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19. ABSTRACT (Continue on reverse if necessary and identify by block number) The Sylvia Beach Language Comprehension Conference 1991 was a conference for internationally-known scholars in the field of language comprehension. It was the second such conference; the first was in 1989. It was a small (only 23 participants), intense, two-and-a-half day conference in which participants had the opportunity to interact both formally and informally. Each participant gave a 30-minute talk over-viewing the current state of his or her research. A thirty-minute round-table talk discussion followed each set of two talks. Informal interaction occurred during sixteen hours of group meals and other activities.			
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**Presentation Abstracts from the
1991 Sylvia Beach Language Comprehension
Conference**

WALTER KINTSCH, University of Colorado

**The Construction-Integration Model:
An Architecture for Comprehension**

The comprehension of a text in its situational context can be modelled as a bottom-up process that is guided by local associations. Globally integrated structures arise through a constraint satisfaction process in which compatible elements strengthen each other and incompatible elements are rejected. Thus, this model of comprehension comprises a locally guided, associative, unintelligent construction process that produces a globally coherent interpretation (and memory trace) of the text.

The construction-integration framework is used to derive models for a number of specific experimental situations. The time scale of the situations modelled ranges from a few 100 msec for priming processes, to several minutes for reading and summarizing and learning from texts several pages long, as well as planning processes for novel action sequences. The proposed architecture is able to provide an account for these diverse comprehension processes.

Four specific applications of the construction-integration theory will be sketched here. The first involves some unpublished priming data by Paula Schwanenflugel. These data show that word identification in a discourse context is affected both by local, associative factors and by global discourse factors.

The role of causal relations in story recall has been explored by Trabasso and van den Broek (1985). We simulate their results, but also point to the role of syntactic signals of discourse relevance, which are often redundant with causal knowledge. Thus, we claim there are two ways to understand a text: by using appropriate domain knowledge, and/or by using general, domain independent language knowledge.

Mannes and Kintsch (in press) have used the theory to simulate how experienced computer users understand simple instructions to perform tasks in which familiar actions are sequenced in novel ways. This is a typical planning task, but it can be understood as a cycle of situated comprehension episodes and actions that change the situation.

How reading a text modifies the reader's knowledge is a somewhat different question than how readers understand and reproduce that text. The episodic memory trace generated from reading a text merges with the reader's general knowledge structure and thereby modifies some components of it. A model is developed to describe this knowledge modification.

GARY DELL, University of Illinois

Retrieval Processes In Language Production

I argue that the retrieval of lexical items and their association with syntactic and phonological frames during language production can be modelled by spreading activation in a lexical network. Certain "interactive" effects on normal speech errors, such as the tendency for phonological errors to create meaningful strings and for semantic word substitutions to be facilitated by sound similarity, are seen as arising from activation spreading in both directions between semantic, lexical, and phonological units.

I will focus on recent applications of this approach to the production errors of fluent aphasic patients. In collaboration with Eleanor Saffran, Myrna Schwartz, and Nadine Martin, I am trying to model both normal and aphasic lexical and phonological errors, by varying general processing characteristics within the lexical network. The goal is to account for both the large increase in error probability in the patients compared to the normal speakers and, more importantly, differences in the error pattern, the relative proportions of error types.

GERRY ALTMANN, University of Sussex

Interpreting Interactions

The controversy surrounding the use to which extra-syntactic information is put during the initial stages of parsing continues unabated. At issue is whether the initial interpretation of an ambiguous sequence is guided by non-syntactic factors such as can be derived from the context of the utterance or from the thematic roles which the entities referred to in the utterance can fill. It is generally agreed that such information does eventually play a role in guiding the construction of an interpretation, but the field is split between those that believe that the initial analysis is derived in the absence of any such information and those that believe the contrary. I shall review some of the main difficulties (methodological and theoretical) that have plagued this research, before describing (briefly) some recent studies which attempt to overcome some of these difficulties.

Methodological difficulties have concerned the experimental method, which has ranged from the relatively coarse reading time measures to the more fine-grained eye movement measures. One problem with the latter measure is that eye-movements can be broken down into a number of sub-measures, and that sometimes data from these different sub-measures conflict.

