# NATIVE LANGUAGE AND FOREIGN LANGUAGE ACQUISITION

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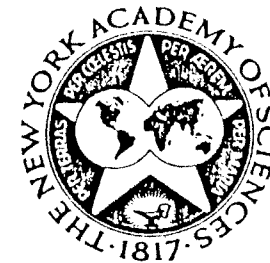
# SECOND-LANGUAGE ACQUISITION FROM A FUNCTIONALIST PERSPECTIVE: PRAGMATIC, SEMANTIC, AND PERCEPTUAL STRATEGIES *

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In her 1977 keynote address to the Stanford Child Language Forum, Susan Ervin-Tripp offered some reflections on all the research that has accumulated in the last decade on semantics, pragmatics, discourse structure, and sociolinguistics.[15] As a pioneer in all of these areas, Dr. Ervin-Tripp offered us the following reminder: *we never did solve the problem of how grammar is acquired.* Although studies of meaning and function are valuable in their own right, they need to be taken one step further, to an understanding of how semantic and pragmatic factors influence the discovery and use of grammatical forms.

One way to meet this goal is through the construction of a *performance grammar*—a unified theory of the pragmatic, semantic, and perceptual processing strategies that adults and children use to comprehend and produce sentences, inside and outside of a discourse context. Such a grammar would focus not only on the "possession" of a rule by a language or by an individual, but on the way grammatical information is handled in real time. In monolinguals, we have evidence suggesting that grammatical processing takes place with incredible speed, integrating many different levels of discourse simultaneously. For example, linguistic research on the relationship between discourse and grammar has shown that many different communicative functions are conveyed with every single grammatical decision.[19,20] Psycholinguistic research has shown that listeners integrate information from every level of discourse (phonology, lexical relations, word order, and prior discourse context) rapidly and in parallel, from the very first word presented in on-line sentence-comprehension experiments.[37] Given these constraints, the accomplishments of an adult bilingual seem nothing short of miraculous. First of all, the bilingual is in the unique position of mapping the *same* underlying meanings and intentions onto *two*

separate (or, at least, separable) sets of surface forms. The potential for interference in real-time processing is tremendous, and yet many investigators have concluded that the evidence for interference and transfer from first language (L1) to second language (L2) is surprisingly small (e.g., Reference 33). Second, the number and variety of discourse functions that grammar must carry for an adult are much larger than the discourse constraints on children. During first-language acquisition, children tend to operate in the "here and now," conveying messages that are of immediate interest without trying to tie that message into a larger, more coherent narrative or text structure.[23] For example, a three-year-old may use the pronoun "he" instead of the phrase "the man," simply to mark the difference between a referent in plain view versus a referent who is out of the room. For older children and adults, pronominalization is a much more complex process, used to mark givenness or newness of referents in regard to a much broader discourse context (e.g., whether this man was talked about several sentences back, and whether other men have been talked about in the meantime). In first-language learning, the many and varied discourse properties of syntax can be acquired gradually across time; new levels of complexity are added when the child becomes sophisticated enough to need them. For the adult second-language learner, *all* of the discourse functions conveyed by grammar are already present; hence the message load, or communicative pressure, on adult second-language learners is much greater than it is for the child. Studies of pragmatic, semantic, and perceptual processing strategies in second-language acquisition may help us to understand how adults deal with all of these competing discourse pressures on grammar—an issue that in turn may be related to problems of literacy, text comprehension, and formal speaking and writing in the adult world.[26]

We have been involved for several years in research on pragmatic and semantic influences on grammar, in children and adults, in several different languages.[1–5,34,35] Using the method of cross-linguistic comparison, we have been trying to develop a performance grammar that can account for the rapid and simultaneous integration of many aspects of discourse during sentence comprehension and production. For reasons that hopefully will become clear below, the theory is called *the competition model.* Although there is relatively little research on processing strategies in second-language learning (cf. Reference 14) and our own pilot results with bilinguals are quite tentative, we suggest that the competition model and its cross-linguistic data base form a useful point of departure for research comparing first- and second-language acquisition.

The competition model is eclectic, representing our own efforts to integrate several linguistic and psycholinguistic proposals. First, the emphasis on processing strategies owes a great deal to Bever,[7] although his own theoretical goals are different. The emphasis on cross-linguistic comparison is inspired by our teacher and colleague Dan Slobin.[44,45] Finally, we share the view of many psycholinguists that more progress can

be made in studies of language performance if we are informed by the principles and assumptions of some kind of linguistic theory—a "competence" model, which may be formulated in somewhat different terms from the psychologists' real-time performance theory.[16]

Some clarification may be needed on what "performance grammar" means, and how it relates to a traditional distinction in psycholinguistics between *competence* (the native speaker's abstract knowledge of the rules of his language) and *performance* (actual language use in speaking, understanding, making judgments, etc.). A performance grammar lies somewhere in between these two poles, involving a description of the native speaker's *competence to perform*. In principle, any linguistic theory could be chosen as the basis for a performance grammar. Within linguistics, there is a variety of proposals available that are particularly compatible with the goal of studying semantic and pragmatic effects on grammar.[13,19,20,27,28,31,32,48] Although these theories vary considerably in detail, they all share one common assumption: *the surface conventions of natural languages are created, governed, constrained, acquired, and used in the service of communicative functions.* These relationships between form and function may be complex and often opaque, involving interactions of many different pragmatic, semantic, and perceptual or mnemonic factors. Nevertheless, there is a kind of Darwinian faith that language forms can and should be explained in terms of functional pressures. For this reason, these linguistic theories collectively can be called *functionalist grammars.*[3]

Because functionalist grammars make reference to such psychologically motivated categories as "topic," "animacy," and "point of view," a functionalist theory of competence may not differ greatly from a psychological theory of performance. For some theorists, the separate concepts of competence and performance converge completely within a single theory of competence to perform, as illustrated in the following quote from Lakoff and Thompson:

> We believe that there is a direct and intimate relation between grammars and mechanisms for production and recognition. In fact, we suggest that GRAMMARS ARE JUST COLLECTIONS OF STRATEGIES FOR UNDERSTANDING AND PRODUCING SENTENCES. From this point of view, abstract grammars do not have any separate mental reality; they are just convenient fictions for representing certain processing strategies.[31]

Whether or not we embrace this strong position, it is still clear that processing strategies (and hence performance) must play an important role in any theory of grammar where linguistic forms are explained in terms of the communicative work they do.

There is an alternative and equally valid approach within linguistics and psycholinguistics, emphasizing instead the absolute *independence* of pragmatic, semantic, and syntactic components. As a theory of competence, this approach perhaps is articulated best by Chomsky in his principles of *absolute autonomy* and *blind application of transformations.*[11] Chomsky

stresses that no syntactic rule may be motivated by semantic concerns, nor may such a rule be formulated in terms of semantic-pragmatic structures.

