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1. ON THE EVOLVING CONNECTIONS BETWEEN PSYCHOLOGY AND LINGUISTICS *

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Over four decades ago the so-called Chomskyan revolution appeared to lay the foundation for a promising new partnership between linguistics and psychology. Many have now concluded, however, that the hopes originally expressed for this partnership were not realized. This chapter is about what went wrong and where we might go from here. The discussion first identifies three reasons why initial efforts at partnership may have been inherently flawed divergent criteria for choosing among competing theories, different ideas about what was to be explained, and different approaches to questions about biology and environment. I then argue that recent developments especially in associative learning theory, in cognitive neuroscience, and in linguistic theory may provide a more solid basis for partnership. Next, the chapter describes two possible ways that bridges between the disciplines might develop. One draws on recent psychological research on attention focusing and on linguistic research concerning language constructions. The other draws on the concept of affordances and perspective taking. The chapter concludes that an enduring partnership between linguistics and psychology may indeed now be possible and that there may be a special role for applied linguistics in this new development.

The relationship between psychology and linguistics has been a curious one. Both aim to understand the fundamental nature of language so there ought to be a very close working association between them. Chomksy (1965, 2000) has even suggested, on more than one occasion, that the work of linguistics can be interpreted as part of psychology. Indeed, 40 years ago the relationship was close. Nevertheless, relatively speaking, psychological research on language today is far less driven by recent advances in theoretical linguistics than it was then; similarly, a great deal of work in theoretical linguistics makes little reference to current developments in psychology. The current state of affairs is easily confirmed by

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comparing works cited at the end of journal articles and textbooks in the two disciplines; apart from historical background references, one finds relatively little bibliographical overlap in a great number of writings. The sad truth is that many psychologists interested in language have not kept up with recent developments in linguistics, especially in what is referred to as the dominant paradigm (Universal Grammar) and, it would also seem that many linguists are not aware of what is happening in psychology, especially in cognitive psychology and cognitive neuropsychology.

The debate about the fundamental nature of language has involved mostly theoretical linguists and experimental psychologists. Applied linguists certainly have an interest in this debate, but they have typically addressed quite different issues from those of concern to theoretical linguists. Davies (1999), for example, lists the following research areas applied linguists engage in: how to provide better language instruction, diagnose speech pathologies, train translators and interpreters, compose valid language examinations, evaluate school bilingual programs, measure literacy, analyze the language of a text, advise on educational or forensic matters related to language. The opportunity for close relations between psychology and applied linguistics in each of these domains is great, and a volume could no doubt be written about each. The present review, however, focuses on what has become, for better or worse, the dominant question that has brought psychologists and linguists into discussion with each other the question about the fundamental nature of language. As will be seen, there is emerging a new perspective that may be of special interest to applied linguists.

Why then, have the disciplines drifted apart? Can the answer suggest how a future collaboration might be more successful? Is a new partnership in the making? In this review, I identify some past barriers to cooperation between psychology and linguistics. I argue that these barriers appear to be dropping due to the rise of new research methodologies, and that we are now entering a time that may see a new convergence between the disciplines. Finally, I speculate about some possible directions that convergence could take, concluding that there may be an especially important role for applied linguists in this future collaboration.

The Past Four Decades

The Chomskyan revolution in linguistics of the late 1950s and 1960s stimulated a profound change in the way psychologists viewed language, making possible a new kind of collaboration with linguists (Lyons, 1991). This partnership was based on the belief that psychologists and linguists could now share a vision about the fundamental nature of language (Miller & Chomsky, 1963). Initial studies based on this new view were very encouraging, but ultimately the two disciplines drifted apart and the level of collaboration dropped significantly. A number of reasons for this drift have been discussed thoroughly elsewhere (e.g., Abrahamsen, 1987; McCauley, 1987; Reber, 1987; Sampson,

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1997; Tomasello, 1998). However, three points in particular are worth considering here because,
with hindsight, they might suggest why the partnership was bound to fail and they may point to a better way to build a bridge in the future.

Divergent Theory Building Criteria

In the 1960s, many psychologists treated the new insights from linguistics as a description of the grammar posited to underlie language competence. It was natural, therefore, to ask whether this linguistic grammar might serve as a specific theory of the brain's mental grammar. The story of how psychologists attempted to test this idea is interesting, but too long and complex to relate here; the important point is that after some early successes, most psychologists failed to be convinced that the then current theories of linguistic grammar could usefully serve as a theory of the brain's grammar (Reber, 1987; Tomasello, 1998). Psychological theory and linguistic theory appeared to be incompatible at some important level and psychologists and linguists, by and large, gave up looking for ways to reconcile their differences.

Why? Among the reasons for this failure is the following. Within their respective disciplines, linguists and psychologists necessarily have to choose from time to time between contending theoretical explanations for the phenomena they investigate. The choice is usually made, ideally, by deciding which contending theory best provides an account that generalizes over all relevant data in the domain while, at the same time, remaining as economical as possible in terms of theoretical elegance and simplicity. These decision guidelines serve as economy criteria for theory building and are intended to ensure that newly accepted theories do a better job than the ones they displace. The problem in the past was that linguists and psychologists generally differed regarding what the relevant data should be when applying these economy criteria. Psychologists tended to prefer theories that explained facts about language processing and development, while linguists generally favored theories that accounted for sentence relatedness as reflected in native speakers' intuitions. Initially, when the set of linguistic phenomena to account for was relatively small, psychological and linguistic theories about language could appear, without much difficulty, to be compatible with each other. Over time, however, more and more data about language intuitions and language processing were gathered. Theory building in the two disciplines inevitably moved in divergent directions, reflecting the fact that the theory builders, in trying to account for very different kinds of data, were using different economy criteria (Watt, 1970).

