Isocrates (two forensic orators), and Demosthenes (the great deliberative orator). Famous Roman orators and writers of rhetorical handbooks were Cicero (*de Oratore* and *de Inventione*) and Quintilian (*Institutio Oratoria*). Both Isocrates and Quintilian were also great educators.

Rhetoric is about structure and strategy. Structure refers to both the arrangement of the whole process and that of the speech itself. The first is expressed by means of the five canons of rhetoric, pertaining to the discovery (*heúrisis*/*inventio*); arrangement (*táxis*/*dispositio*), stylization (*léxis*/*elocutio*), memorizing

(*mnémē*/*memoria*), and delivery (*hupókrisis*/*pronunciatio*) of persuasive arguments in a speech or essay.

Once a proposition has been decided on, a speaker or writer needs to go about gathering, discovering, and generating arguments in support of it. A main strategy is to turn to the topics (*topoi*/*loci*). These are "places" where arguments can be found. The fact that they are already out there in the world and only need to be used led Aristotle to refer to them as "nonartistic proofs." Topics can be internal, external, or special. Internal topics are textual strategies for generating arguments, such as definition, comparison, analogy, cause and effect, and testimony. External topics are literal places and objects where people can go to find arguments, like reference books in libraries, or search engines on the Internet, to give a modern example. Special topics are systems that are particular to the three genres of rhetoric. Deliberative oratory uses special topics like "the worthy" and "the advantageous" in order to persuade people to act or think in a certain way. Forensic oratory uses special topics appropriate for either defense or prosecution in the law courts. One such strategy is *stasis*, a Roman judicial heuristic, which addresses the three questions of whether something happens (evidence), what something is (definition) and the quality of what happened (motives). Epideictic oratory uses strategies relevant for either amplifying or playing down the virtues and vices of individuals or institutions.

A second mode of persuasion in this first canon of rhetoric is what Aristotle termed the *artistic proofs*, incorporating the three appeals: *logos*, *pathos*, and *ethos*. Logos centers on whether arguments are deductive or inductive, fallacious or nonfallacious, syllogistic or enthymemic. Pathos deals with the psychology of persuasion, focusing on the ways that emotions are triggered and then channeled in an audience for the speaker's own ends. Ethos is concerned with the moral character of the speaker, the trust or admiration an audience has for a speaker or writer. It also includes **ETHICS** in the strategies employed in the language use itself, like dealing with counterarguments, opponents, and minorities in a fair and balanced way.

The second canon is concerned with arrangement. This occurs at two levels: that of the entire speech and of the arguments themselves. One famous system is that set out in the anonymous first century B.C.E. Roman manual *Rhetoric ad Herennium*. This work, which also deals with the last three canons, stipulates six parts to a speech: introduction (*exordium*), background/scene setting (*narratio*), a brief list of arguments (*divisio*), the arguments in favor (*confirmatio*), the counterarguments (*confutatio*), and conclusion (*peroratio*). The second level of arrangement concerns sections four and five: which arguments a speaker puts forward first, which last, and which placed in the middle – and, most importantly, why.

The third canon deals with style and is realized by the use of style figures (*tropes* and *schemes*) to produce differing linguistic and cognitive levels of parallelism and deviation in order to draw in, delight, and ultimately persuade listeners and hearers. It also suggests different styles that are suitable for specific occasions: high, middle, or low. The fourth and fifth canons set out the **PERFORMANCE** aspects of rhetoric and involve oral, rather than written, production. These are the memorizing and delivery of a speech. The latter puts much focus on **INTONATION**, prosody, **VOICE, RHYTHM**, and **GESTURE**, something the Roman orators made into an art.

Throughout the latter half of the twentieth century, rhetoric has often been viewed in university language departments as an archaic system. One area where rhetoric did flourish was argumentation analysis. In the 1950s, influential work was conducted by Chaim Perelman and Lucie Olbrechts-Tyteca. What they called "the new rhetoric" challenged the validity of dialectic and logico-rational approaches to argumentation, claiming instead that real arguments are not grounded in absolute or perfect contexts but, rather, in situations that are characterized by the possible, plausible, and probable. Hence, a much more pragmatic linguistic approach to evaluating arguments is required. Other important philosophical and theoretical scholars in this period were I. A. Richards, with his work in literary criticism, and Kenneth Burke, with his "rhetoric of motives," based on his notions of "identification" and "appeal," which focuses more on the reception and context of the persuasive discourse than on the actual production.

Today, rhetoric and persuasion have dissipated into a number of associative language-based domains that include composition, word and image studies, philosophy, psychology, **COMMUNICATION** studies, argumentation analysis, and stylistics. Rhetoric is crucial to freshman composition courses in universities. This has traditionally been the case in the United States but is becoming increasingly so in the rest of the world. The structural and systematic nature of rhetoric lends itself perfectly to **TEACHING WRITING** and **ORAL COMPOSITION**. It is here that the didactic and pedagogical quality of rhetoric as a skill, in the true Aristotelian sense of *technē*, to be applied to other subjects rather than a subject in itself, comes to the fore.