Theoretical difficulties have concerned the precise predictions about the time-course of events. One view of the parsing process assumes an initial syntactically driven analysis followed, where necessary, by a semantically driven reanalysis. At issue is when the reanalysis is initiated. The construction of appropriate experimental materials for addressing the two opposing theories (Garden Path vs. Incremental Interactive) depends crucially on when one supposes the reanalysis to occur.

Two recent studies (with Alan Garnham) will be described which attempt to address these issues. The first (presented at CUNY '91) addresses some of the methodological issues, and the data suggest that referential context (i.e., concerning the need to interpret post nominal material as providing NP-modification as opposed to interpreting that material as some other structure) does allow garden path effects predicted by Garden Path theory to be avoided. However, this study does not address the timing issue, and has been criticized, rightly, for merely demonstrating an effect of context, but not an effect on the initial interpretation of the ambiguous portion of the sentence. A second study will be described which does address this issue (based on a reading time study by Mitchell, Corley & Garnham). The data from this study, although unreliable, suggest that context does exert an early effect.

Finally, I shall move to research in progress concerning another form of ambiguity, namely Closure. Referential context, this time concerning knowledge not about single entities but about whole propositions, could in principle overcome the preferences predicted by Frazier's Late Closure principle. A preliminary study suggests that late closure can be overcome, although it is unclear in this study whether this was in fact due to referential

factors. Future research will be described which should decide the issue. I shall conclude by suggesting that syntactic parsing IS an interactive process, and should not be viewed separately from interpretation.

KEITH RAYNER, University of Massachusetts

Lexical Ambiguity and Eye Fixations in Reading

During the past few years in our laboratory, we have been examining the processing of lexically ambiguous words during reading. We have examined the issue by recording subjects's eye movements as they read sentences containing ambiguous words. We have found that when the preceding context is neutral, readers fixate longer on balanced ambiguous words (with two equally likely meanings) than control words matched on word length and overall word frequency. Alternatively, they do not fixate on biased ambiguous words (with one highly dominant meaning) any longer than they fixate on control words. However, when the following context instantiates the subordinate meaning, they look at the disambiguating word and region for a long time. Interestingly, when the disambiguating context precedes the ambiguous target word, the pattern of results changes. In this case, readers do not fixate on the balanced ambiguous words any longer than the control words, but they fixate longer on a biased ambiguous word than a control word when the subordinate meaning is instantiated by the context.

In this talk, I will describe the basic pattern of results that we have obtained. I will also describe some recent experiments that have been undertaken to determine if one of our primary findings (that subjects fixate for a long time on the biased ambiguous word when the preceding context instantiates the subordinate meaning) is due to the subjects being unfamiliar with the subordinate sense. I will also describe some models of lexical ambiguity resolution that are consistent with our results and present an experiment designed to differentiate between the alternative accounts. Finally, I will contrast our findings on lexical ambiguity with other research from our lab dealing with syntactic ambiguity and syntactic category ambiguity.

PATRIZIA TABOSSI, Università di Bologna

Processing Ambiguous Words in Context

Tabossi (1988) described data suggesting that both dominance and context may have an effect on access. The experiments to be presented here extend those results, showing that the selective findings observed in the previous study are not due to an exhaustive access followed by fast selection, but reflect genuine context effect. In the light of the new findings, a time course hypothesis of how ambiguous words are accessed is introduced, and its explanatory capacity relative to current theories is discussed.

SUSAN GARNSEY, University of Illinois

Using Event-Related Brain Potentials to Monitor Language Comprehension

Language comprehension is an integrative process in which many kinds of linguistic and non-linguistic information must ultimately be combined. A natural question about comprehension is just when and how integration occurs. Attempts to answer this question have often involved examining the resolution of ambiguity, since the availability of different sorts of resolving information can be manipulated, providing a window into the comprehension system. For example, when there is ambiguity about the structural and functional relationships among the words in a sentence, several kinds of information bias the ultimate interpretation, such as how a verb is usually used, or whether a noun phrase has the right semantic characteristics to play a particular kind of role in the sentence, or what the sentence-external context suggests as the likely relationships. To understand how comprehension works, we must determine the time course of the contributions of these and other kinds of information during processing. Are some kinds of information used more quickly than others, and if so, what must the architecture of the processing system be like to give rise to such differential information use? Since much of the debate turns on time-course questions, it is important to use measures which track comprehension closely in time, but still do not intrude upon it and change its character. Event-related brain potentials (ERPs) have the desirable characteristic of being measurable throughout language comprehension without requiring overt behavioral responses which might alter people's comprehension processes. ERPs also provide a complex multidimensional measure, making it possible that the activity of different components of the language processing system may be observable in different ERP waveform patterns. I will discuss ERP studies which show in particular that knowledge about verbs can be used immediately in resolving some kinds of local structural ambiguity, and will also describe some results suggesting that different components of the ERP waveform are sensitive to different aspects of language processing.