Divergent Approaches to Explanation

A related reason for the disciplines drifting apart has been their differing approaches to explanation. The dominant paradigm of linguistics, as it emerged during the revolution in linguistic theory in the late 1950s, asserted that there exists

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an innately determined, autonomously functioning Universal Grammar (UG), a language faculty or organ of mind (Chomsky, 1975; Lightfoot, 1999; Pinker, 1994). The goal of UG linguistics has been to provide a full characterization of this organ. The language faculty is distinguished from general cognitive systems insofar as it specifies, for all human languages, the way patterns underlying language are related to each other and to surface forms of the language. This organ of mind is said to predispose us to process linguistic information in ways that are highly specific to the language domain and unrelated to general cognitive processing. By consulting native speaker intuitions, it has been claimed that we can make inferences about the nature of this organ of mind.

In contrast, the dominant approach in psychology generally has been to focus on the cognitive and neurocognitive *processes* that underlie adaptation. Questions about language, then, are questions about how the human brain solves problems of communication, and the answers must take into account the variegated structure of the brain and its considerable, though not unlimited, plasticity (Bates, 1994). During the past four decades, many psychologists were able to accept, in principle at least, the UG inspired idea that there might be a highly specialized, cognitive module dedicated to language. After all, examples of brain specialization abound. Acceptance of this idea no doubt was further facilitated by the popular computer metaphor of the mind central to much of cognitive psychology. Nevertheless, there emerged a serious explanatory gap between psychologists and linguists on this issue. Psychologists generally were unsure how one could study the language faculty in relation to brain function, given that the faculty was characterized chiefly in terms of abstract, mathematical formalizations not mappable in any direct way onto observable behavior or brain systems.

Linguists objected that it was inappropriate to search for such simple, direct correspondences between the abstract characteristics of language and observable behavior and brain activity. In terms of Marr s (1982) distinctions regarding explanation, UG is a Level 1 theory, a computational theory of *what* is to be explained, not how language is implemented. The point of contention for many linguists and psychologists is whether the computational level of explanation is the only level that is appropriate and, if not, then how to link that level to explanations of the mechanism that are psychologically satisfying (see Black, 1970; Chomsky, 1970a; 1970b; Jackendoff, 1999). Ultimately, the issue appears to reduce to how separate or modular (Fodor, 1983) one believes language is in relation to other forms of cognition; if language is not separate, then the computational approach is not so compelling and may even be inappropriate (Marr, 1982, p. 356).

Recently, it should be noted, there has been an upsurge of interest in some new sources of data that may speak to the issue of a language faculty. This is research on individuals for whom there is a large discrepancy between their language and other cognitive abilities, or who have language disabilities that appear to be inherited (e.g., Gopnick & Crago, 1991; Smith & Tsimpli, 1995; Van der Lely, 1997). Some have interpreted these cases as support for the language

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faculty hypothesis (Newmeyer, 1997; Pinker, 1994); however, the topic remains controversial (see, for example, especially Bates, 1994; Bates, in press; and Leonard, 1998, for discussion). Regardless of where one stands with respect to these particular studies, the fact is that debate over the status of the constructs language faculty and organ of mind has not moved closer to a mutually accepted resolution in several decades, and this has served to weaken enthusiasm for the partnership.

Divergent Approaches to Biology and Environment

A third factor in the drift apart has been a difference between the *way* most psychologists and most UG linguists approach the question about how biology and environment contribute to language. UG linguists have generally been unimpressed with psychologists attempts to turn to learning-based explanations for language acquisition, citing the lack of sensitivity in their models to the deeper complexities of language structure. To many psychologists, however, it has often appeared that UG linguistics made recourse to what Dawkins (1986) called, in a different context, the argument from personal incredulity. This is the argument that, because one personally cannot see how a phenomenon can be explained within one framework, the only available alternative must therefore probably be true, even in the absence of specific evidence for it. The child s acquisition of a first language is a case in point here. UG linguists point out that all children master their first language despite the very complex and from the child s point of view arbitrary structure underlying it, and this acquisition is surprisingly rapid and occurs in an environment that provides few supportive instructional clues (Chomsky, 1965; Jackendoff, 1994; Lightfoot, 1999). Here we have the problem of the poverty of the stimulus or Plato s Problem. How is it that the child comes to know so much about language without support of the environment? To explain this early mastery, it was argued (and still is, for example, in Lightfoot 1999; but see Newmeyer, 1998, for a more nuanced position) that there *must* exist an innately determined, brain-based, language-specific organ of mind that somehow predisposes the child appropriately. The choice of this innateness solution to the problem of language acquisition is generally defended on the grounds that it is inconceivable that any plausible solution will ever be found solely within a general learning theory framework.

The UG linguists proposal that there exists a language organ dissociated from general cognition was received by psychologists with some interest at first. However, over time discussion became increasingly polarized, and this may be due in some measure to the *way* the case for an innate language faculty was made. UG advocates were perceived as dismissing learning frameworks virtually out of hand, claiming that they could never, in principle, provide a satisfactory account of language, even though no testable proposal was offered for the biological alternative (in part, no doubt, because psychological tests were not thought to be appropriate). The result was an impasse with no understanding among researchers in either discipline of what kind of evidence, even in principle, could persuade

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researchers in the other discipline and thereby help advance the discussion. Psychologists and linguists, by and large, went their separate ways. Psychologists focused on learning questions and UG linguists concentrated on developing fuller and more refined mathematical formalizations of the underlying properties of language structure. Almost no one pursued a neurocognitive search for the basis of innate universal language structures.

With hindsight, it might be concluded that these three contrasting ways of addressing questions about language — divergent criteria for choosing among competing theories, different ideas about what is to be explained, and dissimilar ways of addressing questions about biology and environment — probably doomed the partnership from the beginning. On a more optimistic note, perhaps we can now draw lessons about what is needed if interdisciplinary collaboration is to be successful in the future. Of course, one cannot legislate change. The differences just recounted were part and parcel of the two research cultures that existed at the time. Ultimately, we will see if new generations of researchers shift their views to make convergence possible. I think we are now witnessing such a shift in the making, for the reasons described in the next section.

Seeds of Convergence?