In communication studies, the term *rhetoric* has all but disappeared, even if what happens there is essentially still rhetoric as the ancients described it. This social scientific approach to modern rhetorical theory tends to focus more on cognition and emotion than on language, more on reception than production. This can be summed up in Herbert S. Simons's claim that "persuasion is about winning beliefs, not arguments" (2001, xxii). This highlights the need of a persuader to position himself/herself closer to the persuadee. This attempt at creation of common ground, which Simons terms a "coactive approach," must ultimately draw on the classical notions of ethos and pathos.

Rhetoric is also very much evident in the domain of **CRITICAL DISCOURSE ANALYSIS**, where the ordering, presentation, and omission of information in news discourse is crucial for persuading and manipulating mass audiences. The same can be said in the word and image domain of advertising discourse, arguably the most fecund example of rhetoric at work in society in the modern age. Rhetoric also continues to flourish in argumentation analysis, as can be seen in the work of Frans H. van Eemeren and R. Grootendorst (2004), whose "pragma-dialectic" model of argumentation provides a means of resolving differences of opinion based on what they term "critical discussion."

One current approach that warrants further elaboration is *STYLISTICS*: a field which in the twentieth century replaced and expanded on the earlier study of *elocutio* in classical rhetoric (Wales 2001, 372). Its object of analysis is primarily literary

discourse, under the premise that literary discourse is either consciously or subconsciously stylized to order to induce certain persuasive emotive and aesthetic effects in readers. The rhetorical notion of **FOREGROUNDING** – commonly through such techniques as parallelism, repetition, and deviation – is central to this approach. Stylistics is the analytic side of the literary rhetorical coin, the other being production, which currently finds form in university creative writing programs. Stylistics has also made a journey similar to that of rhetoric and persuasion: from a focus on production and form, to one of interaction and then reception, and finally on to the domain of the mind, beliefs, and emotion. This can be seen in recent work being conducted on cognitive stylistics, also often referred to as **COGNITIVE POETICS**. This augmentation shows how linguistic and cognitive approaches to stylistics are not contrary but complementary (M. Burke 2005, 194). Cognitive stylistics thus explicitly seeks to integrate the language-oriented nature of mainstream stylistic analysis with the mind-oriented nature of emotion and **COGNITIVE LINGUISTICS**. This is a line of development that is at the very heart of twenty-first century rhetoric and persuasion.

– Michael Burke

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RHYME AND ASSONANCE

Rhyme and assonance are patterns of **PHONETIC** similarity that function primarily as devices of poetic euphony. In **PHONOLOGY**, *rhyme* (sometimes distinguished by the spelling *rime*) denotes the unit comprising a vowel – the nucleus – and optional following consonants – the coda – that follows an onset in a **SYLLABLE**. In **POETICS**, rhyme refers to the repetition of similar segments beginning with a nucleus or to a **WORD** linked perceptually to others by such repetition. Rhymes are often classified by the kind of segment repeated, the exactness of the repetition, and the location of the repetition within surrounding segments. *Masculine rhyme* pairs words on final **STRESSED** syllables, like *kind/blind*. *Feminine rhyme* pairs words on stressed syllables with one or more identical unstressed syllables following, like *litter/bitter* or *authority/majority*. In *grammatical rhyme*, the word-final syllable(s) are similar inflectional suffixes. In *exact* or *full rhyme*, the repeated segments are highly similar while the syllable onsets are not. *Slant*, *half*, or *near rhyme* allows various deviations from strict similarity: in the syllable coda, such as *time/nine* or *light/rights*; in the nucleus, like *want/flaunt*; or even in syllabic structure, as in *lying/mine*. *End rhymes* occur at the ends of poetic lines (see VERSE LINE), while *internal rhymes* occur irregularly within a group of lines.

Assonance is the repetition of like vowels in neighboring syllables. Nigel Fabb (1997) observes that some instances of assonance could be reclassified as rhyme in traditions that allow sets of phonologically similar consonants in codas. Rhyme and assonance usually, but not necessarily, involve stressed syllables.

Rhyme and assonance are essentially perceptual phenomena, and classifications like those here typically serve to facilitate descriptions of their perception by listeners and readers. Masculine rhymes register more vigorously with listeners and feminine rhymes less so, and grammatical rhymes register very little or not at all. Slant rhymes are less vigorous than full rhymes, while internal rhymes are ordinarily less noticeable than end rhymes. The important question of effective distance between repeated segments has not been closely researched. With assonance, like **ALLITERATION**, repetition outside of a rather narrow structural window, such as a line or two adjacent lines, is not likely to be perceived as echoic. Rhyme that demarcates poetic lines has a larger effective window because the segmentation is overdetermined by other operating schemes.