ROSEMARY J. STEVENSON, University of Durham

Thematic Roles and the Comprehension of Pronouns

Pronouns provide an ideal test bed for examining many of the issues that arise in the study of language comprehension. In particular, pronouns are frequently ambiguous and fixing a final interpretation of a sentence containing a pronoun involves a best guess rather than a search for a correct solution. In addition, the comprehension of pronouns invariably involves the retrieval of general knowledge from which inferences are made to arrive at this best guess. Reliance on the rapid retrieval of general knowledge poses a major problem for understanding how a pronoun (and language in general) is understood because we are lacking an account of how general knowledge might be retrieved during comprehension. Some accounts propose that general knowledge may be accessed in the form of scripts, but scripts may not be sufficiently flexible to be useful in comprehension. Others have highlighted the use of mental models. However, while the notion of mental models provides a useful theoretical framework, it does not explain how general knowledge is accessed when a mental model is constructed. The main problem lies in the fact that language and cognition describe the world differently so that there is no simple way to map a linguistic description onto a representation of general knowledge. What is needed is a way of describing an interface between linguistic and nonlinguistic knowledge that reveals how general knowledge can be rapidly retrieved on the basis of the linguistic input.

In this presentation, I explore the possibility that thematic role information might act as such an interface, thus allowing the fast retrieval of general knowledge during comprehension. Although there is no consensus about the theoretical status of thematic roles, it seems likely that people do categorize the world in terms of agents, patients, experiencers and so on, or at least in terms of properties such as 'cause', that distinguish between agents and non-agents. These categories are also encoded in the lexicon, and thus they provide a natural link between cognitive representations of events and linguistic descriptions of those events. I will discuss work on the comprehension of pronouns which addresses these issues. The work examines the ease with which different thematic roles are assigned as antecedents to pronouns, the way in which pronouns might constrain the interpretation of described events, the way in which the relationship between two events affects the interpretation of a pronoun, and the thematic role of a pronoun as a function of the thematic roles of potential antecedents. The discussion will focus on the cognitive representations of events and their linguistic descriptions and the possible ways in which the linguistic information might map on to the cognitive level and constrain what is retrieved.

MANUEL CARREIRAS, Universidad de La Laguna
and MANUEL DE VEGA, Universidad de La Laguna

Referent Activation in the Comprehension of Short Narratives

We have focused on three subjects related to the elaboration of integrated representations in the course of texts comprehension: First, we have addressed the question of the relative role of linguistic and general knowledge parameters in anaphor resolution. In English, pronouns are resolved more quickly, at least under some circumstances, when their referents are determined by their gender. However, in English there is no arbitrary syntactic gender and such an effect is more naturally explained in semantic terms. In an attempt to resolve the issue, we carried out several experiments in Spanish - a language that does have arbitrary syntactic gender are interpreted more quickly when they can be resolved on the basis of their gender marking. We found clear evidence of an effect of gender matching on the interpretation of pronouns about objects. This finding suggests that both a content-based and a superficial representation are involved in the interpretation of anaphoric pronouns.

Second, we analyzed the time course of comprehension of indeterminate sentences embedded in short narratives, such as: (1) He sat in the main seat comfortably. (2) He looked around him. (3) Everything was in order. (4) He started the takeoff skillfully. Sentences (1) to (3) are indeterminate, because they do not provide any semantic cue which sign to a specific referent (several interpretations are possible). However sentence (4) gives the reader a late resolatory cue ("takeoff") which allows a specific interpretation of the text. The results suggest that subjects rely on a wait-and-see strategy. They start elaborating a linguistic representation of the indeterminate sentences, and they do not build a top-down representation of the referent. Only when the text provides a late resolution cue, as in sentence (4), do subjects try to build the referent and integrate it backward. These experiments allow us to functionally dissociate the linguistic processing of a text from the referential level (e.g., mental model elaboration).