Recent developments suggest we may soon see a new era of collaboration between linguistics and psychology that, one hopes, will be more enduring. Three examples are noted here and the final one will be elaborated with respect to some possible avenues for convergence in the future.

Modeling Associative Learning

Until recently, many people thought that a simple associative learning system could not, even in principle, acquire behavior that had the rule-governed look of the language used by very young children. It was widely believed that learning systems consisting only of simple associative mechanisms could never abstract linguistic categories without some built-in (or "innate") predisposition to do so. However, the emergence of powerful new techniques for modeling associative learning, such as connectionist networks (Bechtel & Abrahamsen, 1991; Elman, Bates, Johnson, Karmiloff-Smith, Parisi, & Plunkett, 1996; Rumelhart & McClelland, 1987) and latent semantic analysis (Landauer & Dumais, 1997) are challenging these beliefs. Bechtel (1996), for example, has shown that, at least in principle, it is possible to train a connectionist network to acquire knowledge of abstract categories that underlie rule-governed behavior without building into the network prior knowledge of the rules or the categories. Rumelhart and McClelland (1987) demonstrated that a connectionist network can learn to correctly inflect regular and irregular verbs for the past tense and to generalize this behavior to new exemplars. All that the associative network contains at the start of learning is the ability to make and modify associations between its internal elements as a function of error correction feedback.

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Not everyone has concluded that such research succeeds in demonstrating that associative learning alone can account for the origins of rule-governed language abilities and this provides a solution to Plato s problem (Bechtel, 1996, p. 74 75; Pinker & Prince, 1988). Nevertheless, one can see a noteworthy shift in the debate. Connectionist models and latent semantic analysis can now be viewed, at a minimum, as existence proofs demonstrating the existence of associative learning systems with the following interesting properties: they can acquire rule-like behavior without prior knowledge of the rules, without having to compute the rule in the course of learning and without having a predisposition for working with rules built into them. The question, then, about what knowledge must be in the head for language to be learned (Bechtel, 1996) has now become an empirical question, whereas before it was one chiefly of speculation. The matter can now be decided by more modeling and experiments that match the output of ever more sophisticated associative models to data about what people do when they use language. That there has been a basic shift in the tone of debate can be seen by comparing, for example, linguists Wexler and Culicover (1980) with Pinker (1999), all supporters of the language faculty construct. In their book, Wexler and Culicover dismissed associative approaches to language learning in a line or two and then concluded In particular, no theory of acquisition can explain the acquisition of the rich and intricate system of syntax (1980, p. 2). Pinker (1999), on the other hand, discusses the data offered by connectionists on their own terms. Thus, although far from being resolved, questions about the poverty of the stimulus and Plato s Problem now appear amenable to research, given the powerful new modeling techniques developed in recent years.

Advances in the Neurosciences

Advances in recent decades in the neurosciences and in neurolinguistics have changed our appreciation of how language is implemented in the brain, compared to how matters were understood forty or more years ago. Our grasp of modularity, brain plasticity, domain specificity topics central to many of the concerns of linguists and psychologists has changed dramatically in the last four decades, chiefly because of the emergence of powerful new brain imaging techniques and the increased collaborative work of neuropsychologists and cognitive psychologists (Rugg, 1999). Questions about the brain that were stimulated by UG linguistics questions about a possible organ of mind, about the language faculty, about innate knowledge are undergoing reformulation in light of what is now known about the brain. In many respects, these advances may have rendered some of the previous theoretical differences irrelevant because the nature of the questions has changed (Bates, 1994, in press-b). For excellent reviews of the numerous developments in this field, see Brown and Hagoort (1999b), Gazzaniga (2000), Grodzinsky, Shapiro, and Swinney (2000), and Stemmer and Whitaker (1998).

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Two points merit comment here. First, complex functional systems such as attention and memory that in the past were referred to as faculties have been fractionated into components that are subserved by different areas of the brain. For example, Posner and his colleagues (e.g., Posner & Petersen, 1990) and others have identified anatomically distinct subsystems that carry out different functions of attention such as orienting to sensory events, detecting signals for conscious processing, maintaining a vigilant or alert state, exerting top-down executive control, and disengaging focus of attention. It is now clear that while regions of the brain carry out highly specialized activities, there is at the same time no single module for attention or consciousness; what we call attention is a complex activity of the whole brain carried out by a highly integrated (in a healthy brain) network of subsystems. The same is true for language. Language functions are not subserved by just one or two regions in the left hemisphere, as may once have been thought, but by a highly integrated network of subsystems widely distributed across the brain (Brown & Hagoort, 1999a). This has obvious implications for the idea of a language module or unitary language faculty subserving language acquisition.

The second point deserving mention is the finding that while, in most people, analogous regions of the brain tend to serve the same language functions (for example, grammatical functions tend to be carried out in frontal regions and anterior temporal regions of the left hemisphere, while semantic functions involving content or open class words tend to be carried out in the posterior cortex), the exact anatomical location of the functions can vary considerably from individual to individual. Moreover, these two subsystems have different sensitive periods for development; if normal development is altered, say by the early onset of deafness, then different brain regions may become responsible for some functions (Neville, Mills, & Lawson, 1992). Such findings point to the considerable plasticity of the brain, a fact which again requires re-evaluation of earlier ideas originating in both psychology and linguistics about how the brain may be specialized for language.

New Developments in Linguistics

Within linguistics itself, there have emerged new approaches challenging the central tenets of UG, approaches known variously as cognitive grammar, functional linguistics, and cognitive linguistics (e.g., Fauconnier, 1994; Givón 1995; Goldberg, 1995; Lakoff, 1987; Langacker 1987, 1991). These approaches challenge the need for many aspects of the formalist UG paradigm, in particular the constructs autonomous syntax, language faculty, and organ of mind. At the moment, there seems to be relatively little dialog between UG linguists and cognitive linguists, but a welcome and important exception is Newmeyer (1998). These new approaches, which I will refer to collectively as cognitive linguistics, are beginning to have a special appeal to psychologists (Ellis, 1999; Tomasello, 1998; Ungerer & Schmid, 1996).

