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Spoken Language Production: A Psycholinguistic Approach

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p0005 Talking is action. Like most action, it is shaped by motives of many kinds. The study of language production in contemporary psycholinguistics centers on how different kinds of motives affect how people talk or, more broadly, how they convey information in language. In theory, the motives range from intentions to convey particular pieces of information, to desires to impress listeners with one's erudition or eloquence, to aims to articulate clearly and fluently, and everything in between. All these facets of communication are relevant to understanding language production. In current practice, most research focuses on how speakers accomplish the most rudimentary of their goals: producing utterances in English—or in Dutch, French, Polish, or whatever the language of custom may be.

p0010 Simple and straightforward though this may seem, it is far from easy to explain how speakers accomplish this action. Producing an effective utterance (one that says what the speaker means) in any language demands recruiting and deploying the linguistic resources appropriate for communicating one's thoughts. At the outset, it calls for being able to think in ways that are readily converted into language, or "thinking for speaking" (Slobin, 1996). Secondarily, it means bringing to mind words or morphemes that are suitable for conveying the thought, arranging the words or morphemes in the way the language requires so as to mean to the listener what the speaker means to say, and energizing the arrangements into sound forms through the actions of the speech musculature.

p0015 Just in case this process sounds easy, consider it in the following terms. A speaker of English who is about to describe where she lives must think about her residence in terms of some coordinate system that is, minimally, expressible in English and, desirably, comprehensible to an English-speaking listener. One precise way to do this is in terms of latitude and longitude: The house is located at 45.000688° north and 85.375743° west. However, someone who thinks to speak in these terms is unlikely to succeed in communicating information that is useful to a typical listener. A better tactic is to take account of where and why the conversation is taking place and what the listener knows and cares about, to consider what AU:1 is called 'common ground' (Clark, 1996) in language, experience, and conversational aims. An important component of this form of perspective-taking is the speaker's retrieval of information about the listener from memory (Horton and Gerrig, 2002).

p0020 Having sketched some thought with the intention of communicating it, the speaker has the beginnings of what we term a 'message.' To transform the message into language and then into actual speech means retrieving from memory a tiny subset of the more than 45,000 words that an English-speaking high-school graduate knows, arranging them into one or more of the roughly 10^{30} relatively short English sentences, forming the necessary syllables from the 14,000 or so syllables that English includes, and articulating the syllables at a rate of roughly five per second, using more muscle fibers than any other mechanical performance of the human body (Fink, 1986). Speaking could be an Olympic sport were it not mastered so universally.

p0025 Because speaking *is* so universally mastered, one tends to take it for granted. To better appreciate this not-so-simple ability for what it is, we examine in this article some of the old and new discoveries of psycholinguistics that illuminate what goes on behind the scenes during mundane speech events. The discoveries rest on observations of spontaneous speech in natural settings, as well as on controlled experimental tests of language production in laboratory settings. In this brief survey, we limit ourselves to the psycholinguistic demands of creating messages, finding words, creating structures, assembling phrases, and producing words. For each of these topics, we focus on a particular phenomenon that discloses hidden challenges that speakers confront in the course of speaking and briefly review what is known about how the challenges are normally surmounted. Our survey neglects some fundamental facets of speaking, including most of the pragmatic and phonological processes that, respectively, start and end individual speech events. For excellent reviews of these topics, see Clark (1996), Dell and Sullivan (2004), and AU:2 Levelt, Roelofs, and Meyer (1999).

Message-Making

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p0030 How humans come to have communicative intentions (or intentions of any kind) is an epistemological mystery shrouded in philosophical controversy. How fluent speakers create from their communicative intentions a set of communicable meanings is closer to becoming a scientific problem that is amenable to careful observation and controlled investigation. One

way in which the problem is tackled is by comparing the ways in which speakers of different languages go about forming messages. Consider a far-reaching difference between English and Chinese: To use appropriately singular and plural nouns and pronouns and the verbs that agree with them, English speakers must engage in rudimentary number cognition in virtually every utterance they produce. In contrast, Chinese speakers can ignore such distinctions because nothing in their language requires them. Are English speakers generally more attentive or sensitive to number differences than Chinese speakers and therefore more likely to include the information in their messages, simply *because* of this language difference?

