STUDIES IN THEORETICAL PSYCHOLINGUISTICS

The Processing of Tense

Psycholinguistic Studies on the Interpretation of Tense and Temporal Relations

MICHAEL WALSH DICKEY

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by

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THE PROCESSING OF TENSE

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This book is for Laura, who Mike said was pregnant, and Nolan, who may someday marry a woman who went to Harvard.

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FOREWORD

This work is a psycholinguistic investigation of the processing of tense (more specifically, the English past tense): When it is interpreted, how it is interpreted, and what it is interpreted with respect to. While there has been a great deal of attention paid to tense in the syntax and semantics literature, little work has been done on the details of the psychological processing of this category. The chief value and contribution of this book is to present a richly detailed in-depth study of the processing of tense in adult comprehension tasks, providing an excellent model of how to conceive of detailed experimental work against a background of sophisticated, deep, and broad linguistic theory. The discussion of the representational issues is deep and informative, and is directly brought to bear on experimental issues.

The experiments aim to evaluate whether a hypothesis called "Parsimony," a highly plausible notion that has received tentative experimental support in other domains, is the chief controlling feature of the interpretation of tense. The experimental results presented quite consistently do not confirm the apparent predictions made by Parsimony, but rather tend to be more consistent with another view (which Parsimony is aimed at opposing) which holds that actual structural factors in the syntax of a sentence are a decisive factor. Along the way, the author considers a number of other plausible hypotheses as the experimental results are presented, but evaluating Parsimony remains the chief organizing principle of the line of research presented here.

The accumulation of experimental results – of seven experiments – do not unequivocally point in one single direction, as the author clearly recognizes. Nevertheless, enough headway has been made on the matters at hand to warrant general attention. The experiments stand as a kind of inspiration, and challenge, for any other experimentalists who wish to pursue this line of work, however they may feel about the experimental design and interpretation. There is a host of facts here that simply cannot be overlooked. In the end, the book sets a very high standard for the way knowledge of semantics, discourse, and linguistic theory may be used to inspire psycholinguistic experimentation.

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TABLE OF CONTENTS

Acknowledgments xi
Foreword, by Greg Carlson xiii
CHAPTER 1: INTRODUCTION 1
1. THE PROBLEM: THE PROCESSING OF TENSE 1
2. EMPIRICAL PHENOMENA 6
    2.1. Temporal anaphora 6
    2.2. Temporal adverbs and adverb preposing 9
    2.3. The Sequence-of-Tense ambiguity 12
3. STRUCTURE AND INTERPRETATION OF TENSE 15
    3.1. Quantificational versus referential views of tense 16
    3.2. Bringing together quantificational and referential properties: The ambiguity of the English simple past 20
    3.3. Formal representation of the semantic content of tense 26
    3.4. Summary and implications for the processing of tense 31
4. STRUCTURE OF THE LANGUAGE PROCESSOR AND HYPOTHESES 32
    4.1. Assumptions regarding the HSPM 32
    4.2. Simplicity versus Parsimony 40
    4.3. Predictions and hypotheses 46
5. CONTENTS OF THE BOOK 52
CHAPTER 2: INTERPRETING ASPECTP 55
1. INTRODUCTION 55
2. THE SPECIAL ROLE OF PREPOSED ADVERBIALS IN TEMPORAL INTERPRETATION 57
    2.1. Temporal adverbials 57
    2.2. Preposed adverbials as Reference Time providers 60
    2.3. Preposed adverbials as sentence-external elements 69
3. THE DISCOURSE FUNCTION OF ADVERB PREPOSING AND THE ADVERBIAL DOMAINS HYPOTHESIS 74
    3.1. Preposed adverbials as discourse segment markers 74
    3.2. The Adverbial Domains Hypothesis 79
4. ASPECT AND THE ROLE OF RHETORICAL RELATIONS 82
    4.1 The contribution of rhetorical relations to temporal interpretation 82
    4.2. Implications for the ADH 91
5. STUDY 1 – PREPOSING AND ASPECT INTERPRETATION 93
    5.1. Introduction 93
    5.2. Study 93
    5.3. Discussion 101