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This development within linguistics has the potential for rebuilding a close partnership with psychology for the following main reason: proponents of cognitive linguistics have declared as their chief goal providing a *psychologically* plausible account of language. For example, Langacker (1998) writes that the movement called *cognitive linguistics*

> contrasts with formalist approaches by viewing language as an integral facet of cognition (not a separate module or mental faculty). Insofar as is possible, linguistic structure is analyzed in terms of more basic systems and abilities (e.g., perception, attention, categorization) from which it cannot be dissociated. (1998, p. 1).

Tomasello (1998) refers to these developments in linguistics as a New Psychology of Language. Of course, a simple declaration of intent does not guarantee success. In fact, I will argue below that more steps must be taken if the psychological content of cognitive linguistics is to be satisfactorily linked to psychology. Nevertheless, the cognitive in the new cognitive linguistics has the potential of providing a basis for collaboration.

Speculations on a Future Psychology-Linguistics Partnership

How might a bridge be built between psychology and this New Psychology of Language? By way of illustration, two examples intended to serve as starting points for thinking about new ways of developing a partnership are considered here. The first comes from a recent study on second language (L2) fluency and attention in our laboratory (Segalowitz & Frenkiel, in preparation) and provides an illustration of how research addressing linguistic constructions as cognitive schemata might converge with the broader psychological study of cognitive schemata. The second example builds on the psychological concept of affordances and the perspective taking approach described by MacWhinney (1999).

Attention Focusing and Linguistic Constructions

Language fluency can refer to many different things, including the extent of one's vocabulary, control over grammar, eloquence in the language, ability to write, speed of comprehension, ability to speak without hesitation, accuracy of understanding, skill in public speaking, ease of using the language in various situations, ability to translate, among others (Riggenbach, 2000; Schmidt, 1992). If we focus just on those aspects of fluency that reflect speed and ease of language processing, then fluency is not a topic one normally thinks about in terms of linguistic theory. In the way we have been accustomed to dividing up chores between psychology and linguistics, research on fluency (here, speed and ease of processing) should be about the operation of performance constraints and individual differences, and not about the underlying, fundamental nature of language itself. In this section, however, we will consider how studying such

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aspects of fluency might provide a way to address some questions about the basic nature of language.

Now, one of the tenets of cognitive linguistics is that linguistic constructions are cognitive schemata or, as Fauconnier (1994) puts it, devices that prompt the construction of schemata. A schema is the brain's representation of the understanding of an event a person thinks about or hears described in language; we might think of it, metaphorically, as a kind of map or diagram in the mind. Cognitive linguists work from the premise that linguistically prompted schemata are no different from the kind used in nonlinguistic behaviors (e.g., Langacker, 1987). Linguistic constructions reflect the way component elements are related to each other in a speaker's schema or mental representation of the thought being expressed. These constructions can be used to direct another person's attention while his or her own schema is progressively elaborated in the course of communication. For example, a speaker may use adverbial constructions to signal when something occurred (*before*), or use conjunctions to signal the logical connection between two events (*because*). Linguistic constructions are used to foreground and background certain elements within a schema (Langacker, 1987, 1991) and to place elements in proper relation to one another. In other words, the speaker or writer elicits a mental representation in the brain of the listener or reader by using available language packaging devices to affect schema building processes. In this view, a fluent L2 user will be one who can rapidly shift focus of attention from one dimension of schema building to another as a function of the linguistic constructions encountered during communication.

The ability to shift attention rapidly and flexibly is an important aspect of cognitive control. In our research, we have been interested in measuring individual differences in cognitive control as it relates to L2 skill development (Segalowitz, 2000). In the study to be summarized here, we asked whether a person's L2 fluency level, defined in our work as efficient language processing, is related to the ability to shift focus of attention in response to commonly used time words and logical connectives. We used time words which place events represented in a mental model of the world either closer to or further away from the present moment (*now, next, promptly, shortly;* or *afterward, later, tomorrow, never*). We also used causal connection words that link ideas in a mental model by indicating the presence or absence of a causal connection (*because, consequently, due to, therefore; although, but, despite, however*). Thus, for example, if someone says "I'll do it **now**" versus "I'll do it **later**," a fluent listener will construct a mental model or schema of what the speaker intends, and locate the part of that schema corresponding to the action somewhere on a time line. The word *now* places the action very close to the present moment on this time line, and *later* places it further away. Similarly, if someone says "John did well in his exams **because** he studied all night" versus "John did well in his exams **despite** partying all night," the listener will construct schemata that foreground the elements differently. *Because* indicates that the second idea (that he studied all night) is to

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be foregrounded as the cause of John doing well, whereas *despite* signals that the second idea (that he partied all night) is *not* the cause of John doing well.

We investigated the relationship between L2 fluency (speed of single word reading) and the linguistic control of attention focusing in English speaking university students with varying levels of ability in French. In the main part of the experiment, they had to perform an attention switching task based on a procedure developed by Rogers and Monsell (1995). In this task, they had to judge words presented one at a time. When a time word was shown, they pressed the left or right button to indicate if the word referred to a time near or far from the present moment. When a causal connection word was shown, they pressed to indicate whether the word referred to a cause being present or absent. The design of the study was such that every alternate trial required a switch from a time judgement to a causal connection judgement, and trials in between required a repeat (i.e., the sequence was ... *time time cause cause time time* ...). As others have found using this switching paradigm in a variety of situations, the reaction time (RT) on switch trials was systematically slower than RT on repeat trials. The difference in these RTs provided an index of the cost of switching, namely of how much more difficult it was to respond when one had to change the focus of attention from one dimension to the other. This task was conducted in both French and English, in separate blocks. We also calculated an index of English and French reading fluency based on RTs in a task in which participants judged whether words referred to living or nonliving objects using variability of word recognition RT as described in Segalowitz and Segalowitz (1993).