p0035 The intuitive sense in such questions motivates the perennial appeal of an idea made famous by Sapir (1921) and Whorf (1956). According to the 'linguistic relativity' hypothesis, speakers of different languages experience their shared world in different ways, with the differences filtered through the lexical and grammatical devices of language. Slobin's (1996) thinking-for-speaking hypothesis is a more conservative variant of linguistic relativity that is specific to the question of making messages. Thinking-for-speaking implies that speakers must learn to conceptualize the kinds of distinctions that matter in the languages they speak, because the requirements differ among languages. In short, English speakers may have to think-to-speak number in ways that are unnecessary, and maybe even impossible, for speakers of languages that treat number differently or do not treat it at all (cf. Gordon, 2004).

p0040 Unfortunately, the attractions of the linguistic relativity hypothesis are more than matched by the challenges of defining and testing it satisfactorily. Lucy (1992) provided a sympathetic analysis of the definitional problem; Pullum (1989) dispelled the many myths surrounding one familiar Whorfian claim—that Eskimos experience snow differently because their languages seem to have many words for snow. Tests of the hypothesis suffer from these pitfalls—(1) those inherent in the disparate cultures and environments of people from disparate linguistic backgrounds (for example, the residents of Amazonian jungles differ from the residents of American suburbs in ways that go beyond language), (2) eliminating the contaminating effects of language from administration and performance of the experimental tests (important because the hypothesis has to do with an enduring impact of language on nonlinguistic cognition), and (3) interpreting any differences obtained in terms of linguistic relativity. However, there are provocative results consistent with the relativity hypothesis (Roberson *et al.,* 2000; Boroditsky, 2001; Bowerman and Levinson, 2001; Gordon, 2004), as well as continuing controversy (Levinson *et al*., 2002; Li and Gleitman, 2002). AU:3

p0045 The properties of messages, as opposed to their contents, have begun to be illuminated in research on referential communication. One such property, a definitional property, is that messages are pre-verbal: They lack most of the trappings of language. The recollections of a victim of transient aphasia offer striking testimony to the absence of words in messages. His experience "was one of being fully aware of the target *idea* yet totally unable to accomplish what normally feels like the single act of finding-and-saying-the-word …. The idea … was as complete and full as any idea one might have normally, but was not an unspoken mental sentence" (Ashcraft, 1993: 49).

p0050 One consequence of the pre-verbal nature of messages is that speakers cannot tell in advance when a message will give rise to linguistic ambiguity, and so speakers do not reliably disambiguate utterances that are made ambiguous by properties of the language. When a scene contains both a baseball bat and a flying (mammal) bat, speakers referring to just one of the objects are likely to call it a *bat*, failing to realize that from a listener's perspective, there are two *bats* (Ferreira *et al*., in press). This does not AU:4 seem to be due to sheer egocentricity on the part of speakers, because they do try to avoid ambiguity when it has a perceptual or conceptual basis. People describing scenes that contain the kinds of perceptual or conceptual similarities that make for referential ambiguities (e.g., a large and a small baseball bat) reliably refer to them with discriminating adjectives (e.g., *large* or *small;* Ferreira *et al*., in press).

p0055 To frame messages in ways that are comprehensible to listeners, speakers may have to draw on fairly explicit experience about the kinds of information that listeners need. One supposes that frequent callers to an office in which two men are named Dave typically add the surname; if there is only one Dave or if the caller is unaware of the multiple Daves, the surname may be omitted more often. However, in many circumstances, speakers have to work hard enough merely to transform messages into language that they do not engage in the perspective-taking required to reckon with what listeners do and do not know (Brown and Dell, 1987; Keysar *et al.,* 2003). This transformation c into language omprises the coordinated processes of finding words, assembling syntactic structures, and fitting words and structures together.