6. STUDY 2 – PREPOSING AND ASPECT INTERPRETATION REDUX 102
6.1. Introduction 102
6.2. Study 103
6.3. Discussion 108
7. GENERAL DISCUSSION AND CONCLUSIONS 110
CHAPTER 3: INTERPRETING TENSEP 115
1. INTRODUCTION 115
2. REPRESENTING TEMPORAL ANAPHORA 117
2.1. TP and temporal anaphora 117
2.2. Alternative approaches to tense and temporal anaphora 121
2.3. Summary and implications for processing of tense 124
3. ANAPHORA RESOLUTION 125
3.1. Definite NPs and pronouns 126
3.2. Other types of anaphora resolution 131
3.3. Temporal anaphora – an indirect test 134
3.4. Summary 137
4. HYPOTHESES REGARDING THE INTERPRETATION OF TP 138
5. STUDY 3 – TEMPORAL CONTEXT CLASH 140
5.1 Introduction 140
5.2. Study 141
5.3. Discussion 146
6. STUDY 4 – MINIMAL EVENTS AND TP INTERPRETATION 147
6.1. Introduction 147
6.2. Study 151
6.3. Discussion 158
7. GENERAL DISCUSSION AND CONCLUSIONS 160
CHAPTER 4: SEQUENCE OF TENSE AND SIMPLICITY 165
1. INTRODUCTION 165
2. REPRESENTING THE SOT AMBIGUITY 167
2.1. The facts of SOT phenomena 167
2.2. Representing SOT 174
2.3. Alternative approaches to SOT 179
2.4. Summary and implications for resolving the ambiguity 180
3. PREVIOUS RESULTS 181
4. HYPOTHESES REGARDING THE RESOLUTION OF SOT AMBIGUITIES 183
5. STUDY 5 – PILOT SOT QUESTIONNAIRE STUDY 187
5.1. Introduction 187
5.2. Study 187
5.3. Discussion 193

6. STUDY 6 – SOT QUESTIONNAIRE STUDY: ADVERB EFFECTS 195
6.1. Introduction....195
6.2. Study....196
6.3. Discussion....200
7. STUDY 7 – SOT ON-LINE....202
7.1. Introduction....202
7.2. Study....202
7.3. Discussion....207
8. GENERAL DISCUSSION AND CONCLUSIONS....209
CHAPTER 5: CONCLUSIONS AND REMAINING QUESTIONS....213
1. THE QUESTIONS....213
2. IMPLICATIONS FOR MODELS OF THE PROCESSOR: STRUCTURE-DRIVEN OR DISCOURSE-DRIVEN?....217
3. IMPLICATIONS FOR THE REPRESENTATION OF TENSE AND TEMPORAL RELATIONS: ONE INTERPRETIVE STEP OR TWO?....219
4. QUESTIONS FOR FURTHER RESEARCH....222
4.1. Interpreting TenseP....222
4.2. Interpreting AspectP....223
4.3. Different methodologies....225
4.4. Larger issues....227
APPENDICES....231
APPENDIX A: MATERIALS FOR STUDY 1, PREPOSING AND ASPECT INTERPRETATION....231
APPENDIX B: MATERIALS FOR STUDY 2, PREPOSING AND ASPECT INTERPRETATION REDUX....237
APPENDIX C: MATERIALS FOR STUDY 3, TEMPORAL CONTEXT CLASH....246
APPENDIX D: MATERIALS FOR STUDY 4, MINIMAL EVENTS AND TP INTERPRETATION....250
APPENDIX E: MATERIALS FOR STUDY 5, SOT PILOT QUESTIONNAIRE....277
APPENDIX F: MATERIALS FOR STUDY 6, SOT QUESTIONNAIRE: ADVERB EFFECTS....280
APPENDIX G: MATERIALS FOR STUDY 7, SOT ON-LINE....294
References....297
Index....307

CHAPTER 1

INTRODUCTION

1. THE PROBLEM: THE PROCESSING OF TENSE

The central empirical question that this book addresses is how tense, specifically the past tense, is processed in English. Structurally, tense is a morphosyntactic category which takes the form of a suffix on a sentence's verb. Semantically, it is the component of the sentence which serves to locate the situation being described in time (Comrie, 1985: 9). As such, tense has two major functions. Its first function is to locate the situation described with respect to some evaluation time. In most sentences, that time is the utterance time, "now." For example, in (1) below, the past-tense marker *-ed* on *jumped* indicates that the jumping event described in the sentence took place before the time at which the sentence was uttered.

(1) John jumped through the hoop.

Theories differ as to what exactly is responsible for this function: whether an operator (Prior, 1957) or some other element (Partee, 1973) picked out by tense directly relates the situation to utterance time, or whether some other element such as an aspect operator intervenes and mediates this relationship (Dowty, 1982; Klein, 1994; Kratzer, 1998). However, all theories agree that some element associated with finiteness markers like *-ed* serves to locate the situation with respect to the evaluation time/the utterance time.

The second function associated with tense is to help locate the situation with respect to other events already described in preceding discourse. For example, in (2a), Max's greeting follows John's standing up. In (2b), it precedes it.