The two most important results are these: First, the French (L2) switch cost was found to correlate quite highly with the measure of French fluency (r = .652, p = .006). This suggested that, as hypothesized, the ability to switch attention focus in L2 is related to fluency. It is important to note that this measure of French switch cost involved a difference score between RT on repeat and switch trials and so was not confounded with individual differences in single word reading fluency (or even the speed of button pressing), as was the fluency measure. The second result was that French switch cost was still significantly related to French L2 fluency even after English reading fluency was statistically partialled out (r = .648, p = .007). This is especially interesting because it indicates that the relationship between attention focusing ability and L2 fluency in French was not due solely to a *general* cognitive ability to focus attention that would be operating in both language situations. Rather, the results indicated that L2 fluency was significantly related to a measure of cognitive control specific to reading in the L2, the kind of control that may be involved when updating a schema as a function of linguistic input.

This technique provides a way of assessing how easily a person can switch from one dimension of linguistically signaled attention to another. We are currently experimenting with this and related paradigms to assess linguistically controlled attention in a longitudinal study of adult second language learners.

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Research of this type has interesting potential for building new bridges between psychology and linguistics (of the cognitive linguistics variety). One can ask, for example, whether some modes of linguistically directed attention are acquired earlier than others. If so, is this a function of the linguistic construction itself (e.g., how complex the construction is) or of the type of attention control involved (e.g., control in a time dimension versus a spatial or some other dimension)? How do these attention directing skills unfold and what role do they play in L1 and L2 development? What kinds of language and non-linguistic experience are required to achieve a given level of ability in linguistically directed attention? The program of research implied by these questions will involve language analyses of the type done by cognitive linguists, combined with field observation of people using and acquiring language in real situations, plus laboratory investigation of the behavioral and the brain correlates that underlie skilled use of cognitive schemata under the control of linguistic constructions.

On the psychological side, the techniques for such research now exist. On the linguistic side, too, a great deal of knowledge has already been accumulated about the acquisition of different linguistic constructions, especially in cross-linguistic language acquisition research (Slobin, 1985 1997, 1997). In this respect, Slobin (1996) has put forward an interesting hypothesis that could be explored through the kind of psychology/linguistics partnership envisaged above. Slobin hypothesized that the most challenging aspects of a second language are those elements that refer to categories of meaning that cannot be experienced directly in our perceptual, sensorimotor, and practical dealings with the world. Examples include the aspectual difference in meaning between She *went* to work versus She *has gone* to work, or the definiteness difference between *a* car and *the* car, distinctions not all languages signal explicitly (Slobin, 1996, p. 91). These constructions serve to place certain elements or aspects of a situation into the foreground of attention, while placing others into the background. In a much fuller treatment of this topic, Talmy (1996) discusses what he calls the windowing of attention by language, also from a cognitive linguistic perspective (see also Tomlin, 1997). The volume *Language and Space* (Bloom, Peterson, Nadel & Garrett 1996) contains a number of papers that also address the way language constructions map onto cognitive (spatial) schemata.

Affordances

The dominant view in much of psychology is that linguistic communication is about the packaging of *propositions* in a way that allows the receiver to unpack the information as intended by the sender. MacWhinney (1999) discusses an interesting alternative to this view by arguing instead that language is used to communicate *perspectives*, rather than propositions. He identifies four levels of perspective taking, one of which is especially germane to the present discussion *affordances*.

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The concept of *affordances* was introduced into the psychology of perception by Gibson (1977). He proposed that what an organism perceives is the set of possibilities the environment provides — or affords — for fulfilling its goals. Gibson defined affordances as follows: The affordance of an object to an animal or an individual is "a specific combination of the properties of its substance and its surfaces taken *with reference to the animal*" (1977, p. 67, emphasis added). That is, information about these affordances is encoded in terms that refer to the self, rather than in the neutral terms of primary sensations (color, form, texture, etc.) describable without reference to the organism or its place in the environment. Support for this approach to perception has been accumulating in recent years from investigations demonstrating that people's perceptions of the physical environment (doorways, stairs, catchable objects) are encoded in terms that relate to their own body measurements and capacities (Lee, 1993; Mark, 1987; Van den Bergh, Vrana & Eelen, 1990; Warren, 1984; Warren & Whang, 1987). (For fuller discussions, including some of the more controversial issues involved, see Carlson, 1997; Greeno, 1994; Kelso, 1995; Marr, 1982). Affordances, in this view, are important for learning, because it is only by being able to perceive affordances that an organism is able to navigate its way around the environment successfully. Learning, according to Gibson (1966), involves not remembering past events, but becoming attuned to — that is, able to attend to — invariant information provided by the environment (e.g., perceiving that a given object affords support even though its color, shape, and other characteristics may vary as lighting conditions change, etc.; see also Bransford, McCarrell, Franks & Nitsch 1977).

Now, MacWhinney (1999) draws attention to the important role language plays in communicating information about situational affordances, and how this fact about language fits in well with some current research trends in psychology concerning the role of action and embodiment in learning and memory (e.g., Glenberg, 1997). He suggests that this approach to the relationship between language and memory may provide new insights into the process of language acquisition and will help us understand how language emerges from experience. While this idea is very promising, and should be pursued, I think there is another, unexpected yet potentially fruitful, avenue to explore if we take MacWhinney's point about affordances and language just one step further. This avenue may even lead to an unanticipated opportunity for collaboration between psychologists and linguists.