Outside of poetry and verbal play, rhyme and assonance figure little in linguistic organization. They sometimes help motivate word coinage, as, for example, in the so-called rhyme-motivated reduplications of English, like *mumbo-jumbo*, *teeny-weeny*, or *claptrap*. Nevertheless, the human facility for rhyme and rhyme recognition serves as an important tool for linguistic investigation. **PSYCHOLINGUISTICS** has revealed that rhyme words are associated in memory, so that a word prompts recall of its rhyme cohorts, and the presence of a rhyming competitor of a target item delays visual identification of that word's referent. Phonologists have used the poetic classification of half rhymes to investigate the perceptual basis for phonological similarity judgments. Eve Sweetser (2006) suggests that rhyme relations between words can prompt **CONCEPTUAL BLENDING**.

– Claiborne Rice

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RHYTHM

The notion of rhythm is widely present in language sciences and an abundant literature ranging from **ACOUSTICS** to phonological theory and neuropsychology is available, leading to several – and sometimes conflicting – definitions. Nonetheless, most would agree that rhythm involves the temporal organization of speech and results from a threefold complex interaction among

- the nature of the rhythmic atomic constituents;
- the use of alternations between more and less prominent constituents;
- the pattern of regularity for the grouping of the constituents into longer units.

According to this definition, rhythm is fundamental to languages (it seems that no language may be defined as arrhythmic, even if the last two proposed dimensions may be irrelevant in specific languages).

In the twentieth century, **PHONETICS** searched mainly for the acoustic correlates of rhythm units, while **PHONOLOGY** – with the exception of metrical phonology – usually considered rhythm as a mere sequence of timing slots on which linguistic properties are cast. In addition, cognitive science addressed distinct questions, namely, why languages are rhythmic and whether rhythm plays a role in the cognitive processing of language.

Current State of the Field

RHYTHMIC TYPOLOGY. The long-lasting view that speech rhythm would consist in isochronous occurrences of some acoustic event or unit along the speech stream, popularized by Kenneth L. Pike (1945) and David Abercrombie (1967), is now widely rejected. Explaining how rhythm is perceptually salient despite the absence of objective regularity and why it seems nevertheless possible to gather languages into a few rhythmic categories is consequently a challenging issue. These categories, initially known as stress-, syllable- and mora-*timed*, have been renamed stress-, syllable- and mora-*based* in Laver (1994, 528–9). This distinction is enlightening about the change from a discrete to a continuous approach to rhythm variation across languages: Rhythmic **TYPOLOGY** has to cope with languages that do not strictly match categorical prototypes, and there is now general agreement that this typology better reflects tendencies, rather than mutually exclusive categories (Roach 1982; Dauer 1983). According to Rebecca M. Dauer, the "difference between stress-timed and syllable-timed languages has to do with differences in syllable structure, vowel reduction and the phonetic realization of stress and its influence on the linguistic system" (1983, 51). In other words, she states that typological differences in rhythm are side effects of the phonological characteristics of languages.

Over the last decade, the durational correlates of rhythm types have been thoroughly investigated, highlighting in particular distributional properties of vocalic and intervocalic segment durations (Ramus, Nespor, and Mehler 1999) and the pairwise variability of these segment durations (Grabe and Low 2002). For example, British English exhibits both vowel reduction and fairly complex syllable structure, yielding a low proportion of vocalic intervals and a high variation in the duration of consonantal intervals. On the contrary, European Spanish lacks vowel reduction, and its syllabic structure is simpler, resulting in a reversed pattern with a relatively higher proportion of vocalic intervals and a lower duration variability in consonant intervals. Several experimental studies have emphasized the salience of these indices in language discrimination tasks performed by human subjects (e.g., Ramus, Dupoux, and Mehler 2003), and an abundant literature has followed. However, further investigation is still needed for understanding some dynamical aspects of rhythm (metric patterns, speech rate, etc.) and the possible interaction among intensity, **PITCH**, and duration, explicitly in terms of rhythm.

RELATION AMONG RHYTHM, METRICS, AND STRESS. As Anthony Fox pointed out, "[rhythm] is rarely taken into account in a formal way in phonological theory and description" (2000, 86). However, nonlinear approaches, and especially metrical phonology (see METER), take rhythm into consideration by investigating both the structure and the weight of rhythmic constituents (e.g., Hyman 1985; Blevins 1995) and their relation to metric and **STRESS** patterns (Hayes 1995).

WHY ARE LANGUAGES RHYTHMIC? There is extensive evidence in support of speech rhythmicity as fundamental for speech communication. From the production side, no uncontroversial position has yet emerged. For instance, Peter MacNeilage (1998) proposed an evolutionary scenario deriving speech rhythmicity from cycles of mandibular oscillation during ingestion; Robert F. Port (2003) proposed that neurocognitive oscillators could synchronize the production of prominent events with perceptual attention, renewing approaches initiated in psychology (for a review, see Evans and Clynes 1986). Furthermore, quite a few experiments have assessed human awareness of rhythm differences for neonates, young infants, or adults, and several studies suggest that rhythm plays an important role in segmenting the speech stream and thus for language acquisition (see, among others, Morgan and Demuth 1996 and Mehler and Nespor 2004; see also SPEECH PERCEPTION IN INFANTS).