Finding Words

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p0060 Words serve to invoke concepts. They do this by using largely arbitrary phonological emblems: The English

rabbit is *konijn* in Dutch, *lapin* in French, and *królik* in Polish. To bridge the divide between meaning and sound in production, many theories postulate that there is an intermediate retrieval step in the transition from a concept to the sound form that conventionally conveys the relevant meaning. Because messages are not represented linguistically, appropriate words must be located within or retrieved from the vast mental dictionary in a speaker's memory. Word-finding occurs as part of a process of grammatical encoding, in which messages are transformed into abstract linguistic codes. The abstract codes for words are called 'lemmas' (Kempen and Huijbers, 1983; Levelt *et al.,* 1999) or 'lexical entries,' foyers of the mental lexicon (Bock, 1995).

p0065 Lexical entries may be located on the basis of meaning, of syntactic category information (e.g., noun, verb), and of the morphological or phonological forms with which they are associated. Entries are therefore accessible from messages, from the structural procedures that play out words into connected speech, and from sound (during comprehension or from recurrence within the production system). These multiple avenues make the lexical entryway a busy intersection in the process of production, as well as in comprehension (Levelt *et al.,* 1999), and the target of research aimed at uncovering how the intersection works. Two issues have received considerable attention: (1) the relative separability of the semantic, grammatical, and phonological properties of words and (2) facilitation of retrieval by context, codability, and word frequency.

p0070 Regarding the separability of semantic, grammatical, and phonological properties, two familiar phenomena from the experience of normal speakers have been turned into tools for exploring how and how well different types of information are linked in the mental lexicon. One phenomenon is the tip-of-the-tongue (TOT) state, in which a known word eludes retrieval. TOT states offer abundant evidence for some separation of what a word means from how it sounds, because speakers can be fully aware of the meaning for which they are seeking a word without being able to come up with the word's form (Burke AU:5 *et al.,* 1991). Speakers in this state may also report correct word-specific grammatical information, such as syntactic class or grammatical gender information (e.g., Vigliocco *et al.,* 1997). Anomic patients show the same dissociation between retrieval of grammatical information and sound information (Badecker *et al.,* 1995). This means that a speaker of Italian (for example) may know that a sought-for word is grammatically feminine without knowing anything about how the word sounds.

p0075 Error in speech is a second familiar phenomenon that also points to a separation of meaning and sound in lexical retrieval. The majority of speech errors tend to involve either whole words (which are retrieved on the basis of meanings in messages) or individual sounds (which are retrieved from lexical entries; Dell, 1995). The implication of this distribution of errors is that production involves processes that manipulate words and processes that manipulate phonemes. Whole-word errors can also reflect these two kinds of processes. Word-substitution errors sometimes show the influence of similarities of meaning (e.g., saying "tomorrow" instead of "yesterday") and sometimes of form (e.g., saying "conversation" instead of "compensation"). Errors of these and other types have served as the basis for influential theories of word and sentence production in both normal (Fromkin, 1971; Garrett, 1975; Dell, 1986; Garrett, 1988) and aphasic speakers (Garrett, 1992; Dell *et al.,* 1997; Foygel and Dell, 2000).

p0080 Another influential approach to word production emphasizes a different kind of evidence for the separation of meaning and sound, evidence about the speed with which the meanings and sounds of words are recovered during the naming of pictured objects (Levelt *et al.,* 1991). A strong intepretation of these data is that the retrieval of semantic and grammatical information strictly precedes the retrieval of phonological information (Levelt *et al*., 1999). On this point, however, there is controversy. Although models of word production generally agree on a representational separation between lexical entries and phonological form in the mental lexicon (but see Caramazza, 1997), there is mounting evidence that, in the course of production, the temporal separation is not absolute. As candidate words for expressing messages are located, it seems that their corresponding word forms become active even before the speaker settles on which candidate to select.

p0085 So although semantic effects tend to be obtained early and phonological effects late during object naming (Schriefers *et al.,* 1990), the impact of phonological information can be observed before the semantically driven processes that settle on what word to use have run their course (Peterson and Savoy, 1998; Cutting and Ferreira, 1999). The concurrent activity of meaning and sound during word production can also be called on to explain errors that combine both semantic and phonological features of intended words (e.g., saying *rat* when *cat* was intended) and the tendency for sound errors to create real words at rates above chance (Dell and Reich, 1980; Dell, 1986; Martin *et al.,* 1989). The concurrent activity of meaning and sound constitutes

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a challenge to theories that posit discrete stages in word production.

p0090 The semantic and phonological properties of words are linked respectively to two powerful forces in word finding: conceptual accessibility and word-form frequency. The meanings of words vary in how specific they are, with some having a rich, coherent set of properties and others a weak and fairly sparse set. Because retrievability depends in part on the goodness of the match between the retrieval context (e.g., the circumstances in which a to-be-named referent presents itself) and the information associated with a word's meaning in memory, contexts with many relevant cues can facilitate naming in comparison to AU:9 contexts with fewer cues (Griffin and Bock, 1998). Complementarily, words with sparser semantic representations (e.g., proper names and abstract words), are harder to retrieve than words with richer representations (e.g., concrete words), other things being equal (Burke *et al.,* 1991).