It is this: We can consider a language itself, like any physical environment, as possessing affordances. A given language supports a particular set of constructions, as described by cognitive linguists (e.g., Goldberg, 1995; Langacker, 1987, 1991), which are available for packaging a message if the speaker knows how to use them. These constructions afford the possibility of making certain messages but not others, and make some messages easier to communicate than others. There is also, of course, variation across languages in the availability and nature of many of these linguistic affordances. Following upon Gibson, we can hypothesize that *language acquisition involves attuning one's*

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attention system to perceive the communicative affordances provided by the linguistic environment. Now, a psychologist might ask: Is the perception of affordances really a critical element in learning in general? Important contributions to the answer may possibly come from future collaborative research involving psychologists and linguists. This work will require the study of language use and acquisition in a variety of settings in order to observe the distribution of linguistic affordances and determine whether and how learners make use of them in the acquisition process. Linguists are uniquely equipped to inform psychologists about the affordances in such environments. Finally, it is probable that *applied* linguists, because of their involvement in observing language acquisition and language use in a wide variety of contexts, will have an especially important contribution to make here.

Summary and Conclusion

We have seen that, despite initial efforts more than four decades ago, theoretical linguists and cognitive psychologists have not succeeded in developing a unified view of language that is broadly accepted by researchers in the two disciplines. The reasons discussed here include divergent approaches regarding how a theory about language should develop, what kind of explanation is appropriate, and how to address basic questions about biology and environment. There are signs, however, that future prospects for collaboration are brighter. Specifically, new advances in the brain sciences and in modeling associative learning systems have refocused many older questions and put debate on a firmer empirical basis. At the very least, there now appears to be emerging a consensus on what kinds of evidence will decide issues regarding the poverty of the stimulus, the rule-governed nature of language, the modularity of language systems in the brain, etc., even if there is not yet broad agreement about the actual substance of the issues themselves. This emerging consensus about what counts as evidence is probably the most important change that has occurred. It is what makes possible a new bridge to be built between the disciplines. An especially exciting development is the emergence of new approaches from within linguistics that explicitly try to link models of language to cognitive psychological processes. This chapter has presented two examples of how such approaches might develop into collaborative research programs. Applied linguists, in particular, might have a special contribution to make in this new collaboration.

Notes

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ANNOTATED BIBLIOGRAPHY

Barlow, M., & Kemmer, S. (Eds.) (2000). *Usage based models of language.* Stanford, CA: Center for the Study of Language and Information.

This volume contains a collection of papers exploring various questions about language, all from the vantage point of usage-based models of language, where theory about a person s linguistic system is grounded in instances of producing and understanding language. Ronald Langacker, who coined the term usage based model, provides a very useful chapter outlining the cognitive psychological and the linguistic assumptions underlying this idea. The volume contains chapters on phonology, on some of the premises of neurolinguistic approaches to language, and on connectionist models of usage based models of language. The chapters point to areas where collaboration between psychologists and linguists may be fruitful.

Savage-Rumbaugh, S., Shanker, S., & Taylor, T. (1998). *Apes, language and the human mind.* Oxford: Oxford University Press.

This volume reports some impressive language-like performance by nonhuman primates and discusses these achievements in terms of what it teaches us about human capacity for language. These authors challenge both Tomasello s view that humans have a unique ability to regard others as intentional beings and that this accounts for the emergence of language, and Chomsky s view that, at bottom, language acquisition involves a species specific innate module for language development. The volume will be stimulating for both linguists and psychologists.

Talmy, L. (2000). *Toward a cognitive semantics.* Volumes I & II. Cambridge, MA: MIT Press.

These two volumes represent an updated collection of Talmy s most important contributions to the development of cognitive linguistics. Of special interest to psychologists are his ideas about how language structure shapes attention. These volumes provide an excellent and detailed example of the new psychology of language referred to by Tomasello (1998), discussed earlier.

Tomasello, M. (1999). *The cultural origins of human cognition.* Cambridge, MA: Harvard University Press.

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Tomasello, following Langacker (1987), approaches language development from the premise that "language is "cognition packaged for purposes of interpersonal communication" (p. 150). In his view, what makes humans special is their ability to perceive others as intentional agents, which makes possible participation in joint attentional scenes, interactions where child and adult jointly attend to some event or object, and to each other's communicative intentions. Language is the means by which people direct the attention of other persons in such interactions, in order to make them adopt a certain perspective on some event or object. Drawing upon insights from cognitive linguistics, Tomasello develops this hypothesis, arguing that interesting structural properties of language flow from the existence of joint attention scenes in development, rather than from innate, language specific mechanisms.

UNANNOTATED BIBLIOGRAPHY

Abrahamsen, A. A. (1987). Bridging boundaries versus breaking boundaries: Psycholinguistics in perspective. *Synthèse: An International Journal for Epistemology, Methodology and Philosophy of Science, 72*, 355–388.

Bates, E. (1994). Modularity, domain specificity and the development of language. *Discussions in Neuroscience*, *10*, 136–149.

Bates, E. (In press-a). On language savants and the structure of mind. *International Journal of Bilingualism*.

Bates, E. (In press-b). Plasticity, localization and language development. In S.H. Broman & J. M. Fletcher (Eds.), *The changing nervous system: Neurobehavioral consequences of early brain disorders*. New York: Oxford University Press.

Bechtel, W. (1996). What knowledge must be in the head in order to acquire language. In B. Velichkovsky & D. M. Rumbaugh (Eds.), *Communicating meaning: The evolution and development of language* (pp. 45–78). Hillsdale, NJ: Lawrence Erlbaum Associates.

Bechtel, W., & Abrahamsen, A. (1991). *Connectionism and the mind*. Oxford: Blackwell.

Black, M. (1970). Comment. In R. Borger & F. Cioffi (Eds.), *Explanation in the behavioural sciences* (pp. 457–461). Cambridge: Cambridge University Press.

Bloom, P., Peterson, M. A., Nadel, L., & Garrett, M. (Eds.) (1996). *Language and space*. Cambridge, MA: MIT Press.

Bransford, J. D., McCarrell, N. S., Franks, J. J., & Nitsch, K. E. (1977). Toward unexplaining memory. In R. Shaw & J. Bransford (Eds.), *Perceiving, acting, and knowing: Toward an ecological psychology* (pp. 431–466). Hillsdale, NJ: Erlbaum.