Third, we explored the processing of homographs in the context of four-sentence narratives. Each homograph was presented twice for each text, and the second presentation involved the same or different meaning than the first one. There was a filler sentence between both presentations of the homograph which provided an appropriate context for the second presentation. The reading time for the target words was recorded, and the pattern we obtained for homographs was the reverse of the standard repetition effect. These results suggest that the selection of a meaning for the ambiguous word in the first presentation involves a long term inhibition or suppression of the alternative meanings. In a new experiment, a lexical decision task was introduced after subjects read the second presentation of the target (either immediately or after a delay), providing new evidence of a long-term inhibition effect of the non-primed meaning.

SHARI SPEER, Northeastern University

The Influence of Prosodic Structure on Understanding and Remembering Spoken Sentences

I will use results from sentence comprehension experiments and recognition memory experiments to argue that prosodic structure plays a fundamental and necessary role in understanding and remembering spoken sentences. I measured comprehension times for sentences with a local syntactic ambiguity. For example, the following two sentences are ambiguous at the verb 'sings,' which is transitive in "When Madonna sings the song, it's a hit," but intransitive in "When Madonna sings, the song is a hit." Slower reading times are found for the intransitive sentences, suggesting that readers are 'garden-pathed.' When these sentences are spoken, prosodic information can resolve the syntactic ambiguity. Cross-spliced spoken sentences contained disambiguating, neutral, or misleading prosodic patterns. Comprehension times were fastest when prosodic constituents coincided with syntactic constituents and slowest when they were consistent with the inappropriate syntactic analysis. The results support a model of sentence processing in which relational information from prosodic structure informs parsing decisions.

Because integrative language comprehension processes must take place over multiple utterances, and because prosodic structures themselves express meaning, we might expect to find that prosodic structure is a durable part of the memory representation for a spoken sentence. A series of recognition memory experiments investigated the status of phrase-level prosodic structure in memory. We examined the influence of changes in sentence meaning on recognition memory for prosody. We pre-tested two sets of sentences to show that sentence meaning was altered either substantially or subtly when we interchanged the prosody and words of sentence pairs. Recognition effects were shown for prosodically disambiguated sentences, e.g., "They are frying chickens" vs. "They are frying chickens," as well as for matched unambiguous sentences where identical changes in prosodic structure indicated subtler differences in meaning ("They are frying quickly" vs "They are frying quickly"). The effects were not greater when prosodic changes resulted in different syntactic analyses than when prosodic changes affected only sentence focus or presuppositions. Thus, the way a sentence is spoken influences the way it is encoded in memory, and thereby the way it is recognized later.

These results suggest that listeners directly remember prosodic structure, so that components of the surface prosodic structure are directly part of the memory representation. Another possibility is that prosody guides access to the meaning of any sentence at encoding and also at recognition. From this perspective, the influence of the prosodic structure on the memory representation is indirect, mediated by other sources of linguistic information, such as that associated with individual words. A third experiment showed recognition memory effects for

strings of nonsense words spoken with utterance-level prosodic structures matched to those from the initial experiments. Certainly no ~~traditional~~ syntactic analysis could have been performed on these "sentences," since they had no meaningful units. Yet hearing these nonword strings spoken with the same prosodic structure as on original presentation facilitated recognition.

LINDA MOXEY, University of Glasgow
and TONY SANFORD, University of Glasgow

The Meaning of Quantifiers

People use quantifiers such as "many" or "a few" to modify everyday assertions. Specifically, the main function of quantifiers appears to be that of providing information about the size of the subset of which the assertion is being made. Psychological work on the semantics of these, and related terms (such as expressions of probability) has tended to explore the mapping between expressions and numerical values on some scale or another. While it is not explicitly assumed by most researchers that we have numerical scales in our heads on which such expressions are represented, it is clearly assumed that subjects can express at least part of the meaning of a quantifier as a point (or a range of points) on a scale. Other work on the semantics of quantifiers, mainly by linguists and formal semanticists, glides over this very quantitative aspect of quantifier meaning, concentrating more on the types of inference which are enabled or disabled when a particular quantifier is used. We propose an entirely psychological model of how quantifiers are processed, taking the context as a starting point for the meaning of an expression in any instance, and bringing together the notion of inference and the quantitative interpretations which we expect of our subjects.