– François Pellegrino

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RIGHT HEMISPHERE LANGUAGE PROCESSING

The human brain is comprised of two cerebral hemispheres, which are anatomically very similar but have well-known asymmetries in terms of their functional capacities. One of the best-known facts about the interface between the brain and cognition is that the left hemisphere (LH) is *dominant* for language. (This description applies to the vast majority of right-handed people, and probably at least two-thirds of left-handers.) However, the nature of this left hemisphere language dominance, and of right hemisphere (RH) contributions to language, remains far from clear, and several schools of thought persevere. What is known:

- **APHASIA,** a marked deficit in language function following brain damage, is almost always associated with damage to the LH, whereas similar damage to the RH is not associated with overt aphasia.
- Yet, people with aphasia following extensive LH brain damage often recover at least some linguistic function, and in some (but not all) cases, homologous areas of the RH (those areas mirroring the damaged LH language areas) seem responsible for recovery (Blasi et al. 2002; Leff et al. 2002). Indeed, children who have their entire LH removed as a last resort to treat a crippling form of epilepsy often go on to develop language abilities within a normal range (Vargha-Khadem et al. 1997).
- Neurologically intact individuals can perform most language tasks better (faster and more accurately) when processing linguistic stimuli received via the right visual field or the right ear, both of which project most directly to the LH, compared to stimuli received via the left visual field or left ear, which project to the RH.
- **NEUROIMAGING** in various modalities often shows stronger brain activity in the LH than in the RH during most standard language tasks. However, there usually is some activity in homologous regions of the RH, even if it is weaker (e.g., Mazoyer et al. 1993).
- All of this information (derived from lesions, divided inputs to LH and RH, and neuroimaging) reveals that the RH seems important for processing many aspects of prosody and the melodic contour of language used to stress some elements, conveying emotion, or (in many languages) demarcating questions and sentences (Joanette, Goulet, and Hannequin. 1990; cf. Schirmer and Kotz, 2006).
- Likewise, a variety of evidence demonstrates that the RH strongly contributes to some language tasks, particularly in higher-level language comprehension.

This final point concerns the vast majority of work on RH language processing, and it demands elaboration. Lesion studies, neuroimaging, and behavioral evidence all indicate that RH language processing is important for drawing connective inferences (Beeman 1993; Brownell et al. 1986; Mason and Just 2004; Virtue et al. 2006); understanding jokes (Coulson and Wu 2005; Goel and Dolan 2001) and at least certain types of metaphors (*Brain and Language* special issue in 2007; see METAPHOR, NEURAL SUBSTRATES OF); integrating new input with previously comprehended text (Robertson et al. 2000); and comprehending the gist of stories or conversations (St. George et al. 1999). In other words, many of the truly communicative aspects of language seem to rely in some good measure on RH function. Moreover, paradigmatic tasks known to elicit primarily LH brain activity can be slightly adjusted to elicit increases in RH activity, if more distant semantic associations are involved. For instance, generating the first verb that comes to mind when reading a noun elicits predominantly LH frontal activity, but generating a novel or unusually associated verb predominately increases activity in the RH, compared to generating the first verb (Abduallaev and Posner, 1997; Seger et al. 2000).

Any successful theory of language asymmetries must account for all of these facts. One long-favored view is that only the LH possesses the requisite neural machinery for language processing. A common explanation is that evolution favored a single hemisphere to control speech, and that other aspects of language processing could interact with speech more efficiently if organized within the same hemisphere. By evolutionary chance (or perhaps for reasons associated with right-hand tool use), the LH gained control of speech, and thus the brain evolved to have language centers (performing various component processes that continue to be enumerated) only within the LH. On this view, all contributions of the RH for understanding language are merely paralinguistic, that is, outside the realm of pure language processing. It is easy to see how this applies to prosody; moreover, it is often also applied to the higher-level language processes for which the RH seems important, described previously.

This LH-only view has the advantage of easily explaining the association of classic aphasia with LH lesions. However, it suffers from several disadvantages. First, it is merely descriptive, failing to explain how the LH, but not the RH, is able to process language. It may be true that the left planum

temporale (near Wernicke's area) or the left Broca's area, or both, are slightly larger than their RH counterparts, but these asymmetries seem imperfectly correlated with language laterality (e.g., Gannon et al. 1998; Moffat, Hampson, and Lee 1998). Second, the LH-only view has difficulty parsimoniously accounting for RH involvement in language recovery from aphasia following LH brain damage (or entire hemispherectomy in children). Although the brain is famously plastic, there are limits to plasticity, and it seems prima facie unlikely that a brain area having nothing to do with language prior to injury (e.g., one that processes visuospatial information) could, after LH injury, rewire itself to suddenly perform language processing. Furthermore, the LH-only view does not incorporate language comprehension subprocesses to which the RH is known to contribute.