The autonomous component approach often proves difficult for nonlinguists to understand. Functionalist theories, in which linguistic forms are mapped directly onto meanings and functions, have a more immediate appeal to us as psychologists because they seem to follow our intuitions about how we formulate thoughts into utterances. However, autonomous component theories are equally appealing on formal grounds. Imagine an algebra in which rules for moving $x$ and $y$ were formulated in terms of specific numerical content, e.g., "for any $x$, unless that $x$ is an even number greater than 7 and less than 104." Such an algebra would be cumbersome, difficult to learn, and difficult to use. By the same token, syntax in an autonomous component theory functions as a kind of linguistic algebra, elegant and useful precisely because it does *not* make reference to semantic or pragmatic content. As a performance theory, this kind of "modular" approach to language is defended by Forster in the following quote:

> The whole point of a language having a syntax is to provide a clear and unmistakable indication of the correct interpretation of the sentence. . . . Any move to allow the syntactic processor to be influenced by pragmatic factors works against the fundamental purpose of syntax. In fact, one might surmise that the evolution of syntax has been influenced by the degree to which it successfully guards against errors introduced by a consideration of pragmatic and semantic facts.[17]

It is an empirical question at this point which approach will prove most useful in helping us to understand first- or second-language acquisition. However, there are two reasons why we prefer to approach the acquisition problem from a functionalist perspective.

The first reason is the *directness of form-function mappings* in functionalist theories (i.e., without a series of intervening transformations or separate components). This close and direct relationship between meaning and form is consistent with a growing literature on rapid, parallel processing of information at every level of discourse in sentence processing.[37] And it also is consistent with our own experience as second-language speakers, i.e., the feeling that we begin with the same familiar set of meanings and intentions that we use in L1, and acquire L2 by seeking out those forms that do the same communicative work (see also Reference 50). If we make the same assumptions of direct mapping in experimental research with bilinguals, we are justified in selecting one or more functional inputs as independent variables (e.g., topic, animacy) and observing their effects on corresponding forms in the speaker's two languages (e.g., word order, noun-verb agreement). In short, the direct-mapping assumption is useful at both the intuitive and the experimental levels. Of course any grammatical theory could describe such intuitions and experimental results *indirectly*. The advantage of functionalist theories for research on processing strategies in second languages is that the functional equivalence of forms in L1 and forms in L2 can be stated so directly.

*The second reason involves fuzzy, probabilistic or weighted form-function mappings.* In many functionalist theories, the relationship between a particular surface form and its associated functions is stated in probabilistic terms (as we will explain in more detail below). This means that we can talk about the *strength* or *degree* to which a given form and function are tied to one another in a complex interaction. These weights or strengths can change across time (a) in the history of a given language, (b) in the acquisition of a first language, and (c) in the transition from one language to another. Hence what may look superficially like a discrete, discontinuous change may actually reflect a much more gradual and continuous process. Theories that incorporate such "fuzzy" or probabilistic elements are at an advantage in describing subtle patterns of interference or transfer in second-language acquisition. We do not have to talk about the presence or absence of rules, but rather the degree to which a processing strategy applies.

The principle of "fuzzy" or weighted mappings may help us to explain a number of phenomena that are not covered by traditional models of interference and transfer, including why second-language learners sometimes seem pragmatically "odd," even though no obvious grammatical errors are introduced. Let us illustrate with a couple of examples from our own second-language experience. Both of us (E.B. in Italian, B.M. in Hungarian) have become conversationally fluent in languages with much more flexible word orders than English. Although we are at the point where we rarely produce grammatical errors, both of us have been told that we make a rather "peculiar" use of emphatic stress. Because Italian and Hungarian can use word order to express topic-focus relationships, they also make much less use of stress.[35] But we Americans continue to "double mark" topic and focus in our second language by using *both* the word-order variations of Italian and Hungarian and the contrastive stress strategies of English. There is a concomitant transfer of strategies back onto English. For example, after many weeks in Rome speaking little or no English, Bates finds herself making inordinate use of the few word-order variations that are permissible in English (e.g., "him I don't like"), as though an Italian topic-focus mapping strategy still were being applied. Note that these are not "errors" in the strict sense, because they result only in grammatically well-formed utterances. But they could be regarded as errors at the discourse level. These are the kinds of processing comparisons that we hope to capture more precisely with experimental methods from the competition model.

To summarize, we feel that functionalist theories are well suited to cross-linguistic research, and that they offer useful mechanisms for describing what it means to be "in between" two different languages or two different stages in a single language. *The major thrust of our own proposals concerning second language is the assessment and explanation of "in-between status" during the acquisition of a second set of semantic, pragmatic, and perceptual processing strategies.*

To illustrate how the competition model works, we will draw most of our examples from *Italian* and *English*, plus some pilot findings from *German*. These three languages make a particularly interesting contrast for research on bilingualism because they are formally similar, but there are good reasons to expect some marked differences in functional processing strategies. We will concentrate primarily on one aspect of grammar—*the surface role of subject*. In all three languages, this role is defined (at least) by *preverbal position* in pragmatically neutral sentences, *agreement* with the verb in person and number, plus a limited form of *case marking*. This surface role is related to (at least) two underlying functions: *the semantic role of agent* and *the pragmatic role of topic*. Before proceeding, let us briefly consider a few relevant facts about these languages.

Italian, English, and German all have a basic word order of subject-verb-object (SVO) in pragmatically neutral, active declarative sentences. In all three languages, the subject agrees with the verb in person and number, but not in gender (with one small dialectal exception in Italian past-participle constructions, see Reference 49). With regard to case marking, Italian and English are identical: the only case marking available is non-productive, restricted to the personal-pronoun system (e.g., "I" versus "me"). In German, there is a more extensive case system: for example, a nominative-accusative contrast carried on the article preceding a noun phrase. This type of case marking of course is much more limited than the rich case systems of such languages as Hungarian and Russian. Furthermore, case endings in German are not always a reliable cue to basic syntactic-semantic relations. For example, German nouns in the feminine gender have the same article for nominative and accusative.

The other important contrasts among these three languages involve possible deviations from basic SVO order. English is known to be one of the most rigid word order languages in the world. SVO order is followed in main clauses and subordinate clauses, in questions (except for the fronted auxiliary) and declaratives, and in actives and passives alike. Also, subject deletion is possible only in imperatives (where it is obligatory, e.g., "wash the dishes") or in response to questions (e.g., "What did you two guys do last night? Went to the movies."). However, a small amount of word-order variation can occur even in English: OSV, or left-dislocated constructions (e.g., "eggcreams I like"), and VOS, or right-dislocated constructions (e.g., "really gets on my nerves, that guy"). Even in informal conversation, though, other variations are impossible: SOV (e.g., I eggcreams like") and VSO (e.g., "really gets on, that guy, my nerves").

Since German has case marking on nouns and English does not, we might expect Germans to use more word-order variation. Pragmatic variations are possible in German, but they are far from "free." For example, OVS sentences do occur in active declarative form, but only when there is a case contrast on the two nouns. VSO is used in questions and commands, or when a focussed adverbial phrase precedes the verb. VOS does occur under certain pragmatic conditions, but it is very rare. Finally, the obligatory order of constituents in relative clauses is SOV.