SAM GLUCKSBERG, Princeton University

**When Love is Not a Journey:
What Metaphors and Idioms Mean**

People use novel metaphors such as "our love has become a filing cabinet" in everyday conversation. What knowledge sources do people draw upon when producing and understanding such figures of speech? From a minimalist, communicative viewpoint, I argue that people primarily draw upon knowledge of potentially relevant properties of the metaphor topic and vehicle concepts. The topic concept (e.g., our love) constrains the sorts of properties that might be attributed to it. In most cases, such attributes would be diagnostic in the sense of discriminating the particular metaphor topic from its cohort of plausible alternatives. The metaphor vehicle concept (e.g., filing cabinet) ideally provides a stereotypical property by which the metaphor topic is characterized.

An alternative, maximally rich view (e.g., that of Lakoff and his colleagues) posits the use of deep conceptual metaphors that provide systematic mappings between metaphor topic and vehicle domains. Thus, the love-filing cabinet metaphor should exploit the basic conceptual analogy RELATIONS ARE CONTAINERS. In a preliminary test of this issue we asked people to provide interpretations of novel metaphors. Contrary to Lakoff's proposals concerning conceptual root metaphors, people relied almost entirely on specific properties of metaphor vehicles rather than on more general conceptual analogies. For example, the love-filing cabinet metaphor was generally taken to mean that the relationship had become organized, business-like and devoid of passion -- properties that seem to be totally unrelated to the concept of containers.

In contrast, stable conceptual frameworks do seem to underlie comprehension of some types of idioms. For example, idioms that express anger such as "blow one's top" seem to reflect the underlying concept of anger involving pressure building up and finally exploding (cf. Nayak & Gibbs, 1990). We asked people to choose among alternative idioms, where one alternative is always consistent with the contextually appropriate underlying concept, while the other is not. People consistently preferred to use conceptually appropriate idioms.

These two sets of findings reflect our general view that metaphor use can be spontaneous and creative, while idioms tend to rely on pre-stored conceptual analogies in semantic memory. These findings also bear upon more general issues concerning the reciprocal relationships between literal and figurative meanings in discourse.

CRISTINA CACCIARI, Università di Bologna

Acquiring and Understanding Idioms

Idioms are part of a vast repertoire of fixed phrases, clichés, speech formulas, etc., that shares some degree of conventionalization of meaning at the same time differing in semantic as well syntactic properties.

So far, two main psycholinguistic approaches face each other. According to the first, idioms do not differ in nature from any other unit contained in the mental lexicon. The comprehension process is therefore based on the same steps and features that are used when a word is encountered. According to the second approach, the linguistic assumption, according to which idioms are non-compositional units in the lexicon, fails to account for a relevant number of issues and must therefore be abandoned. A differentiation among types of idioms and processing strategies is proposed based also on speakers' assumptions of the level of semantic analyzability, semantic productivity, rhetorical motivation, syntactic features, etc.

The relevant point at issue is represented by the role played by the meaning of the constituents words of the idiom string, namely the extent to which the meaning is available and used both during acquisition, comprehension and production.

A strictly connected problem is represented by the interpretation of idioms: Is their interpretation simply retrieved from the lexicon with the right paraphrase substituted, or are more elaborated strategies required? This problem will be examined with respect to current hypotheses and in the light of: (a) a series of experiments conducted in collaboration with Sam Glucksberg (Phrase Induced Polysemy Hypothesis) and (b) the preliminary results of two experiments on the interpretative strategies used in imagining idiomatic actions and in assigning a meaning to unfamiliar idioms.

Lastly, the role of word meanings in idioms will be examined with respect to a developmental model on figurative competence acquisition proposed by Chiara Levorato and me.

RICHARD K. OLSON, University of Colorado

Genetic and Environmental Influences on Disabled Readers' Deficits and Component Reading and Language Skills

Studies of identical and fraternal twins conducted at the University of Colorado have revealed roughly equal genetic and shared environment influences on reading-disabled twins' deficits in word recognition. However, deficits in the phonological decoding component of word recognition (speed and accuracy in nonword reading) are predominantly due to genetic factors and account for most of the heritable variance in word recognition. Much of the heritable variance in phonological decoding deficits is in turn linked to heritable deficits in the twins' segmental language skills (phonological awareness).