p0095 The frequency with which words are produced has long been known to affect how quickly or easily they are uttered. Higher-frequency words are produced faster than low-frequency word forms (Oldfield and AU:10 Wingfield, 1965), with an estimated decrease in production latency of roughly 30 msec for each $\log_{10}$ unit of frequency per million words in print (Glaser, 1992). The phenomenon of 'frequency inheritance' suggests that frequency affects the retrieval of word forms more than access to lexical entries proper. Frequency inheritance refers to a finding that the production of low-frequency words (e.g., *wee*) benefits from the presence in the lexicon of high-frequency homophones (e.g., *we*; Dell, 1990; Jescheniak and Levelt, AU:11 1994) that are unrelated in meaning.

s0015 Creating Structures

p0100 There is more to sentence production than finding individual words. Even the speech that adults address to 9-month-old infants consists predominantly of multiword utterances. Setting aside vocatives and interjections, over 90% of what adults say to babies consists of more than one word (van de Weijer, 1999). The word groups that we produce combine in ways that are much more than the sums of their word parts, thanks to the workings of syntax.

p0105 The building of sentence structure is one of the most crucial but least understood facets of language production. This ability is crucial because, without a facility for assembling novel arrangements of words on the fly, speakers would be unable to adapt old thoughts to expression in new settings or to convey new ideas to anyone. Try to imagine freedom of thought with inflexible speech, leaving humans without the linguistic means to express new messages. The topic of structural formulation is also controversial because of its natural links to ongoing debates over the linguistic nature of syntax (Harris, 1993) and to the long-standing discomfort of some psychologists with structural abstractions (Bock, 1990). It is undeniable that connected speech is more than a limning of meaning, more than a string of words, and considerably more than "motor habits in the larynx" (Watson, 1913). AU:12

p0110 Vivid testimony to the structural underpinnings of everyday utterances again comes from the occurrence of speech errors. Intending to say "I got into a discussion with this guy" and instead saying "I got into this guy with a discussion" (Garrett, 1980) illustrates several truisms about the structural scaffolding behind words. First, something more than meaning guides word placement, because the typical products of errors are nonsensical, yet grammatical. Second, there are patterns in errors that disclose what are the mechanisms of arrangement. Considering words in terms of their structural form classes rather than their meanings makes it evident that form class (e.g., noun, preposition, adjective) matters a great deal to structural assembly: Words that are confused in errors are very likely to represent the same form class, as though the assembly process at some point selects words in terms of their structural rather than their semantic suitability. AU:13

p0115 Structural features of utterances also come to the fore in explaining the intricacies of that most scorned topic in English grammar, subject-verb number agreement. Despite its effete overtones, agreement is in fact something that speakers do not only routinely (more than once every few seconds in running speech) but also with surprising accuracy (even 4-year-olds get it right 94% of the time; Keeney and Wolfe, 1974). AU:14 Consider what is involved in producing subject-verb agreement. First, speakers must understand what constitutes a subject. It is not just the first word or phrase in a sentence, because questions (cf. 'What *is* your name?' and 'What *are* your names?') and subordinate clauses of various kinds put subjects in other positions. Subjects are not associated with specific meanings reliably enough to predict the properties of normal agreement, and even those meanings that are most typical of subjects are no more reliable agreement controllers than atypical meanings (Bock and Miller, 1991). Even nonsensical sentences demand normal agreement: Colorless green ideas *sleep*, not *sleeps*, furiously. What is crucial is not meaning, but the structural relationship to the rest of the sentence in which a subject appears. Second, speakers must determine what the verb is and which part of the verb carries number. Finally, there is the

problem of determining what the number of the verb should be. There are competing theories about how this is determined (Eberhard *et al.,* in press, provide a review), but a traditional idea is that the number of the subject controls the number of the verb.