Surprisingly, Italian actually has more word-order variation than German does, despite the fact that Italian is equivalent to English in the amount of available case information. In informal conversation, all possible word orders can and do occur—in statements, questions, main clauses, and relative clauses. People actually say things like "the lasagna ate Giovanni" and "Giovanni Maria kissed." Furthermore, Italian (unlike German or English) permits extensive subject deletion (in over 70% of informal conversation, according to Bates).[1] This means that semantic and pragmatic facts must play a central role in a performance grammar of Italian, perhaps even more so than in German. Furthermore, we would expect both Italians and Germans to pay more attention to grammatical cues other than word order, e.g., agreement with the verb. In short, performance grammars for these three languages may look very different, perhaps more distant than we would expect just on the basis of formal grammatical differences.

Most of what we do know about processing strategies in these languages involves research with children. For example, several studies suggest that English-speaking children use a rigid SVO word-order strategy around the age of five (e.g., Reference 7), which leads them into errors in interpreting passives. Ervin-Tripp reports that English children who are losing their English while transferring to French, regress to such a first-noun strategy to interpret English sentences but show no such errors in their new language.[11] Slobin and Bever report that English and Italian children both use SVO strategies by (at least) the age of five; however, this word-order strategy seems to be stronger in the American group.[46] Finally, Roeper has argued that German children pay considerable attention to word order, even when case information is available.[39] Much less is known about word-order strategies in adults, even in English. For example, Forster predicts that English adults should use a first-noun strategy to "guess" the meaning of noun-noun-verb (NNV) sentences like "doctor patient cure."[17] However, as we shall see later, this prediction is not borne out by our own comprehension experiments in English.

Let us turn now to the theoretical framework for our cross-linguistic studies. A more complete description of the competition model is presented elsewhere.[3] We will provide a much briefer summary here, hopefully enough for the design and interpretation of our experiments to be clear.

### The Competition Model: Basic Tenets

#### Competition and Coalitions

We begin with the assumption that the resources of the acoustic-articulatory channel are so limited (by the number of things that we can do at all, and by perceptual and memory constraints in real time) that functional categories (e.g., topic and agent) must compete for control of surface grammatical resources. The more important a category (e.g., high

frequency, high information value), the stronger its claim on channel resources. Because of this competition for "surface territory," there is a pressure in all natural languages toward "doubling up" wherever possible.

Natural languages recognize the need for doubling up, by exploiting situations of natural overlap (i.e., functions that cooccur most of the time) and assigning surface devices not to *one* function but to a *coalition of associated functions.* For example, we humans tend to talk about ourselves a great deal. As a result, the two functions of topic and agent overlap in natural discourse (e.g., Reference 13). One way to exploit this overlap is to create a "high-priority" surface category like "subject," which may be governed *jointly* by a coalition or category comprised of both topic and agent.

Another result of forming *joint functional categories* is the creation of *joint surface categories,* or coalitions of surface forms that may have served separate functions at some earlier point in the history of the language. The surface category of subject illustrates this principle also. For example, many functionalists have discussed reasons why preverbal position should be associated with the discourse notion of topic: specifically, it is useful for our listeners if we make our topic explicit before we deliver a comment on it (e.g., Reference 27). It is also clear why the semantic role of agent or actor should be closely associated with its corresponding action verb. As Slobin has noted, processing is more efficient when semantically related units occur close together in an utterance.[44] Givon has offered some interesting arguments on why these different surface solutions (topic first, agent close to the verb, topic close to its comment) might have merged together naturally to form a set of devices that operate as a block: preverbal position, subject-verb agreement, semantic case markings for agency.[18,20] Keenan has reviewed evidence across many different languages for a "special" surface role corresponding to subject.[24] He reports that the exact makeup of this heterogeneous surface category varies from one language to another but that all languages seem to draw from the same universal set of possibilities (including topic-related and agent-related phenomena).

To summarize, the complete performance grammar that results from these assumptions comprises a large and interrelated set of *surface categories containing coalitions of forms* and *functional categories containing coalitions of meanings and intentions.*

#### Category Membership

When an utterance is produced, the decision to assign a surface role to a particular element would be triggered by the membership of that element at the functional level. Hence the element that provides the "best fit" to a joint topic-agent would be assigned the surface role of subject. In comprehension, the process works in reverse. As summarized in Bates and MacWhinney, a number of problems concerning categorization processes

are solved if we assume that grammatical categories at both levels are structured in a manner similar to the category structures proposed in Rosch's theory of prototypes.[3,10] Categories are defined in terms of an idealized "best member," or prototype, which may have a heterogeneous internal structure (as with the above coalitions). Category membership is a function of *degree of resemblance* to this prototype, from central "best instances" to peripheral instances at the "fuzzy" outer boundaries. In processing terms, Rosch has shown that reaction times are faster for prototypes, that information learned about the prototype spreads faster through the category than information learned about peripheral members, and that prototypes are confused much less easily with members of neighboring categories.[10] All of these predictions would apply to a grammar organized around the prototype model. This theory has been used to explain a number of grammatical phenomena, e.g., some syntactic differences between active verbs ("good") and stative verbs ("peripheral") in Ross.[11] (For further discussions of prototype theory in grammar, see References 8, 12, 30, and 42, among others.)

## Vector Weighting and the Breakdown of Coalitions

What happens when two converging elements in a functional category do *not* overlap, for example, if we want to topicalize the patient of an active verb? One solution is to assign an alternative (although perhaps less efficient or more complex) surface form. For example, in English we can topicalize the patient with a passive ("the ball was hit by John"), or focus on the subject through contrastive stress ("*John* hit the ball"). In either case, *the unity of the surface subject coalition* is retained: the same element receives preverbal position, agreement, etc.

In Italian, both of these options are available. However, Italians usually elect a very different solution to patient topicalization—break the surface subject coalition down into its component parts and assign those parts separately. Hence first position is assigned to the topic, but verb agreement is retained for the agent (e.g., "the apples eats Giovanni"). Another way of saying this is that the unity of the surface subject coalition, i.e., its tendency to operate as a block, is greater in English than it is in Italian. Word order can be "broken out" of the set fairly easily in Italian, but not in English.

We have already introduced one quantitative notion: the degree to which a surface coalition sticks together. We need another one as well, which a surface coalition sticks together. We need another one as well, to decide which element of a functional coalition "wins" assignment of shared surface privileges when overlap breaks down. We assume that coalitions of functions operate like coalitions of parties in a parliamentary system, so that distribution of resources when an alliance is suspended is determined by relative power or strength in different sectors. In the competition model, individual functions within a coalition carry *canonical weights* or *vectors* (i.e., a determining force of measurable magnitude and

direction) that state their degree of association with the surface coalition as a whole, and with components within that surface coalition. For example, word order and agreement *both* are associated with topic and agent, in English and Italian. However, word order seems to be tied more strongly to topic in Italian, while it is tied more strongly to agency in English. In other words, two languages can have the same configuration of forms and functions, but assign different weights. We would expect these differences to show up in the processing strategies used in cross-linguistic experiments.