A second component skill in word recognition, orthographic coding (distinguishing the word in word-pseudohomophone pairs, e.g., "rain rane"), is not significantly heritable. Instead, the twins' orthographic coding deficits are strongly linked to shared environment influences on deficits in word recognition. Indirect measures of print exposure suggest that it may be a major source of shared environment influence on twins' deficits in orthographic coding and word recognition.

The heritability of reading and related process deficits could be quite different from the heritability of individual differences in the normal range. However, a comparison of identical and fraternal twin correlations in a group of normal readers revealed similar patterns of heritability and genetic covariance for individual differences in word recognition, phonological coding, and orthographic coding.

A second project at the University of Colorado is exploring the benefits of computer-based remediation for reading disabilities. Phonological decoding deficits constrain the development of word recognition skills while reading, and this disadvantage is compounded when help for decoding problems is not available, or the children are too embarrassed to ask. Although our twin study indicates that deficits in phonological coding are highly heritable, this result only implies that extraordinary environmental intervention may be required for effective remediation. The recent availability of high-quality synthetic speech for microcomputers led us to explore this technology as a means to help disabled readers while they read stories on the computer. When they encounter difficult words, they can target the words with a mouse and receive immediate speech feedback. A primary experimental question has been whether and how to segment the orthographic and speech feedback. A condition wherein targeted words were highlighted and spoken as units (whole-word feedback) was compared with several methods of segmenting the speech feedback and corresponding orthographic units within the words. Both whole-word and segmented feedback groups showed approximately twice the gains in word recognition over a comparison group that received the normal course of reading instruction in their classrooms over a semester. Greater gains in phonological coding (nonword reading) were also significant for

both computer groups, but the gains were somewhat stronger for the segmented feedback condition. Gains in phonological coding from whole-word feedback were about three times greater, and gains from segmented feedback were about four times greater than the control group's gains. Thus, segmented feedback appeared to have significant additional benefits for the development of disabled readers' phonological decoding skills. Further studies are exploring the use of computer speech in the training of disabled readers' spelling skills and phonological awareness.

G.B. FLORES D'ARCAIS, Max Planck Institut für Psycholinguistik

**The Process of Comprehending A Written Word
In A Non-Alphabetic System**

The paper will be concerned with the activation of the different components involved in the process of comprehending a word written in a non-alphabetic, logographic system, namely Chinese. The work reported will deal with the processes and the time course of the activation of the figural, phonological, and semantic information which underlies the recognition of a word written in Chinese characters in Chinese and Japanese readers.

During the process of recognizing a written word, visual, phonological and semantic information is made available in the mental lexicon. The processes underlying this retrieval have been investigated in a variety of studies, and interesting models are available. One of the important questions asked concerns the time course of the activation process. When does the phonological and the semantic information become available?

Chinese characters offer an unique feature which allows us to obtain interesting evidence on the issue. A very large proportion of complex characters are made up by two radicals: the left one often offering information about the meaning of the character, the right one, the phonetic, indicating its pronunciation. This feature allows independent manipulation of the time at which access to semantic and to phonological information is possible, thus offering the possibility of investigating the rate at which the meaning and the pronunciation of a word become available.

In one of the studies to be reported I have tried to assess the relative strength of the contribution of the visual, phonological and semantic information to the process of comprehending a word. This was done by manipulation of the form of the character and by appropriate association and dissociation of the semantic and phonetic radicals in the complex characters presented for speeded naming.

In another of the studies to be reported, I have used a procedure of presenting the two radicals, the semantic and the phonetic one, with an onset asynchrony, in such a way that either the left or the right radical is presented before the whole character, the other radical being temporarily withheld. Appropriate manipulation of the onset asynchrony between the radical and the whole character has allowed us to investigate the rate at which the phonological and semantic information are becoming active. By momentarily withholding the phonological radical, the subject knows the meaning of the radical but is still unable to know how to pronounce it. Alternatively, by presenting first the phonetic radical followed after some interval by the semantic one, the subject is in the condition of knowing the pronunciation of the character without knowing its meaning.

The results of this study, which used different SOAs between the onset of one radical and the presentation of the whole character, seem to indicate an early activation of phonological information, and a somewhat later activation of semantic information, which can even produce some interference in the naming task, because of the

number of possible candidates which can be named.