How do speakers decide on the number of the subject? Typically, the main considerations are the numerosity of the referent of the subject noun phrase (one or more than one thing), the lexical-grammatical number of the subject noun (singular or plural), and the presence in an utterance of plural nouns that are not the subject. The roles of referent numerosity and grammatical number are fairly obvious: When a referent comprises more than one thing, English speakers are likely to select plural nouns, and plural head nouns make for plural subjects. Nonetheless, the comparative contributions to agreement of the referential underpinnings and lexical contents of agreement controllers fuel a continuing debate (Middleton and Bock, 2004).

The presence of nonsubject plural nouns in an utterance creates a tendency toward a type of error in agreement called 'attraction.' Attraction is illustrated in the statement, *The time for fun and games are over.* Like other kinds of errors, attraction discloses some of the mechanisms behind normal, error-free language production. Among its most salient properties are two that point to the structural underpinnings of agreement. First, attraction does not occur willy-nilly, but respects basic structural boundaries: Verbs are more attracted to nouns in their immediate structural vicinity than in their immediate temporal vicinity (that is, in the word string). For instance, they are more attracted to nouns within their own clauses than to nouns in other clauses, even when both nouns immediately precede the verb (Bock and Cutting, 1993).

Second, attracted verbs do not simply take whatever number is seemingly dictated by a neighboring noun; by and large, plurals are more likely to create attraction than singulars. Among other implications, this means that attraction is not the mistaken implementation of agreement with something that is not the subject; if it were, errors like *The king of the islands were cruel* (plural attraction) and *The kings of the island was cruel* (singular attraction) should be about equally likely. Because only plural attraction occurs reliably, despite the fact that plural verbs are in other respects less likely to err than singulars (Stemberger, 1985), it seems that what goes wrong is not agreement with the wrong subject, but rather agreement with the right subject that has somehow acquired the wrong number.

Another phenomenon that discloses the properties of the phrase-structure building in which speakers must engage is 'structural priming' (Bock, 1986). Speakers display a small but consistent tendency to echo the structures of utterances they themselves have recently heard or recently said. They do so even when the words and meanings conveyed by the echoed structure change between the first and subsequent occasions of use. These echoes are easy to find in spontaneous speech, as in this interchange from the Switchboard corpus about hanging wallpaper:

> Speaker B: "Repeating patterns is what you have to check for when you buy your paper."
> Speaker A: "Yes."
> •
> A: "That 's what I needed and I didn't think about that. I got a Mickey Mouse print is what I got."

In this exchange, the same structure displayed in the underlined words of Speaker B ("is what you have to check for") shows up later, twice, in Speaker A's speech, the second time in a comparatively awkward locution ("I got a Mickey Mouse print *is what I got*"). In establishing that the structures behind the words can drive this repetition, experimental work has shown that structural repetition occurs in the absence of lexical repetition (Branigan and Pickering, 1998; Bock, 1989), in the absence of event role similarity (Bock and Loebell, 1990), and even across languages (Loebell and Bock, 2003). It persists across time (Saffran and Martin, 1997; Boyland and Anderson, 1998; Corley and Scheepers, 2002) and over interruptions by other structures (Bock and Griffin, 2000) in both adults and children (Huttenlocher *et al.,* 2002, 2004). Although structural priming is initially enhanced when words are repeated (Pickering and Branigan, 1998; Cleland and Pickering, 2003), the enhancement fades fairly rapidly, leaving a persistent structural effect of the same magnitude that occurs in the absence of lexical repetition (Konopka and Bock, 2004). This suggests separable sources for the lexical and structural effects observed in studies of structural priming.

There are two competing theoretical accounts of structural priming. One (Pickering and Branigan, 1998) rests on activation in so-called combinatorial nodes that are claimed to be responsible for sentence structure. Because combinatorial nodes are linked to words with corresponding syntactic privileges, this approach readily explains the lexical enhancement of structural priming. The second kind of account emphasizes the abstract structure building behind priming and its persistence. An explicit model of the process treats priming as a kind of implicit learning with natural links to language acquisition in children (Chang *et al.*, 2004).

p0150 Structure building and lexical selection are heavily dependent on one another. The fact that speakers are more likely to echo a recently heard structure when what they say also repeats a word from a priming structure is one consequence of this dependence (Pickering and Branigan, 1998; Cleland and Pickering, 2003), and it can be interpreted in terms of the bindings that must occur between words and structures at the outset of sentence formulation. A second consequence is related to the fact that some words are easier to retrieve than others: They are more accessible. Accessible information, including accessible words and accessible expressions (Bock, 1982), tends to be produced before less accessible information, provided that there is a structure into which it fits (Bock *et al.*, 2004). That brings us to the topic of incrementality.