## Conventionalization

In the competition model, the line between *probabilistic tendencies* and *determinate rules* becomes a matter of degree. In fact, two rules that are treated as obligatory in some competence models actually may carry different psychological weights (e.g., a hypothetical difference of 100% versus 97%).

To illustrate how two apparently obligatory rules might differ in degree of conventionalization, consider an experiment in Hebrew by Frankel and Arbel.[18] In a sentence interpretation experiment, these authors presented Hebrew listeners with simple sentences consisting of a verb and two nouns. These sentences reflected all possible converging and competing combinations of basic NVN order, number agreement, and gender agreement. Both the interpretations and the reaction times are consistent with the view that "not all rules are created equal." The fastest and clearest responses were of course obtained when all three cues converged on the same interpretation (i.e., the prototype). Otherwise, the three cues added and subtracted in a probabilistic fashion. When word order competed with both number and gender agreement, the two morphological cues clearly won out (i.e., listeners rarely chose the first noun). When word order allied with gender, number still won (but at low levels, with slower reaction times). When word order allied with number, gender lost (although this "standoff" still produced slow reaction times and some inconsistent responses). In other words, we can rank order the determining value of grammatical cues in Hebrew as follows: number agreement, gender agreement, and word order. Such probabilistic results could not be predicted or explained by a grammatical theory that views all rules as completely obligatory.

## Processing Claims

To summarize so far, the competition model involves direct mappings of coalitions of functions onto coalitions of surface forms. The speed and clarity of these mappings are a function of converging and competing vector weights from each form-function relationship within the coalitions: prototypic combinations yield fast and clear responses, but two cues can compete

with one another or "conspire" together to "gang up" on some stronger or weaker cue. Cases of competition and conspiracy should take longer to resolve, depending on the difference in strength on both sides of the competition. *We make the further claim that this mapping process takes place through simultaneous, parallel weighting of cues.* This parallel-processing assumption is compatible with research on language processing by Marslen-Wilson and Tyler,[37] and with certain models for visual pattern recognition including the classic "pandemonium model." [43] The notion of direct and parallel mapping of surface forms is also compatible with several linguistic theories, including some that do not believe in functionally defined grammatical categories (e.g., References 9 and 38).

In the experiments that we are about to describe with monolinguals and bilinguals, we have tried to evaluate the competition model by setting up competition experiments, that is, experiments in which forms and functions are set into competing and converging combinations so that we can evaluate the relative strength of cues from one language to another. An analogy to the Gestalt perceptual literature may be useful here. Because our perceptual organizing principles evolved to fit world events, we may not notice how they interact unless they are set in competition—in Necker cubes, Escher prints, and other ambiguous or internally contradictory stimuli. When speakers are asked to describe an unnatural event (e.g., a cartoon with an inanimate object chasing around a given or "topicalized" animal), or when listeners are asked to interpret an internally contradictory or unlikely utterance (e.g., "a pencil chased the cow"), we can use their responses and reaction times to understand the separate and interacting contributions of different forms and functions to language processing. If we waited for such "conspiracies" among cues to occur in natural conversation, we might have to wait a very long time.

### Some Cross-Linguistic Experiments

The largest experiment that we have completed so far is a sentence interpretation study with Americans and Italians.[4] The method is similar to the Frankel and Arbel study reported above, except that we included semantic and pragmatic cues in the converging and competing item sets.

Subjects were 30 Italians and 30 Americans. All were middle-class, college-educated adults—an important point, since Gleitman and Gleitman have shown that processing strategies may vary as a function of social class.[21] Each subject heard a total of 81 sentences (English and Italian versions were exact translations of one another), and each subject received a unique random order and a unique combination of specific lexical items. This means that specific lexical effects (e.g., sheep are more likely than cats to kick a pencil) were homogenized as much as possible across the design. The 81 sentences represent a complete orthogonal combination of four factors at three levels each: *word order* (NVN, NNV, VNN), *animacy* (reversibles, nonreversibles with animate first, nonreversibles with animate

second), *contrastive stress* (default stress, first noun stressed, second noun stressed), and *topicalization* (no topic, first noun topicalized, second noun topicalized). The topic manipulation involved introducing one of the nouns first (e.g., "here is a cow"), and then referring to it with a definite article in the target sentence, while the other noun was indefinite (e.g., "the cow a horse kicked"). TABLE 1 lists some corresponding examples from English and Italian. The two dependent variables were *percent choice first noun* and *reaction time.*

TABLE 1

SOME SAMPLE ITEMS FROM TWO COMPREHENSION EXPERIMENTS

| Experiment 1 | |
|---|---|
| English | Italian |
| 1. The horse hits the cow. | Il cavallo colpisce la vacca. |
| 2. The pencil hits the cow. | La matita colpisce la vacca. |
| 3. The cow the eraser kisses. | La vacca la gomma bacia. |
| 4. *The eraser* the dog grabs. | *La gomma* il cane afferra. |
| 5. Here is a ball. Kisses the ball a camel. | Ecco una palla. Bacia la palla un cammello. |
| 6. Here is a lamb. *The lamb* a dog pats. | Ecco un agnellino. *L'agnellino* un cane carezza. |
| 7. Here is a cube. Sniffs the cube *a monkey.* | Ecco un cubo. Annusa il cubo *una scimmia.* |

| Experiment 2 | | |
|---|---|---|
| English | Italian | German * |
| 1. The horse is kissing the cow. | Il cavallo bacia la vacca. | Die Ratte kuesst die Kuh. |
| 2. *The balls* are eating the camels. | *Le palle* mangiano cammelli | *Die Kerzen* fressen die Eidechsen. |
| 3. Is grabbing *the cat* the cigarettes. | Afferra *il gatto* le sigarette. | Ergreift *die Katze* die Zigaretten. |
| 4. Are licking the pens *the cat.* | Leccano le penne *il gatto.* | Lecken die Zengen die Katze. |

* German lexical items were changed to insure ambiguity of case, so that feminine gender nouns are substituted randomly for items used in the English and Italian versions.

Since this procedure yields a 2 (language) $\times 3 \times 3 \times 3 \times 3$ design, the results were extremely complex, involving a large number of main effects and interactions down to the four-way level. But we can at least summarize the most important results:

1. Italians and Americans showed *completely opposite processing strategies.* Americans relied primarily on word-order cues, while Italians relied primarily on animacy (see FIGURE 1).

2. The American reliance on word order extended not only to NVN,

but also to a powerful second-noun strategy in interpreting VNN and NNV items. As far as we know, this second-noun strategy has never been described in the literature (and is the opposite of Forster's prediction for English). However, it is perfectly consistent with our earlier comments about pragmatic reordering in English: VOS and OSV do occur in informal conversation, but VSO and SOV do not.