LORRAINE K. TYLER, Birbeck College
and WILLIAM MARSLEN-WILSON, Birbeck College

Morphological Structure in Spoken Language Processing

The mental lexicon - the listener's mental representation of what words sound like and what they mean - stands at the heart of the spoken language comprehension process. The phonological properties of lexical items form the immediate target of the early stages of speech analysis, while the syntactic and semantic attributes associated with these items form the basis for subsequent processes of parsing and interpretation. It is, therefore, a crucial question for a theory of language comprehension to specify the basic units in terms of which the lexicon is organized. Are lexical representations word-based, or are they organized along morphological lines, so that the morpheme rather than the phonetic word is the primary unit of representation? What is the unit in terms of which word-candidates and their competitors are specified in the lexical access process, as well as in the subsequent processes of integration with higher levels of processing?

To answer these questions, it is necessary to study the representation and access of morphologically complex words. These allow us to dissociate word- and morpheme-based theories of representation, as well as their associated theories of lexical access. In particular, are morphologically complex words represented as unanalyzed full forms, or is the representation decomposed into constituent morphemes?

The research we will discuss at this meeting focuses on the structure of the lexical entry for morphologically complex words in English. We define the lexical entry as the abstract, modality-independent representation of a word's phonological, morphological, syntactic and semantic properties. In a series of experiments, using a cross-modal priming task, we asked whether the lexical entry for derivationally suffixed and prefixed words (e.g., happiness, disloyal) is morphologically structured or not, and how this relates to the semantic and the phonological transparency of the relationship between the stem and the affix (govern + ment is semantically transparent, depart+ment is not; happy+ness is phonologically transparent, vain+ity is not). We found strong evidence for morphological decomposition, at the level of the lexical entry, for semantically transparent prefixed and suffixed forms, independent of the degree of surface transparency in the phonological relationship between the stem and the affix. Semantically opaque forms, in contrast, seemed to behave like monomorphemic words.

Taken together, these findings suggest that semantically transparent derived words are represented in the lexical entry in terms of a common stem to which prefixes and suffixes are linked. Prefixed forms do not have links between their prefixes. They are only linked via their common stem. Suffixed forms, in contrast, are linked both through their common stem and their suffixes.

These findings can be readily interpreted within the cohort model (Marslen-Wilson, 1978; 1989) of lexical processing in the

following way. When a listener hears a prefixed word, the cohort of words beginning with the same initial sequence is activated. This does not ~~include~~ other prefixed words which share the same stem because they do not share the same word-initial sequence. Thus, prefixed forms will not be competitors within the same cohort. Since prefixed words prime each other, we conclude that this is via activation of a common stem.

In contrast, when listeners hear a suffixed word, it is the stem which initially gets activated. This, in turn, activates all those suffixed forms within the derivational paradigm since they all share the same initial sound sequence. These words are competitors in the sense that they are members of the same word-initial cohort. In current versions of the cohort model (Marslen-Wilson, 1989) competitors inhibit each other, and we find evidence of inhibition between suffixed words in our studies. Prefixed and suffixed forms prime each other because they are not competitors since they are not members of the same word-initial cohort.

This account of the structure of derivationally complex words suggests that when listeners hear a semantically transparent derived word, its morphological structure is always accessed. Derived words (either prefixed or suffixed) which are not semantically transparent do not function in the same way. They do not prime their stems and they do not prime each other. This suggests that semantically opaque derived words are not represented in terms of their morphological structure at the level of the lexical entry. It may well be the case that these words are indistinguishable in their structure from morphologically simple words.

ELIZABETH BATES, University of California at San Diego

Cross-Linguistic Studies of Sentence Processing in Aphasia

The Competition Model is a framework for the cross-linguistic study of sentence processing. It is a member of the larger family of interactive-activation models, emphasizing (1) the graded or probabilistic nature of linguistic performance (and the representations that underlie that performance), and (2) strong interactions among information types (i.e., semantic, pragmatic, syntactic, morphological), which compete and converge on equal footing to determine sentence meaning. Two key principles have been used to quantify similarities and differences between languages in the nature of this competitive process: cue validity (a measure of the information value of a given linguistic form) and cue cost (a measure of the processing costs involved in the use of a given linguistic form, when validity is held constant). These principles have been applied to the study of sentence processing in more than a dozen different languages, in several different tasks (sentence comprehension, sentence production, and grammaticality judgment), and in a range of populations (normal adults and children; bilinguals; adult aphasics; children with language disorders).