p0155 Incrementality is a requirement of the processes of spoken language production, simply because the vocal output channel is heavily restricted in what it can do. Words and the syllables that compose them are uttered one at a time: Even when two words erroneously blend together in speech (e.g., *slickery, flustrated*), they blend as a single word. The questions this poses for theories of production are (1) how incremental are the psycholinguistic preparation processes in the run up to speaking, (2) what are the units of incrementation, (3) and what is the target of incrementation. To complicate matters, each of these questions must be addressed for each type of psycholinguistic formulation that goes on in production: Included are at least the formulations of messages, words, syntactic structure, phonology (including prosody), and articulation.

p0160 Incrementation can be both hierarchical (Yngve, 1960; Kempen and Hoenkamp, 1987) and linear. The distinction between these two types of incrementation was drawn in terms of the timing of eye movements by Bock, Irwin, Davidson, and Levelt (2003). When speakers describe events in single sentences, their eye fixations on specific elements of the events tend to systematically precede the mention of those events during fluent speech (Meyer *et al.*, 1998; Griffin and Bock, 2001). This finding suggests that, at some level, planning may proceed roughly in terms of words or phrases in the order in which they occur. However, the existence of an underlying hierarchical component to planning is suggested by increased gaze durations, longer fixation latencies, and longer latencies to speech at the onset of utterances. This implies that in preparing an utterance, the scope of a plan extends beyond the upcoming word. Similar claims have been made on the basis of patterns of pausing, disfluency, and word repetition during spontaneous speech (Boomer, 1965; Clark and Wasow, 1998).

Conclusion

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Until relatively recently, the normal processes of adult language production garnered little systematic attention from either linguists or psycholinguists. The reasons are well known and often recited. How people talk is hard to study (Bock, 1996) and easy to dismiss as a viable scientific problem (Fodor, 1983; Chomsky, 1986). Both of these issues have receded in importance. There are now valid, reliable methods for getting at the underpinnings of production, burgeoning scientific interest in the language production ability, and fertile controversy over its nature.

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We conclude with three questions about language production that remain far from a solution. From a linguistic standpoint, one puzzle about language production is how it relates to language comprehension. Linguistic communication works as well as it does because speakers and listeners know the same language, sharing a grammar and lexicon to encrypt and decrypt their ideas with a satisfactory degree of validity. Yet, do the grammar and lexicon function in the same ways during production and comprehension? Assuming a performance grammar, one that participates directly in processing and producing language (Kempen, in press), at issue is whether any coherent grammar could function in the same ways during understanding and speaking, while relying on the same basic mechanisms.

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From a psycholinguistic standpoint, the key question about language production is how speakers put their knowledge of language to use *along with* their perceptual, attentional, conceptual, and motor abilities to adequately convey particular meanings at particular places and times to particular audiences. Knowing a language, having a grammar, is just one piece of this intricate puzzle. The grammar must be dynamic and configured in a way that fluently interfaces with a speaker's perceptions (auditory, visual, kinesthetic), thoughts, and other actions (prominently including gesture; McNeill, 1992) to support efficient communication.

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The problem of integrating language with other cognitive and motor abilities is at the core of debates about the modularity of language and language processes (Fodor, 1983), a debate that is as relevant to the phenomena of language production as to language acquisition and comprehension (Bock and Kroch, 1989). If language abilities are no different in kind from other mental functions and skills, the question of integration, of interfacing language with other abilities, simply does not arise. What has to be explained, from this perspective, is how the stuff of general cognition can work to yield the human capacity to learn and use language.

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p0185 If language is different in kind from other abilities—that is, a genetically distinctive human endowment—the explanatory challenge is greater. There is not only the issue of the interface between language and cognition. The nature and origins of the language capacity have to be explained and without the advantages of the animal models that have informed broad theories of human learning, cognition, and action. The development of neuroimaging techniques holds some promise for filling this gap (Indefrey and Levelt, 2000), although the study of production in particular still presents enormous challenges to current technologies. For these reasons, the controversy over modularity continues to be an organizing theme in the psycholinguistic study of language, bearing as it does on the basic questions of who we are as a species and why we talk.

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