(2) a. John stood up. Max greeted him.
b. John stood up. Max had greeted him.
(Lascarides & Asher, 1993)

Theories differ in how they analyze the contribution of preceding discourse to the interpretation of tense. However, most agree that at some level, some element associated with tense is involved in locating the event of the current sentence with respect to other situations in the discourse. A domain restriction (Roberts, 1991; Musan, 1995; Ogihara, 1996), or one of the intervals used in interpreting tense, such as a Reference Time (Dowty, 1982; Partee, 1984; see also Klein, 1994), refers to a definite moment in time. This definite interval is typically taken from preceding context, and locating this interval is what temporally connects a sentence to its preceding context. Thus, the finiteness markers on the verbs in (2) also introduce an anaphoric or presuppositional element, which connects the current sentence to previous sentences/events.

This book examines how and when the language processor assigns an interpretation to tense markers, giving rise to these two functions. In probing this question, it will look primarily at the second function associated with tense: the anaphoric component, the part which refers to definite moments in time and connects the current sentence to preceding ones. Looking at how and where the processor locates a value for the anaphor associated with tense markers, and how it connects a sentence to preceding ones, will serve as an index for probing its behavior in processing tense. The book uses this tool to examine three different phenomena connected to tense and its interpretation: temporal adverbials and adverb preposing; tense in matrix contexts and temporal anaphora; and sequence of tense phenomena. In examining these cases, it asks four questions, found in (3) below.

(3) a. What are the domains over which the processor does temporal interpretation?
Does the processor operate over sentence-level constituents in assigning an interpretation to tense morphology? Or does it instead make use of larger domains in doing such interpretation (such as discourse segments, e.g.)?

b. What factors guide the processor in temporal interpretation on-line?
Is the processor guided by sentence-level factors in assigning an interpretation to a tense marker? Or is it guided by discourse-level factors, such as, referential or presuppositional properties of the preceding context?

c. Is all temporal interpretation done immediately?
Does the processor assign a full interpretation to a tense marker as soon as it encounters it? Are all interpretive decisions related to tense made immediately, or can some be delayed?

d. Does simplicity guide the processor in the analysis of temporal structure, as it does in other domains of processing?
If so, what notion of simplicity is relevant: structural simplicity, or discourse-referential simplicity?

With respect to the first question (3a), existing evidence suggests that the domains over which temporal interpretation takes place are best defined at the discourse level. Evidence for this view comes from the fact that discourse-structural factors are what appear to determine the domain which the language processor takes as relevant for assigning an interpretation to a tense marker. Specifically, the presence or absence of preposed temporal adverbials – which have been argued to serve as discourse segmentation markers (Bestgen and Vonk, 1995, 2000) and appear likely to be Topics of some sort (see Chapter 2) – determines whether the processor interprets a tense marker with respect to the preceding temporal context or not. If a preposed adverbial is present, the processor does not try to relate the event described in the sentence to events previously described (Bestgen and Vonk, 2000). It also does not take the Reference Time, the value for the anaphoric component of the current clause's tense, from the preceding sentence (Partee, 1984; see also Dowty, 1986). Thus, the domain which the processor makes use of in assigning an interpretation to a tense marker appears to be something akin to a discourse segment, one which can be defined by discourse-structuring devices like Topics.

With respect to the second question (3b), evidence suggests that discourse-level factors, rather than sentence-internal factors, drive the processor's operations in temporal interpretation. Specifically, it appears that the temporal properties of preceding context determine what structure and interpretation the language processor chooses to assign to a tensed sentence. If preceding temporal context is incompatible with the interpretation usually associated with a tense marker, the parser does not build the structure associated with that interpretation. For example, when embedded in a future-tense context, the ambiguous string in (4) will be assigned a structurally

more complex reduced relative analysis, rather than the structurally preferred past-tense main verb analysis (Trueswell and Tanenhaus, 1991, 1992):

(4) Tomorrow, a proctor will notice a student cheating on a linguistics exam.
The student spotted ...

Since the preceding future-tense context does not provide a suitable value for the anaphoric/presuppositional element usually associated with past-tense sentences in discourse, the parser avoids assigning a past-tense interpretation to *spotted*. Thus, it appears that the processor decides what temporal interpretation to assign to a sentence not on the basis of material contained in the sentence, but on the basis of material in preceding discourse. This evidence is also consistent with the view that the discourse segment, rather than the sentence, forms the unit for temporal interpretation by the processor. Thus, with respect to both the first and second questions (3a-b), discourse-level concerns seem to be primary in the processor's handling of temporal interpretation.