Brown, C. M., & Hagoort, P. (1999a). The cognitive neuroscience of language: Challenges and future directions. In C. M. Brown & P. Hagoort (Eds.),

https://doi.org/10.1017/S0267190501000010 Published online by Cambridge University Press

The neurocognition of language (pp. 3–14). Oxford: Oxford University Press.
Brown, C. M., & Hagoort, P. (Eds.). (1999b). *The neurocognition of language*. Oxford: Oxford University Press.
Carlson, R. A. (1997). *Experienced cognition*. Mahwah, NJ: Lawrence Erlbaum Associates.
Chomsky, N. (1965). *Aspects of the theory of syntax*. Cambridge, MA: MIT Press.
Chomsky, N. (1970a). Problems of explanation in linguistics. In R. Borger & F. Cioffi (Eds.), *Explanation in the behavioural sciences* (pp. 425–451). Cambridge, UK: Cambridge University Press.
Chomsky, N. (1970b). Reply. In R. Borger & F. Cioffi (Eds.), *Explanation in the behavioural sciences* (pp. 462–470). Cambridge: Cambridge University Press.
Chomsky, N. (1975). *Reflections on language*. New York: Pantheon Books.
Chomsky, N. (2000). *New horizons in the study of language and mind*. Cambridge: Cambridge University Press.
Davies, A. (1999). *An introduction to applied linguistics*. Edinburgh: University of Edinburgh Press.
Dawkins, R. (1986). *The blind watchmaker*. London: Longman.
Ellis, N. (1999). Cognitive approaches to SLA. *Annual Review of Applied Linguistics, 19,* 22–42.
Elman, J. L., Bates, E. A., Johnson, M. H., Karmiloff-Smith, A., Parisi, D., & Plunkett, K. (1996). *Rethinking innateness: A connectionist perspective on development*. Cambridge, MA: MIT Press.
Fauconnier, G. (1994). *Mental spaces*. Cambridge: Cambridge University Press.
Fodor, J. A. (1983). *The modularity of mind*. Cambridge, MA: MIT Press.
Gazzaniga, M. (Ed.) (2000). *The new cognitive neurosciences*. Cambridge, MA: MIT Press.
Gibson, J. J. (1966). *The senses considered as perceptual systems*. Boston: Houghton-Mifflin.
Gibson, J. J. (1977). The theory of affordances. In R. Shaw & J. Bransford (Eds.), *Perceiving, acting and knowing* (pp. 67–82). New York: John Wiley & Sons.
Givón, T. (1995). *Functionalism and grammar*. Amsterdam: John Benjamins.
Glenberg, A. M. (1997). What memory is for. *Behavioral and Brain Sciences, 20*, 1–55.
Goldberg, A. (1995). *A construction grammar approach to argument structure*. Chicago: University of Chicago Press.
Gopnick, M., & Crago, M. B. (1991). Familial aggregation of a developmental language disorder. *Cognition, 39*, 1–50.
Greeno, J. G. (1994). Gibson's affordances. *Psychological Review, 101*, 336–342.
Grodzinsky, Y., Shapiro, L., & Swinney, D. (Eds.) (2000). *Language and the brain: Representation and processing*. New York: Academic Press.
Jackendoff, R. (1994). *Patterns in the mind: Language and human nature*. New York: Basic Books.

https://doi.org/10.1017/S0267190501000010 Published online by Cambridge University Press

Jackendoff, R. (1999). The representational structures of the language faculty and their interactions. In C. M. Brown & P. Hagoort (Eds.), *The neurocognition of language* (pp. 37–79). Oxford: Oxford University Press.

Kelso, J. A. S. (1995). *Dynamic patterns: The self-organization of brain and behavior.* Cambridge, MA: MIT Press.

Lakoff, G. (1987). *Women, fire, and dangerous things.* Chicago: University of Chicago Press.

Landauer, T. K., & Dumais, S. T. (1997). A solution to Plato's problem: The latent semantic analysis theory of acquisition, induction, and representation of knowledge. *Psychological Review, 104,* 211–240.

Langacker, R. W. (1987). *Foundations of cognitive grammar, Volume I: Theoretical prerequisites.* Stanford, CA: Standford University Press.

Langacker, R. W. (1991). *Foundations of cognitive grammar, Volume II: Descriptive application.* Stanford, CA: Stanford University Press.

Langacker, R. W. (1998). Conceptualization, symbolization, and grammar. In M. Tomasello (Ed.), *The new psychology of language* (pp. 1–39). Mahwah, NJ: Lawrence Erlbaum Associates.

Lee, D. N. (1993). Body-environment coupling. In U. Neisser (Ed.), *Emory Symposia in Cognition: Vol. 5, The perceived self: Ecological and interpersonal sources of self knowledge* (pp. 43–67). New York, NY: Cambridge University Press.

Leonard, L. B. (1998). *Children with specific language impairment.* Cambridge, MA: MIT Press.

Lightfoot, D. (1999). *The development of language: Acquisition, change, and evolution.* Oxford: Blackwell.

Lyons, J. (1991). *Chomsky* (3rd ed.) London: HarperCollins.

MacWhinney, B. (1999). The emergence of language from embodiment. In B. MacWhinney (Ed.), *The emergence of language* (pp. 213–256). Mahwah, NJ: Lawrence Erlbaum.

Mark, L. S. (1987). Eyeheight-scaled information about affordances: A study of sitting and stair climbing. *Journal of Experimental Psychology: Human Perception and Performance, 13*, 361–370.

Marr, D. (1982). *Vision.* New York: W.H. Freeman.

McCauley, R. N. (1987). The not so happy story of the marriage of linguistics and psychology; Or, why linguistics has discouraged psychology's recent advances. *Synthèse: An International Journal for Epistemology, Methodology and Philosophy of Science, 72*, 341–353.

Miller, G. A., & Chomsky, N. (1963). Finitary models of language users. In R. D. Luce, R. R. Bush, & E. Galanter (Eds.), *Handbook of mathematical psychology, Vol. 2* (pp. 419–491). New York: John Wiley.