3. By contrast, Italian use of word order was relatively weak even on NVNs. On reversible items, with no competition from their preferred animacy strategy, Italians still chose the first noun only 84% of the time (compared with 96% for the Americans)—and it took them much longer
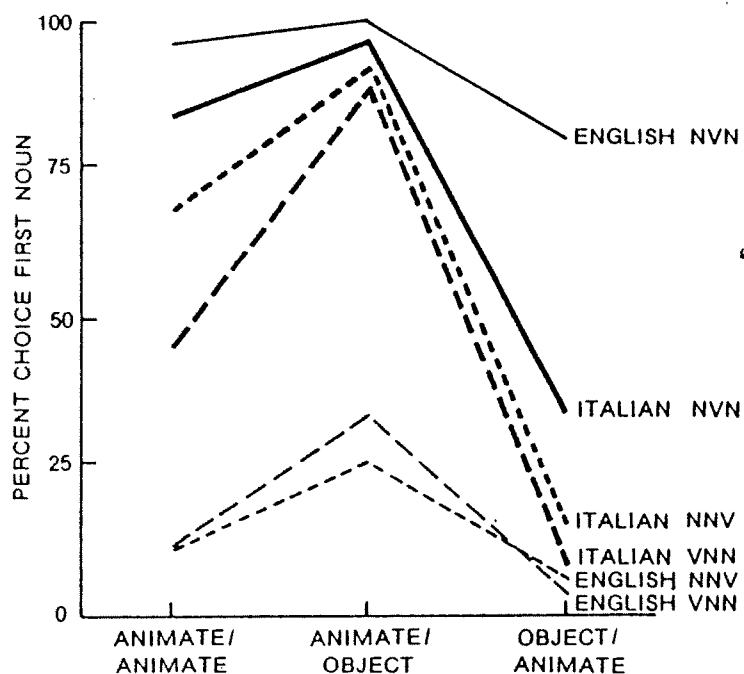


FIGURE 1. Word order × animacy interaction in 30 American and 30 Italian native speakers.

to reach those decisions. On VNN their performance was completely random when there were no semantic or pragmatic cues, and on NNV there was only a slight bias in the opposite direction from Americans, toward SOV. It seems fair to conclude that Italian is *quantitatively less* of a word-order language than English, even when there is no competition from semantic or pragmatic information.

4. Finally, stress and topic were much weaker cues in this experiment—not surprisingly, since we were emphasizing interpretation of agent rather than interpretation of topic. Nevertheless, the evidence on how stress and topic interact with order and animacy strongly supports our theory of

coalitions and competition. We made a series of 24 specific predictions about how pragmatic cues should converge to shore up a high-probability interpretation, or conspire to shore up a weak one. For example, default stress should strengthen use of a pragmatically neutral SVO interpretation, while contrastive stress should increase the acceptability of a marked OVS interpretation. Nineteen of the 24 predictions were supported—good evidence for a coalition model in which cues converge in parallel to determine a response.

The main conclusion from this experiment seems to be that lexical contrasts (animacy) are at the "core" of Italian processing to the same degree that order information is at the "core" of English. Any processing theory that gives universal priority to either type of information would have difficulty accounting for these data. Furthermore, the probabilistic results (competition, convergence, conspiracy) fit in a principled way with a processing theory that makes use of weighted form-function mappings. We see no way that a theory based on determinate, obligatory, 100% rules could account for these findings.

However, these results do not necessarily mean that Italians ignore syntax! We now are carrying out a new version of the experiment using competing and converging combinations of order, animacy, stress, and noun-verb agreement, e.g., "are kissing the cows the pencil" (see TABLE 1 for more examples). This experiment is being carried out in English, Italian, and German (using feminine nouns in German so that number agreement can vary without using case contrasts). Although the results are preliminary (involving three to four subjects per language), they again suggest strong and consistent differences among languages in weighting of cues.

FIGURE 2 illustrates the word-order strategies in all three languages, for items where animacy and agreement both are ambiguous. It is clear that German and Italian are more similar to one another than to English: they both make slightly less use of SVO than English does, and there are no clear and unambiguous strategies for dealing with nonstandard word orders.

FIGURE 3 illustrates the effects of animacy, summing across word orders, for items where agreement is ambiguous. Once again, Italian and German are more like one another than like English: they make very consistent use of the lexical contrast (slightly less in German than in Italian), compared with much smaller animacy effects in English.

Finally, FIGURE 4 illustrates the effect of agreement, summing across word orders and animacy conditions. This graph looks strikingly like the results for animacy, with German and Italian clustering close together in their extensive use of agreement, against much smaller effects in English. We have said that Italian is "less" of a word-order language than English. It also appears to operate "more" like a case-inflected language. We have not graphed the *order × animacy × agreement* interactions for these languages, because they are so complex. However, it looks as though the order of importance of cues in English is word order first, followed
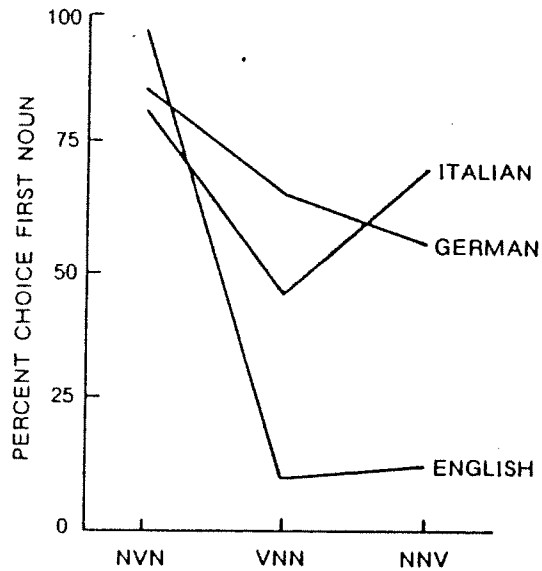
FIGURE 2. Main effect of word order (only in items that are ambiguous with regard to animacy and subject-verb agreement) in English, Italian, and German native speakers (Germans include only a pilot sample of three subjects).
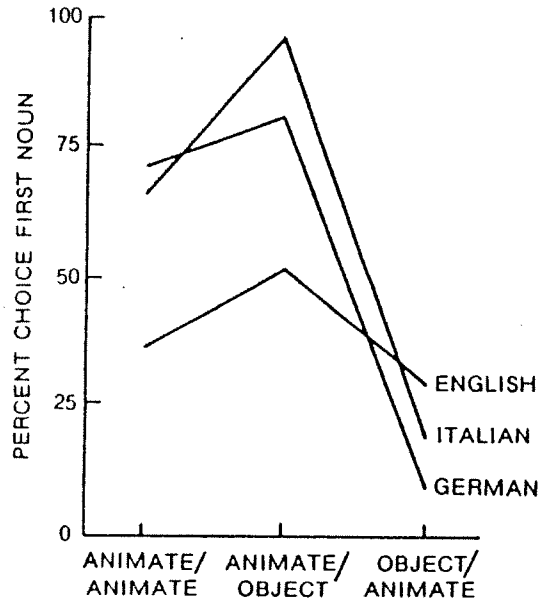


FIGURE 3. Main effect of animacy summed across word orders (only in items that are ambiguous with regard to subject-verb agreement) in English, Italian, and German native speakers (Germans include only a pilot sample of three subjects).

by agreement and animacy. The order of importance of cues in both German and Italian is agreement first, followed by animacy and order.