In this presentation, I will concentrate on our results for language breakdown in aphasia, illustrating three main findings. (1) There are robust cross-language differences in the symptom patterns displayed by patients from the "same" clinical groups, in the directions predicted by cue validity. (2) Superimposed on these cross-language differences, there is evidence to support the idea that grammatical morphemes are selectively vulnerable in aphasia. (3) This vulnerability is not restricted to so-called agrammatic aphasics; it is observed in many different patient groups, and can be induced in normal listeners under certain experimental conditions.

These results are used to argue against the notion that grammar and semantics can be selectively "lost" or "spared" (a favorite claim by proponents of modular grammar). Instead, the array of symptoms displayed by aphasic patients are compatible with the idea that grammatical knowledge is broadly distributed in the brain (i.e., it is hard to take the Turkish out of the Turk). The selective impairments that are observed reflect an interaction of cue validity and cue cost factors across this preserved knowledge base.

MARYELLEN MACDONALD, MIT
and MARK S. SEIDENBERG, University of Southern California

Relax: Sentence Processing is Neither Serial Nor Parallel

In our presentation we will give a general overview of a theory of on-line processes in language comprehension. Much of the literature on language comprehension is organized around questions as to whether the parser is serial or parallel. The central metaphor governing our approach, however, is that of relaxing into an interpretation, in the sense of relaxation-labelling schemes in vision and some connectionist models. The goal of the system is to compute an interpretation, using information that becomes available in a given context in conjunction with stored knowledge of the language and of the world. The central problem is ambiguity resolution: coping with local stretches in which these sources of information do not dictate a single interpretation. The central processing mechanism is constraint satisfaction: rapidly exploiting numerous soft, probabilistic constraints in order to converge on a single interpretation. The central modulating influence on this solution is restrictions on processing capacity, specifically limits on working memory capacity. The net result is a system that is neither strictly serial nor parallel but rather tolerates a limited amount of parallelism--specifically, exactly as much as is dictated by the structure in question, given the limits of human knowledge and processing capacities.

Given this approach, the central research questions are as follows:

- 1) What are the types of ambiguities that must be resolved? This involves determining what types of information (levels of representation) are computed in language comprehension and how, given the organization of language, they result in local ambiguities.
- 2) What kinds of cues are utilized in resolving ambiguities? Here we have in mind the types of "soft constraints" emphasized by the connectionists. Considerable research has focused on the types of information that occur prior to an ambiguity that might affect the processing of it (e.g., thematic information, subcategorization, syntactic configurations, etc.). It follows from the view that the processor tolerates a constrained amount of parallelism, **however**, that cues that occur after some ambiguities may also be **effective**.
- 3) How does **variability** with respect to working memory capacities affect processing? Here the specific hypothesis is that variations in working memory capacities affect the degree to which the processing system tolerates parallel representations. This yields some non-obvious predictions concerning garden path effects which have been studied in research by MacDonald, Just, and Carpenter. Having sketched the big picture we will discuss specific studies bearing on each of these issues as time permits.

CONFERENCE PRESENTERS

Gerry Altmann (University of Sussex)
Elizabeth Bates (University of California at San Diego)
Cristina Cacciari (Universita di Bologna)
Manuel Carreiras (Universidad de La Laguna)
Gary S. Dell (University of Illinois)
Manuel de Vega (Universidad de La Laguna)
G. Flores d'Arcais (MPI für Psycholinguistik)
Susan M. Garnsey (University of Illinois)
Sam Glucksberg (Princeton University)
Walter Kintsch (University of Colorado)
Maryellen MacDonald (MIT)
William Marslen-Wilson (Birbeck College)
Linda Moxey (University of Glasgow)
Richard Olson (University of Colorado)
Keith Rayner (University of Massachusetts)
A. J. Sanford (University of Glasgow)
Mark Seidenberg (University of Southern California)
Shari Speer (Northeastern University)
Rosemary Stevenson (University of Durham)
Patrizia Tabossi (Universita di Bologna)
Lorraine K. Tyler (Birbeck College)

CONFERENCE ATTENDEES (WHO DID NOT GIVE TALKS)

Paul Chapin
Joseph Young