The "LH superiority" view is a slightly less extreme theory, maintaining that the LH is greatly superior to the RH at most or all language processing, although there may be a range of RH linguistic ability (or bilaterality) among different individuals. Some theorists hold a hybrid view, that the RH is inferior at some processes but completely lacking in others, such as syntactic processing or speech production. Such LH superior views describe fairly well, without explaining, the aforementioned phenomena regarding language asymmetries, and may better account for RH involvement in language recovery. Specifically, patients who suffer extensive damage to the LH early in life may recover language very well because developmental plasticity permits a rewiring of the rudimentary language systems in the RH to take over that function. This is more likely than, say, rewiring a visuospatial processing system to suddenly perform language function. However, while plausible, it seems uneconomical for large cortical regions to be poorly functioning "backup" systems that only retune to serve useful purposes in the event that the primary language systems, all in the LH, are severely impaired.

Finally, a more recent class of theories is that the two hemispheres both process all (or nearly all) aspects of language but compute the information in slightly different manners, each type of computation conveying advantages for different sets of tasks. Such *computational asymmetry* views do not posit equality in language ability, but rather assert that when cooperating with an intact LH, the RH makes unique and significant contributions to language processing. Furthermore, they provide, to varying degrees, some causal explanation for the observed asymmetries of language function.

For instance, one theory asserts that relatively fine coding of information by LH language areas permits rapid categorization and selection of information (Thompson-Schill et al. 1997) that is fundamental to many language functions. When speaking a word, for instance, people must select one lexical and phonological representation to articulate; for example, they must choose between *cup* and *mug*, but the precise duration, stress, and accent are less important. During comprehension, upon hearing the word *foot*, LH fine coding will strongly activate a small set of semantic features strongly related to the context (or to the dominant meaning, in absence of context). This is clearly beneficial, as comprehenders would quickly get bogged down if they fail to discern whether foot means a part of the body or a unit of measurement. Also, LH relatively fine semantic coding is unlikely to maintain activation of semantic features peripherally related to foot, such as the fact that it is susceptible to injury.

In contrast, the theory asserts that relatively coarse coding of information by RH language areas poorly serves such selection, because multiple lexical and phonological representations remain active. This is clearly disadvantageous for speech output. Coarser semantic coding explains why the RH shows more sensitivity to distant semantic associations in behavioral **PRIMING** (Chiarello et al. 2003) and electrophysiological studies (Federmeier and Kutas 1999). Thus, coarser coding allows for multiple word meanings, shades of meaning, and seemingly distant associations to remain active and contribute to the aspects of language comprehension that are relatively dependent on RH processing. For example, RH semantic processing is conducive to recognizing semantic overlap from multiple words that are each distantly related to a primed concept (Beeman et al. 1994). Thus, when people hear "Joan walked barefoot near some glass, then felt a stab of pain," coarser coding may help detect the semantic overlap that helps people infer that she cut her foot; as noted, multiple lines of evidence suggest the RH contributes to such connective inferences in important ways.

Some theorists also claim that computational asymmetries in language processing arise from documented asymmetries in neural microcircuitry of language areas, such as broader dendritic branching that expands input fields to pyramidal neurons (which constitute the majority of excitatory neurons in the cortex), thus proposing a causal mechanism (Jung-Beeman 2005; see also Hutsler and Galuske 2003). Furthermore, recovery from aphasia is readily explained by small changes in previously asymmetric microcircuitry, such as a slight retuning of dendritic branching, rather than wholesale rewiring of areas that were previously completely nonlinguistic, or merely paralinguistic.

– Mark Beeman

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ROLE AND REFERENCE GRAMMAR

Role and reference grammar (RRG) is a theory of the **SYNTAX-SEMANTICS-PRAGMATICS** interface (Van Valin 2005); its theoretical and descriptive constructs derive from the investigation of many non-Indo-European languages, yielding a theory with rather different approaches to the analysis and explanation of morphosyntactic phenomena. RRG posits only a single level of syntactic representation, corresponding to the actual form of the sentence; there are no abstract levels of representations or derivations, as in Chomskyan generative grammar. Moreover, no phonologically null elements are allowed in syntactic representations. The name of the theory comes from its view that much of grammar is an interaction between semantics (role) and discourse-pragmatics (reference). The organization of the theory is in Figure 1. There is a mapping between the syntactic and semantic representations, mediated by the linking algorithm. Discourse-pragmatics plays a role in this mapping, but the role varies across languages, leading to important typological differences among languages. It is represented in part by discourse representation structures (DRSs) taken from discourse representation theory.

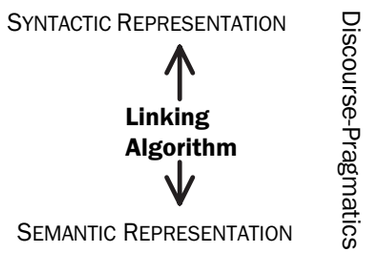

Figure 1. The organization of RRG.