With respect to the third question (3c), existing evidence suggests that tense markers are fully interpreted immediately, as soon as they are encountered by the processor. Not only does the language processor immediately build a syntactic structure for tense (i.e., for a tensed verb), but it also immediately assigns a semantic interpretation to that structure. Trueswell and Tanenhaus's results suggest that the processor immediately (or nearly immediately) rejects a past-tense main verb analysis for a word like *spotted* in a future-tense context, because assigning a past-tense meaning to it would make the sentence uninterpretable in that context. The processor thus appears to be assigning an interpretation to a tense marker (and evaluating that interpretation) at the earliest possible moment. This view is compatible with the widely-held assumption that sentences are interpreted and related to preceding context immediately, on a word-by-word basis (Marslen-Wilson and Tyler, 1980, Crain and Steedman, 1985).[1]

With respect to the fourth question (3d), previous research suggests that simplicity does play a role in temporal interpretation. However, here again it appears that it is primarily discourse-related notions of simplicity that drive the analysis of tense and temporal expressions. As discussed above, if the

[1] Frazier (1999) has argued that such immediate and complete interpretation is untenable, but she also maintains that there is at least immediate partial interpretation. The processor must immediately choose among genuinely incompatible meanings of a word. We will return to the issue of how much interpretation must take place immediately in section 4 below.

processor cannot find a time in the preceding context which satisfies the anaphoric/presuppositional component of tense, it will choose a different structure rather than accommodate such a time into the evolving discourse model. It appears to be taking on extra syntactic complexity in order to avoid extra discourse-referential complexity (cf. Trueswell and Tanenhaus, 1991, 1992). This perspective is very compatible with the referential approach to sentence processing (Crain and Steedman, 1985; Altmann and Steedman, 1988), which argues that referential or presuppositional considerations determine the processor's behavior in analyzing ambiguous sentences. In many ways, a referential approach seems particularly appropriate for the processing of tense. Temporal processing involves primarily semantic/interpretive decisions, in which referential or presuppositional considerations presumably play an important role. Many researchers have argued that tense is a referential or presuppositional entity (cf. McCawley, 1971; Partee, 1973, 1984; Webber, 1988; and many others), meaning that its referential or presuppositional requirements must be met for it to be interpreted. Thus, the processing of temporal expressions seems to be an ideal environment for finding evidence that referential considerations drive processing decisions.

This book argues that the opposite is true. Structural and compositional semantic considerations stated at the sentence level, rather than purely discourse-referential ones, bear primary responsibility in determining how and when the processor assigns an interpretation to the morphosyntactic category tense. In line with this view, the book argues for several specific points. First, it argues that the processor does temporal interpretation over much smaller domains than previous evidence has suggested, over sentence-level constituents rather than discourse-level ones. Second, it argues that sentence-level linguistic structure cues the processor in how it makes use of context rather than having context guide what linguistic units are constructed. Third, it argues that structurally-based preferences determine what semantic structures will be built and what presuppositions must be accommodated, rather than having presuppositions determine what structure is built or which analysis is chosen. In addition, it presents evidence that at least some decisions regarding the interpretation of tense can be delayed, rather than having all interpretive decisions be made immediately by the language processor, as must be assumed in discourse-driven models of processing. The data and arguments presented here therefore constitute evidence against a strongly referential approach to sentence processing, at least as applied to the temporal domain. They also serve as evidence against the traditional assumption that all interpretation is done immediately by the language processor, at least in its strongest form. Further, they provide

tentative support for the idea that sentence-level grammatical constraints have primary influence in guiding semantic processing.

In the remainder of this introduction, I will lay out the basic phenomena to be addressed in the book in more detail, along with a brief description of previous work on them in section 2. I then describe my assumptions about the structure of tense in section 3. In the interests of space, I will delay discussion of the representations for the specific phenomena to be addressed – temporal adverbs and adverb preposing, temporal anaphora, and sequence-of-tense phenomena – until the chapters directly examining those issues. In section 4, I describe my assumptions regarding the nature of the human sentence processing mechanism and lay out the basic hypotheses to be explored in the book. In section 5, I preview what is to come in the following chapters.

2. EMPIRICAL PHENOMENA

2.1. Temporal anaphora

2.1.1. Basic phenomenon

Perhaps the best illustration of the second function of tense, the anaphoric component, is found in cases of *temporal anaphora.* These kinds of intersentential temporal connections were briefly illustrated in (2) above. The tenses in English discourses like the one in (2) and (5) are typically taken to be related to each other in some way.

(2) a. John stood up. Max greeted him.
b. John stood up. Max had greeted him.

(5) John came into the room. Mary was reading.

In (5), the moment at which Mary was reading is usually interpreted as overlapping with the moment at which John entered the room, both of which are in the past. In (2a), the time of Max's greeting follows the time of John's standing up. In (2b), the time of Max's greeting precedes the time of John's standing up, and specifically that time: John's standing provides the time which Max's greeting precedes. Even in the case of the past perfect, the temporal interpretation of the second sentence is directly related to the time picked out by the first. Thus, in all three cases, the tense in the second sentence (more specifically, some semantic element underlying the tense marker) is in some way "anaphoric" to an interval associated with the first