We seem to have found a continuum here in the use of morphological versus syntactic information in sentence interpretation. The two languages that make the most use of morphology also make more use of lexical information (as though bound- and unbound-morpheme strategies hang together somehow). The English reliance on word order operates at the expense of attention to either inflectional morphology or lexical contrasts. The idea that this is a continuum rather than a bipolar classification rests on the fact that German seems to be located somewhere in between English and Italian—although it is closer to Italian.
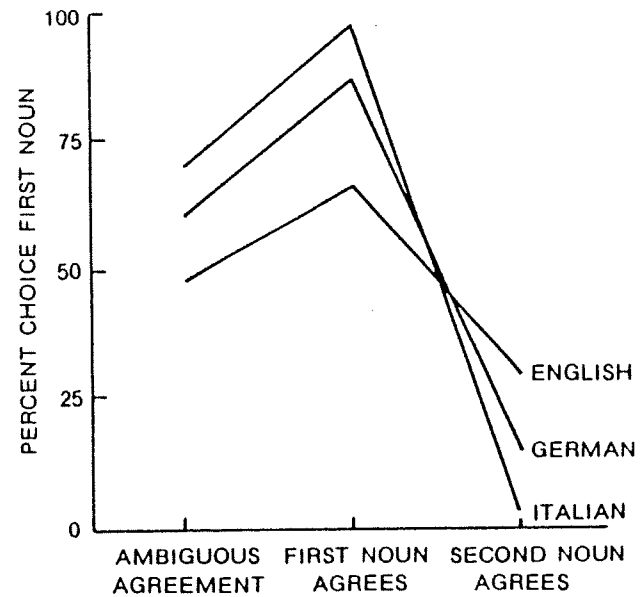


FIGURE 4. Main effect of agreement summed across word order and animacy conditions, in English, Italian, and German native speakers (pilot samples for all three languages).

If it is possible to talk about languages as being "in between" one another on a continuum of processing strategies, what about bilingual speakers? We have given the order-animacy-agreement version of our comprehension experiment to one Italian bilingual, and to several native speakers of German with varying degrees of fluency in English. Although the findings are tentative, they are very clear in showing evidence for a transfer of L1 processing strategies onto the second language.

First a brief introduction to our bilinguals. The Italian, UR, is a graduate student in his 40s, a northern Italian who has spent most of the last 18 years in the United States while working for an Italian company. He writes English well, his accent is noticeable but slight, and he claims

that he now "thinks in English." English was acquired first in school, after puberty. The Germans include a group of three "new bilinguals," southern-German graduate students who are in their first year of study in the United States. Their English was acquired in school, and has a long way to go before it could be called fluent (although it is possible to hold a conversation on any topic). The other two Germans have used English as their primary language for many years. WK is a native-born Austrian, a professor of psychology who learned his English in European schools. He has lived in this country for over 25 years, writes English very well, but speaks with a pronounced German accent. He and his American-born wife speak both English and German in the home. Finally, IB has a Ph.D. in psychology and has lived in this country or England for 22 years. She and her British husband have always spoken English. IB writes flawless technical English prose, and Americans can detect no German in her accent (although British speakers of English are aware that she is not a native speaker). She acquired English in school and spent one year as an exchange student in the United States when she was 15.

The left graphs in FIGURES 5, 6, and 7 plot the main effects in English for our German bilinguals (the three new bilinguals are summed together). Starting with the word-order strategies, it is clear that only IB shows an English pattern: strong first noun on NVN, strong second noun on the nonstandard orders (especially OSV). The new bilinguals are much closer, instead, to the German pattern. WK lies partway in between, but certainly is closer to the German end. In other words, all the German bilinguals show German word-order strategies in English, except for IB. This distribution holds in the other two main effects as well. In FIGURE 6, we can see that IB overlaps entirely with the English plot for animacy. Both WK and the new bilinguals cling closely to the German pattern, making extensive use of animacy contrasts when agreement is ambiguous. Finally, FIGURE 7 illustrates the agreement effects. IB once again clings to the English pattern almost perfectly, making relatively little use of agreement. WK and the new bilinguals show a strong reliance on agreement—with WK even surpassing the struggling new foreign students in his use of German strategies. *In sum, of the four German bilinguals tested, three very clearly are using German processing strategies to interpret English sentences.* It is interesting to speculate on the relationship of these data to differences in accent: IB, whose accent is barely detectable, uses English strategies in grammar as well; WK, whose accent is nothing short of notorious, uses German strategies in grammar. We have begun to test some English bilinguals who have acquired German as a second language. Again, the data are quite tentative, but they are completely consistent with the transfer hypothesis—in the opposite direction, as we would expect, with strong use of word order and very little use of agreement or animacy in German.