The syntactic representation is called *the layered structure of the clause* and is composed of three interlocking projections: the constituent projection (predicate, arguments, adjuncts), the operator projection (grammatical categories like aspect, negation, tense), and the focus structure projection (information structure of the sentence, that is, the potential focus domain of the clause [where focus can potentially fall], the actual focus domain, and the presupposed, non-focus part). The semantic representation is an *Aktionsart*-based decompositional representation. **THEMATIC** *relations* are defined in terms of positions in the decompositions. More important are the semantic macroroles of actor and undergoer, which correspond to the two primary arguments in a transitive predication, either one of which can be the single argument of an intransitive predicate. Based on extensive typological evidence, RRG rejects traditional grammatical relations and instead posits a construction-specific concept, the privileged syntactic argument (PSA) of a particular construction.

The linking between syntax and semantics is bidirectional, reflecting production and comprehension. In semantics-to-syntax linking, the elements in the semantic representation are mapped into positions in a syntactic template, following both universal and language-specific principles. An example from English is given in Figure 2. In syntax-to-semantics linking, information about the syntactic-semantic function of arguments is derived from the overt morphosyntactic markings, and this is linked to the argument positions in the lexical representation of the predicate; a simple example is in Figure 3.

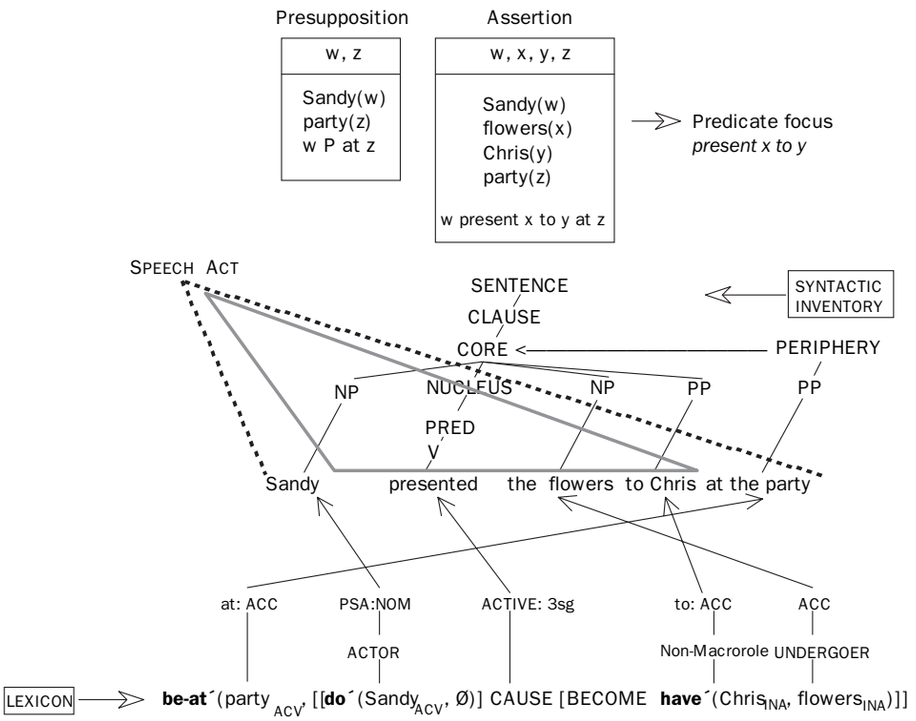

Figure 2. Linking from semantics to syntax. Constituent and focus structure projections shown, along with discourse representation structures.

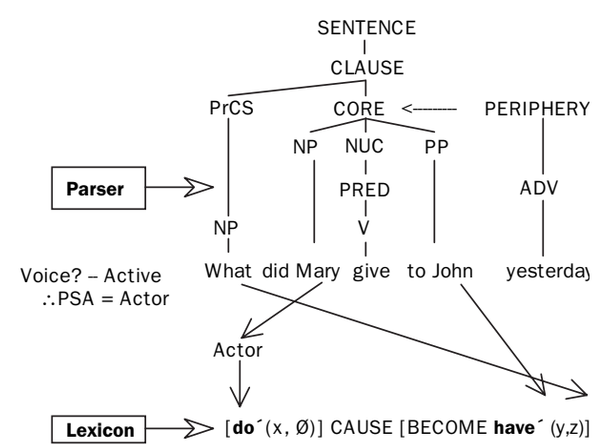

Figure 3. Linking from syntax to semantics.

Not only has work been done using RRG on a wide variety of languages, but there has also been psycholinguistic and neurolinguistic work done as well. RRG takes a cognitivist approach to language acquisition (see Van Valin 1998, 2001), as well as references on the RRG Web site). The application of RRG to the study of sentence processing is investigated in Bornkessel, Schlesewsky, and Van Valin (2004) and Van Valin (2006).

– Robert D. Van Valin, Jr.

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The best source for work and references relating to role and reference grammar is the RRG Web site. Available online at: http://linguistics.buffalo.edu/research/rrg.html.