Neville, H. J., Mills, D. L., & Lawson, D. S. (1992). Fractionating language: Different neural subsystems with different sensitive periods. *Cerebral Cortex, 2*, 244–258.

Newmeyer, F. J. (1997). Genetic dysphasia and linguistic theory. *Journal of Neurolinguistics, 10*, 47–73.

https://doi.org/10.1017/S0267190501000010 Published online by Cambridge University Press

Newmeyer, F. J. (1998). *Language form and language function*. Cambridge, MA: MIT Press.

Pinker, S. (1994). *The language instinct*. New York: William Morrow and Company.

Pinker, S. (1999). *Words and rules*. New York: Basic Books.

Pinker, S., & Prince, A. (1988). On language and connectionism: Analysis of a parallel distributed processing model of language acquisition. In S. Pinker & J. Mehler (Eds.), *Connecctions and symbols* (pp. 73–193). Cambridge, MA: Cambridge University Press.

Posner, M. I., & Petersen, S. E. (1990). The attention system of the human brain. *Annual Review of Neuroscience, 13,* 25–42.

Reber, A. S. (1987). The rise and (surprisingly rapid) fall of psycholinguistics. *Synthèse: An International Journal for Epistemology, Methodology and Philosophy of Science, 72*, 325–339.

Riggenbach, H. (2000). *Perspectives on fluency*. Ann Arbor, MI: University of Michigan Press.

Rogers, R. D., & Monsell, S. (1995). Costs of a predictible switch between simple cognitive tasks. *Journal of Experimental Psychology: General, 124*, 207–231.

Rugg, M. D. (1999). Functional neuroimaging in cognitive neuroscience. In C. M. Brown & P. Hagoort (Eds.), *The neurocognition of language* (pp. 15–36). Oxford: Oxford University Press.

Rumelhart, D. E., & McClelland, J. L. (1987). Learning the past tenses of English verbs: Implicit rules of parallel distributed processing. In B. MacWhinney (Ed.), *Mechanisms of language acquisition: The 20th annual Carnegie Symposium on Cognition* (pp. 195–247). Hillsdale, NJ: Erlbaum.

Sampson, G. (1997). *Educating Eve: The language instinct debate*. London: Cassell.

Schmidt, R. (1992). Psychological mechanisms underlying second language fluency. *Studies in Second Language Acquisition, 14*, 357–385.

Segalowitz, N. (2000). Automaticity and attentional skill in fluent performance. In H. Riggenbach (Ed.), *Perspectives on fluency* (pp. 200–219). Ann Arbor, MI: University of Michigan Press.

Segalowitz, N., & Frenkiel, S. (In preparation). *Second language fluency and attentional flexibility*.

Segalowitz, N., & Segalowitz, S. J. (1993). Skilled performance, practice, and the differentiation of speed-up from automatization effects: Evidence from second language word recognition. *Applied Psycholinguistics, 14*, 369–385.

Slobin, D. (Ed.) (1985–1997). *The crosslinguistic study of language acquisition, Volumes 1–5*. Mahwah, NJ: Lawrence Erlbaum Associates.

Slobin, D. (1996). From "thought and language" to "thinking for speaking". In J. J. Gumperz & S. C. Levinson (Eds.), *Rethinking linguistic relativity* (pp. 70–96). Cambridge, U.K.: Cambridge University Press.

Slobin, D. (1997). The origins of grammaticizable notions: Beyond the individual mind. In D. Slobin (Ed.) *The crosslinguistic study of language acquisition,*

https://doi.org/10.1017/S0267190501000010 Published online by Cambridge University Press

Volume 5: Expanding the contexts (pp. 265–323). Mahwah, N.J.: Lawrence Erlbaum Associates.

Smith, N. & Tsimpli, I. (1995). *The mind of a savant: Language learning and modularity*. Oxford: Blackwell.

Stemmer, B., & Whitaker, H. A. (Eds.) (1998). *Handbook of neurolinguistics*. New York: Academic Press.

Talmy, L. (1996). The windowing of attention. In M. Shibatani & S. A. Thompson (Eds.), *Grammatical constructions* (pp. 235–287). Oxford: Oxford University Press.

Tomasello, M. (1998). Introduction: A cognitive-functional perspective on language structure. In M. Tomasello (Ed.), *The new psychology of language* (pp. vii–xxiii). Mahwah, NJ: Lawrence Erlbaum Associates.

Tomlin, R. S. (1997). Mapping conceptual representations into linguistic representations: The role of attention in grammar. In J. Nuyts & E. Pederson (Eds.), *Language and conceptualization* (pp. 162–189). Cambridge: Cambridge University Press.

Ungerer, F., & Schmid, H.-J. (1996). *An introduction to cognitive linguistics.* London: Longman.

Van den Bergh, O., Vrana, S., & Eelen, P. (1990). Letters from the heart: Affective categorization of letter combinations in typists and nontypists. *Journal of Experimental Psychology: Learning, Memory and Cognition, 16*, 1153–1161.

Van der Lely, H. K. J. (1997). Language and cogntive development in a grammatical SLI boy: Modularity and innateness. *Journal of Neurolinguistics, 10,* 75–107.

Warren, W. H. (1984). Perceiving affordances: Visual guidance of stair climbing. *Journal of Experimental Psychology: Human Perception and Performanc, 10*, 683–703.

Warren, W. H., & Whang, S. (1987). Visual guidance of walking through apertures: Body-scaled information for affordances. *Journal of Experimental Psychology: Human Perception and Performance, 13*, 371–383.

Watt, W. C. (1970). On two hypotheses concerning psycholinguistics. In J. R. Hayes (Ed.), *Cognition and the development of language* (pp. 137–216). New York: John Wiley and Sons.

Wexler, K., & Culicover, P. W. (1980). *Formal principles of language acquisition.* Cambridge, MA: MIT Press.

https://doi.org/10.1017/S0267190501000010 Published online by Cambridge University Press