The right graphs in FIGURES 5, 6, and 7 present our one Italian bilingual plotted against the norms for English and Italian. Although UR feels that he thinks in English, the data clearly show that he applies Italian strategies
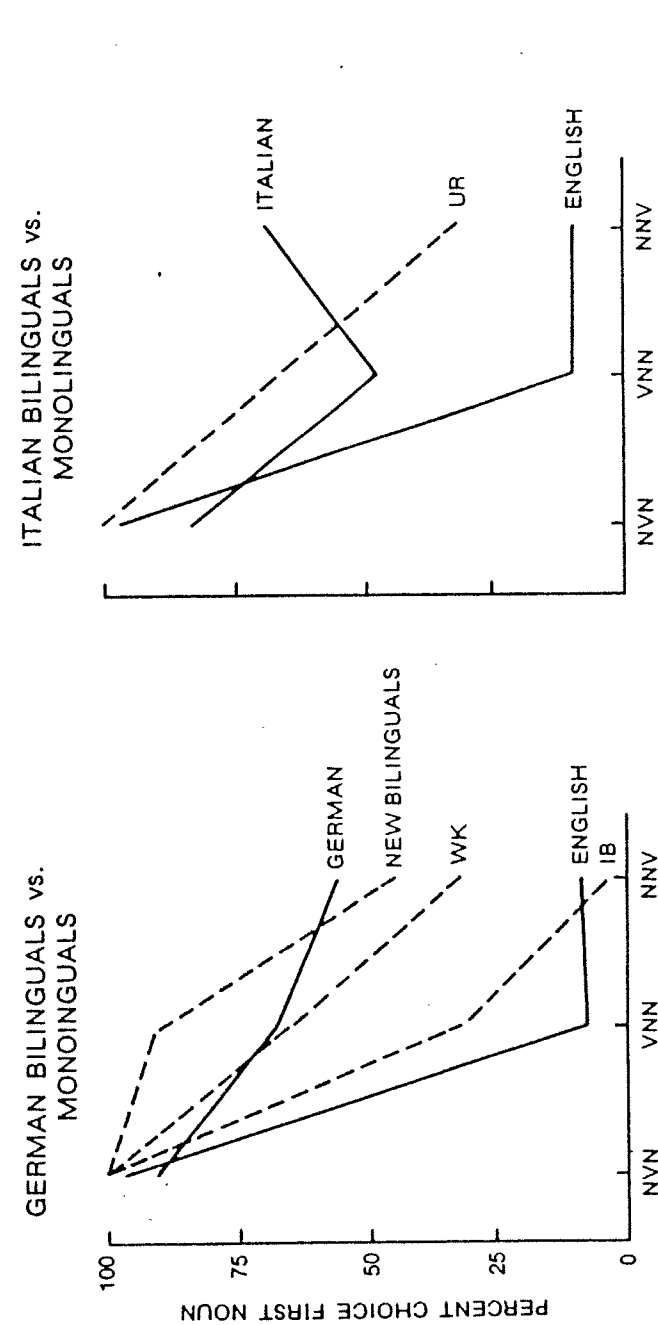
FIGURE 5. Word-order main effects (for items that are ambiguous with regard to agreement and animacy) for native speakers in their first languages (filled lines) and for bilinguals tested in English as a second language (broken lines).
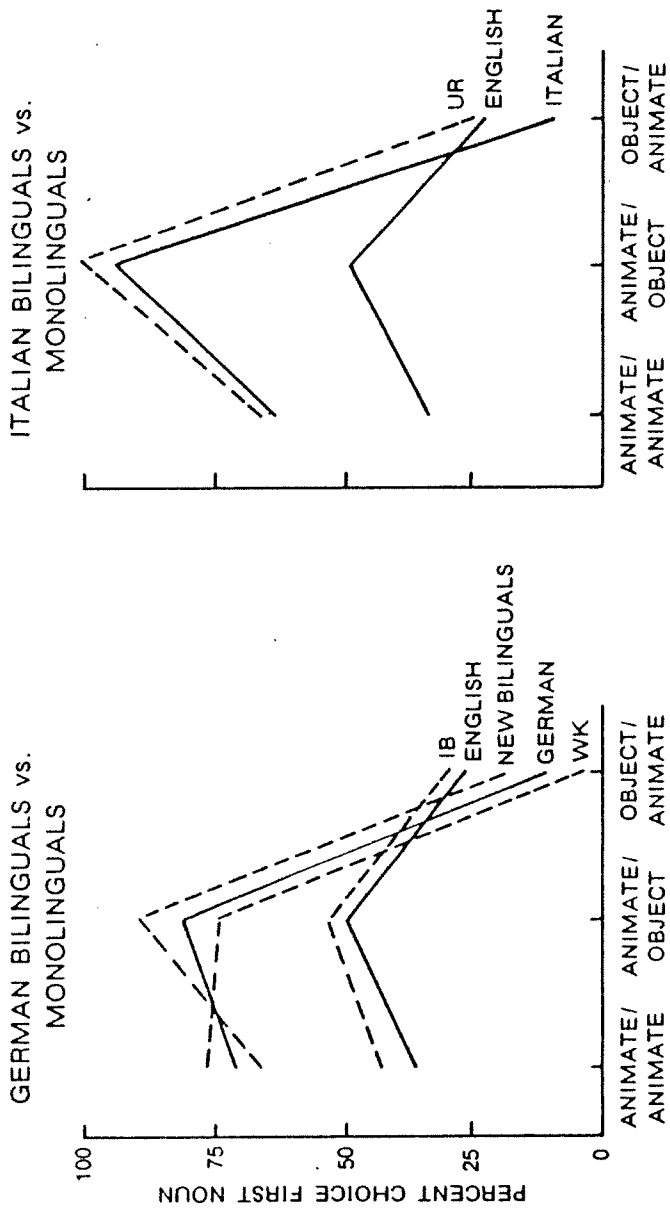
FIGURE 6. Animacy main effects (for items that are ambiguous with regard to agreement, summed across word-order conditions) for native speakers in their first languages (filled lines) and for bilinguals tested in English as a second language (broken lines).
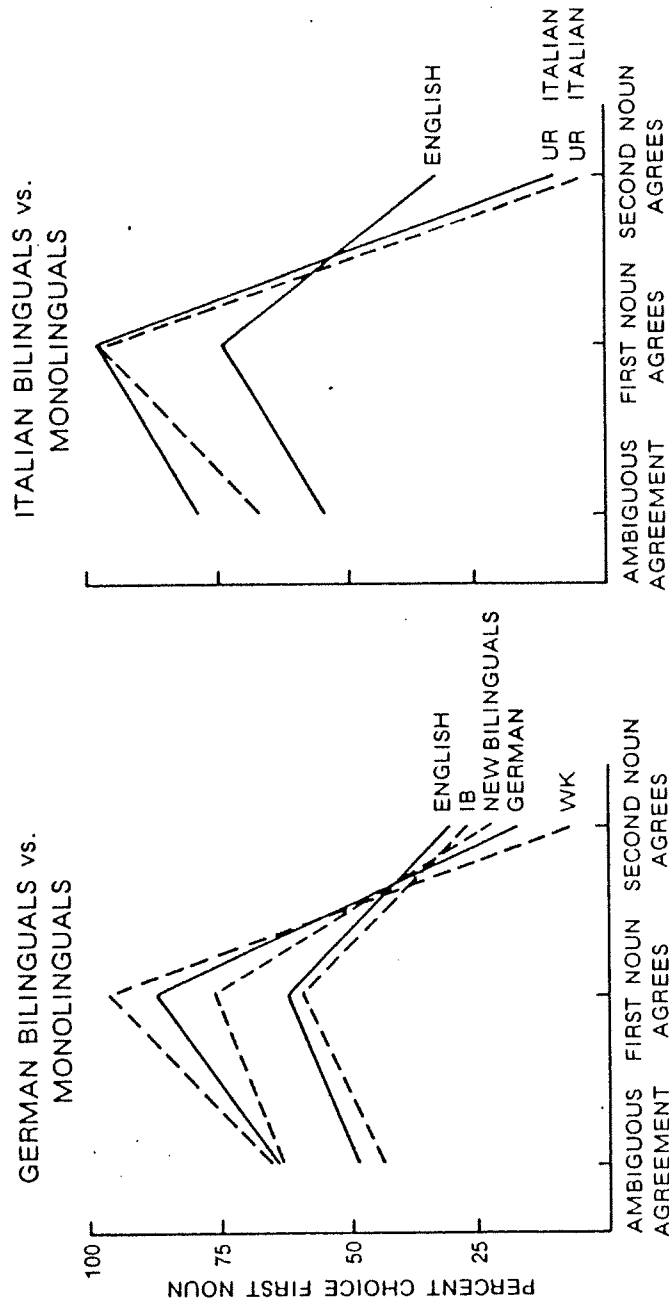


FIGURE 7. Main effects of subject-verb agreement (summed across order and animacy conditions) for native speakers in their first languages (filled lines) and for bilinguals tested in English as a second language (broken lines).

to English sentences: strong use of animacy and agreement, much less use of word order. However, UR does show one interesting differentiation, in that he has moved in the direction of a second-noun strategy in NNV items (OSV) while his VNN performance remains close to chance.