RULE-FOLLOWING

In Ludwig Wittgenstein's late writings, one finds numerous interconnected remarks having to do with meaning, understanding, and rule-following – remarks in which Wittgenstein can seem to be continually circling around these topics without ever arriving at any definite conclusion. An exceptionally clear and compelling way into this material was provided by Saul Kripke in his influential 1982 book, *Wittgenstein on Rules and Private Language*. By presenting Wittgenstein's concerns in the form of a single extended argument, Kripke brought many readers to see that Wittgenstein's discussions of rule-following bear significantly on central issues in (among other things) contemporary philosophy of language. As Kripke recasts Wittgenstein's remarks, they amount to an argument for a radical form of skepticism – a skepticism according to which there are no facts about what we mean by any of our utterances or inscriptions. In what follows, a sketch is provided of the skeptical argument that Kripke finds in Wittgenstein's remarks on rule-following. That done, an effort is made to distinguish the actual, historical Wittgenstein from Kripke's reconstruction of him.

The Skeptic's Challenge

Suppose that I'm asked to add two numbers that I happen never before to have added together: I'm asked (let's say) "What's 68 plus 57?" I think for a moment and reply "125." Kripke imagines a "bizarre sceptic" (1982, 8) who contests this answer. The skeptic suggests that, given what I've always meant by the word "plus" in the past, the correct answer to "What's 68 plus 57?" is not 125. For in the past, he says, what I meant by "plus" might have been a function – call it the "quus" function – that yields 5, rather than 125, given the arguments 68 and 57. By hypothesis, the quus function is consistent with all of the "sums" that I have computed before today. (Imagine that the *only* difference between the quus function and the plus function is that 68 quus 57 – that is, the "quum" of 68 and 57 – is 5.) Kripke's skeptic challenges me to show that, in the past, when I used the word "plus" (or "addition" or "sum"), what I meant was *plus* (*addition, sum)* rather than *quus* (*quaddition, quum*). I'm to show this by citing a fact or set of facts about my former self.

Although the skeptic's challenge concerns my use of a mathematical expression, it is important to understand that what's at issue has nothing especially to do with mathematics. I might just as well have been challenged to show that in the past I meant *horse* by "horse." If the skeptic can secure his conclusion concerning my past uses of "plus," the point will generalize – from "plus" to other words and from past uses to present ones. The conclusion he seeks is that there are no facts of the matter about what I, or anyone, ever meant, or mean, by any utterance or inscription. The argument may be understood to proceed by a process of elimination. Kripke adduces various answers to the skeptic's challenge and, one by one, shows each to be unsatisfactory.

Interpretationalism

Perhaps the most natural reply to the skeptic would make appeal to the notion of a rule or interpretation in something like the following manner: When I learned to add, and so learned what "plus" (and "+") mean, I didn't merely memorize the answers to a finite list of addition problems. I learned a rule for addition (and so for using "plus" or "+") that determines the sum of any pair of numbers, regardless of whether I happen to have yet encountered them. That the correct answer to "What is 68 + 57?" is 125, rather than 5, is determined by this rule – a rule that, Kripke suggests, might have taken the following form:

> Take a huge bunch of marbles. First count out x marbles in one heap. Then count out y marbles in another. Put the two heaps together and count out the number of marbles in the union thus formed. The result is $x + y$. (Kripke 1982, 15)

The problem with this sort of answer to the skeptic's challenge is *not* that I may be misremembering the rule – the interpretation of "+" – that I learned as a child. The skeptic is happy to grant that as a child I learned precisely this formulation and that I remember it clearly to this day. But he questions how this rule – let's call it R – ought to be understood. While the skeptic allows that R is the interpretation that I've long assigned to the plus sign, he claims that I am, at present, misapplying R. He suggests that given what, in the past, I meant by the word "count," the result that a correct application of R would yield, given "68 + 57," is 5.

At this point, I might reply to the skeptic by recalling an interpretation of the word "count" that I also internalized as a child. But he will just make the same sort of move again: He'll grant me the remembered interpretation and suggest that I am, at present, misapplying it. Thus, each new interpretation that I adduce seems to require another one standing behind it, and an infinite regress threatens. The moral – the problem with what might be called *interpretationalism* – may be put as follows: However tempting it is to say that our words derive their meanings from rules or interpretations, saying this just leaves us with the question of where these rules or interpretations get *their* meanings.

Dispositionalism

Another kind of reply to Kripke's skeptic would appeal to dispositions rather than to interpretations or rules. Thus, the skeptic's challenge might be answered as follows: While I have never before added 68 and 57, it's nonetheless true that *had* I been asked to add these numbers, I *would* have arrived at the answer 125. My having meant *plus* (rather than *quus*) by "plus" consists in my having been so disposed – disposed to answer questions of the form "What is x plus y?" with the sum (and not the quum) of x and y.

A problem with this sort of *dispositionalism* becomes apparent when one considers the fact that speakers are sometimes disposed to make mistakes. Imagine that when I'm sleepy, I am disposed to answer 115 if someone asks me to add 68 and 57. We don't want an account of meaning according to which it would follow from this that when I'm sleepy, what I mean by "plus" is not addition but, instead, some function that yields 115, given 68 and 57 as arguments. Or consider a nonmathematical example: It might be that I have a disposition to answer the question "Is that a horse?" affirmatively when I'm shown an albino

zebra or a donkey in dim light. Our account of meaning had better not commit us to claiming that the word "horse" in my idiolect therefore includes albino zebras and dimly lit donkeys in its extension.

A further problem with the dispositionalist answer to Kripke's skeptic (one that Kripke himself does not discuss) is this: The dispositionalist – at least as we (following Kripke) have imagined him or her – takes it as a datum that for much of my life, I have been disposed to answer 125 in response to being asked for the sum of 68 and 57 (disposed, as Kripke puts it, "when asked for any sum '$x + y$' to give the sum of x and y as the answer" [1982, 22]). But to say any such thing is to give a thoroughly *intentional* characterization of my behavior – to describe me not merely as having a disposition to produce certain physically describable movements and sounds (under some set of physically describable conditions), but as being disposed to *answer a question* in a particular way, that is, to *say* something – something with a particular semantic content – in response to being *asked* something. Thus dispositionalism, at least as we've imagined it, takes for granted the phenomenon (semantic content, meaning) that it pretends to vindicate and explain – the very phenomenon that Kripke's skeptic calls into doubt.

Reductionism and Platonism

As these and other replies to Kripke's skeptic are tried and shown to be unworkable, it begins to look as if there may be no way to meet his challenge – that is, no way to justify my present answer to the question "What's 68 plus 57?" by adducing facts that constitute my having meant *plus* by "plus." Perhaps the chief virtue of Kripke's book on Wittgenstein is that it makes a strong case for thinking that persons' meaning something by their words cannot be reduced to a set of, as it were, semantically neutral facts – nonintentionally characterized truths concerning, for example, their (or, for that matter, their community's) behavior or dispositions to behave. As Kripke reads Wittgenstein, however, the latter takes the failure of this sort of reductionism to show that there are no facts about what persons mean by any of their utterances or inscriptions. (Or, anyway, this is how Kripke's book is most often read. There are grounds for claiming that he equivocates on the question of how much Wittgenstein ultimately grants to the skeptic.) If one is convinced that meaning-facts cannot be reduced to semantically neutral ones, must one accept this skeptical conclusion? Why not instead reject *reductionism* about meaning? Why not claim, for example, that I have always meant *plus*, not *quus*, by "plus" – but that this fact about me does not "consist in" any set of facts that could be characterized without recourse to intentional vocabulary? Notice that given such a claim, my inability to satisfy Kripke's skeptic wouldn't come with any earth-shaking skeptical implications. But to many philosophers – Kripke's Wittgenstein among them – this sort of anti-reductionism is liable to look like a kind of mystery-mongering *Platonism*.

Think of Platonism as a desperate attempt to resuscitate (what's referred to as) interpretationalism by blocking the infinite regress that seems to undermine it. Platonism represents meanings as mysterious regress stoppers that stand behind our in-themselves-empty utterances and inscriptions – *super*interpretations that, unlike mere vocalizations or marks on a page, neither need nor brook any further interpretation. Wittgenstein characterizes the impulse toward this sort of position when he writes, "What one wishes to say is: 'Every sign is capable of interpretation; but the *meaning* mustn't be capable of interpretation. It is the last interpretation.'" (Wittgenstein 1958, 34). Platonism *is* a target of criticism in his late writings. But it is a mistake to read Wittgenstein as holding that in order to reject reductionism of the sort that Kripke's skeptic presupposes, one must embrace Platonism.

To get Wittgenstein's response to Platonism into view requires that one appreciate how much the semantic skeptic, the interpretationalist, the dispositionalist, and the platonist have *in common*. All four see our communicative activities as the production of in-themselves-meaningless movements, noises, and marks. All four agree, in effect, with Wittgenstein's interlocutor at *Philosophical Investigations* §431 when he says, "The *order* – why, that is nothing but sounds, ink-marks" (1953). Disagreement arises concerning how best to answer a question that might be put as follows: "What, if anything, gives semantic significance to the (mere) sounds and ink-marks that our orders, assertions, questions, greetings, and so on really are?" Wittgenstein does not offer a fifth answer to this question. Instead, he tries to expose and undermine the philosophical moves that make it seem pressing, moves whose effect is to induce us, first, to consider our words apart from the contexts in which they *have* semantic significance – thus giving them the appearance of being nothing more than "sounds, ink marks" – and, then, to search in vain for the special somethings (interpretations or dispositions or meanings-in-the-sky) that, as it were, bestow significance upon the now flat-seeming words.

Wittgenstein understands this seeming flatness as a kind of self-induced illusion. If he is right, freeing oneself from this illusion would allow one to reject the sort of reductionism that Kripke's skeptic takes for granted *without* lapsing into Platonism.

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