We said earlier that according to some investigators, the evidence for interference and transfer from L1 to L2 is surprisingly small.[33] This may be true when we are using a narrow definition of grammar, looking only for clear-cut examples of grammatical errors, lexical substitution, etc. These competition experiments seem to expose a deeper level of processing, where transfer and "in-between status" are more clearly evident. We suggest that differences at this level of processing, where grammatical forms are mapped directly onto forms like topic and agent, may be involved in subtle difficulties that second-language learners have with discourse structure and with that nebulous area called "stylistics."

We can say much less right now about our production experiments using the competition model, but the general research strategy is the same. We have constructed animated films that set up converging and competing combinations of several factors that are known to affect the selection of sentence subjects (and a variety of related syntactic constructions). These include *animacy* (chairs versus zebras, etc.), *actual movement* (e.g., the chair chases a zebra), *point of view* (induced, for example, through camera angle), and *givenness* (how often and how recently has this animal or object been seen, and did it serve as an actor or as a patient of an action in earlier frames). Subjects include adults, and children from three to seven. In the first experiment, we are asking them simply to describe what they see after each segment. In a second experiment, their descriptions are constrained further by discourse, including questions like "What happened to the chair?" In a third set of experiments, the very same films will be used for comprehension and verification. That is, subjects will view a segment and then be asked to verify whether or not a given sentence (e.g., "*the chair* chased the zebra" or "the chair chased *the zebra*") corresponds to what they have just seen. In all of these studies, reaction time data as well as the responses themselves will serve as dependent variables.

The goal of these production studies is not to show simply that a given function does have an effect. For example, we already know that English speakers tend to mark given information with definite articles. We do not need experiments to prove what is obvious to any native speaker. Instead, our goals are similar to those in an earlier production study comparing English, Hungarian, and Italian children and adults in the effects of givenness and newness on picture description (in sequences of pictures where one element systematically changed and the others remained constant).[35] Our focus there was the *degree* to which a given form was controlled by givenness or newness, in *language × age interactions*. This includes the finding that Americans tend to use contrastive stress at those points where Italians and Hungarians adopt word-order variations, or the finding concerning points where Americans use pronouns while Italians and Hungarians use ellipsis.

We were interested also in the developmental process of *differentiation*: children begin looking more similar to one another in the way that surface forms are controlled by givenness; gradually, they diverge from one another in the direction of adults in their respective languages. Language × age interactions like these are not at all obvious without experimentation, and attest to the value of cross-linguistic research on psycholinguistic issues.

Using the same sentence-production techniques, we now would like to examine the degree to which adult bilingual speakers fit the processing strategies of L1 versus L2 in free production and in response to discourse constraints (e.g., "What happened to the chair?"). With this method, we should be able to investigate more precisely the kinds of transfer that we ourselves experience in moving between the rigid word order of English and the more flexible orders of Italian and Hungarian (overuse of contrastive stress in Hungarian, overuse of topic-focus reorderings in English, etc.). The same differentiation process that we have examined in monolingual children may occur in second-language learning as well, as speakers become more and more skillful in integrating pragmatic and semantic information across discourse.

Finally, for both the comprehension and production experiments, we are beginning to move away from an analysis-of-variance format. Analysis-of-variance designs greatly restrict the number of variables that can be considered together in a given experiment (something that became very clear to us in trying to interpret four-way interactions in Bates *et al.*).[4] Yet the competition model is built around the simultaneous interaction of many different forms and functions in sentence comprehension and production. The method of choice in evaluating such a theory is *structural equation modeling*. We can build a quantitative model of all the hypothetical vectors that impinge on, for example, interpretation of agency in comprehension or subject assignment in production. The weights attached to each vector can be specified in advance, or adjusted empirically to reflect a first round of experiments. We can test the reliability of such models by examining their goodness of fit to a second sample of subjects in the same language group. And we also can derive goodness-of-fit statistics for models of two or more languages—a way of testing the result that seems intuitively right from FIGURES 2 to 4, that Italian and German are closer to one another than to English. The implications of this approach for second-language learning are clear. If we have structural equation models for both L1 and L2, it should be possible to determine the goodness of fit of a given second-language learner to either or both of his two languages, in terms of the processing strategies that he uses in comprehension and production (see Reference 36 for examples of structural equation modeling in cross-linguistic data).

We have claimed that these processing strategies provide a missing link between acquisition of grammar and all the research that has accumulated in the last decade on pragmatics, semantics, discourse structure, and sociolinguistics. If that is the case, the acquisition of the processing strategies in

a second language should accompany an increased sophistication in many subtle pragmatic, semantic, and discourse phenomena that are often the last barrier to true possession of a second language.

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# SYNTAX, SEMANTICS, AND PRAGMATICS—FIRST LANGUAGE: GENERAL DISCUSSION

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UNIDENTIFIED SPEAKER: Dr. Nelson, in L2 [second-language] acquisition we have a problem called avoidance. Some learners will not attempt to speak even though they are capable. Is this particular phenomenon being given attention in L1 [first-language] acquisition, that is, studying children who may be able to speak, but simply don't?

K. NELSON (*Graduate Center, City University of New York, New York, N.Y.*): That is a very interesting question. Very little attention has been given to this issue in first-language learning. However, one reason is that most investigators study children who are speaking and, therefore, tend to avoid children who are not speaking. We have all observed children who go virtually through the second birthday, or even later, without producing any language and then sometime around 25 months begin to produce sentences that are roughly equivalent to those of children who have been producing right along.

Individual differences in language acquisition are probably related to the cognitive style that is used to approach a learning task. We don't have enough information at this time, but we can speculate that the approach that is used to acquire early language is applied later on by the same children when learning to read or learning a second language.

L. MENN (*Boston University School of Medicine, Boston, Mass.*): Just a word in for phonology. With regard to the often-observed spurt in vocabulary growth, it may be that some children who are learning to understand object names are not saying them because they haven't mastered the required sounds of the words. Children avoid saying sounds they cannot produce. It is an early language-acquisition strategy. It is often difficult, of course, to show that a child is avoiding certain sounds. You need to be able to compare the words attempted with the words that the child understands and apparently has opportunity to use, and, additionally, look for systematic absences of attempts at words containing certain sounds or sound patterns.

K. NELSON: I referred to that in terms of the comprehension-production disparity. However, I don't think it explains all of the spurt phenomenon.

UNIDENTIFIED SPEAKER: Dr. Bloom, I don't think you mean to imply that the focus you have given to verbs suggests in language acquisition that communication or the pragmatic use of language is largely irrelevant.

L. BLOOM (*Teachers College, Columbia University, New York, N.Y.*): My presentation addressed the issue of verb development and its implica-