REFERENCE FORM AND DISCOURSE PATTERNS

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Abstract

As a part of language use, people need to refer to things, people, and ideas in ways that they know their interlocutors will understand. Speakers must often choose among alternate forms of reference, for example "she", "Terry Gross", or "the interviewer on Fresh Air". This choice is often explained in terms of how people represent the discourse events and entities, where some entities are more actively represented than others. When the speaker can assume that the listener has a highly activated representation of an entity, the speaker can also assume that it will be easier for the listener to re-activate that representation during referent resolution, in comparison with cases where the referent representation is relatively less active. The activation of representations can be influenced by many things, some of which stem from the linguistic context.

I investigate five linguistic factors here: Recency, Subjecthood, Focus, Parallelism, and Goal Status. For each factor, I find evidence of two generalizations. First, referents associated with each of these linguistic factors have a higher probability of being referred to again in the following utterance than comparable referents. Second, referents with those same properties also are more likely to be referred to with pronouns than comparable referents. For each factor I discuss possible explanations for the frequent subsequent reference to certain types of entities, and how this might relate to the speaker's choice of reference form. I also discuss issues relevant to each factor, and provide cross-linguistic evidence for three of them.
My results are discussed in terms of two traditions of psycholinguistic research. One is the language-as-action tradition, in which discourse is seen as a joint activity, driven by the public and private goals of the discourse participants (H. Clark, e.g., 1996). The other is the constraint-satisfaction approach to language processing, in which the mechanisms of language processing are sensitive to an individual's past experience with regular patterns in language and the world (e.g., MacDonald et al., 1994; Trueswell and Tanenhaus, 1994).
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Chapter 1

Introduction

One of the central aspects of language use is the process of referring -- speakers refer to people, places, things, and ideas, and then say things about them, and in order for communication to be successful, the listener must know what the speaker is referring to. At the same time, however, human beings have limited time, energy, and patience, and generally desire to make their communicative interchanges as economical as possible. One way to make communication more efficient is to use a shorter, less specific form of reference, such as a pronoun, when the referent is accessible to the listener. When there might be some doubt about the referent, however, the speaker needs to use a longer, more specific form of reference, such as a name or description. This tension between communication and efficiency is reflected in and embodied by Grice's maxim of quantity: "Make your contribution as informative as is required...[but not] more informative than is required" (Grice, 1975).

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1 I will use the terms "speaker" and "listener" throughout the dissertation, although in fact I usually mean for the term "speaker" to extend to writers and other producers of language, and for the term "listener" to extend to readers and other comprehenders of language. I will also use the term "discourse participants", which comprises the speaker/writer and all addressees.
CHAPTER 1: INTRODUCTION

This dissertation addresses the following questions: What accounts for speaker choices in reference form, and how are comprehenders able to interpret referring forms as intended? These questions have concerned cognitive scientists of all types, including linguists, psychologists, philosophers, and computer scientists. This topic has attracted so much attention because it is a common yet complex aspect of human behavior. The reason that language exists at all is to communicate, which requires speakers to indicate who or what they are talking about. The existence of nominals and other referring expressions reflects the important role that reference plays in communication. Many other components of language are also used primarily to communicate information about participants and their roles: roughly speaking, verbs specify the actions, and their predicate argument structures specify the roles of the participants.

Another reason for studying reference form is that it provides a window into understanding other cognitive processes. Most researchers explain the appropriateness of particular forms of reference by appealing to the cognitive status of the referent in the mental representations of the discourse participants. For the most part, a pronoun is used when the speaker believes that the referent is already available in the listener's consciousness (i.e., when the entity is "given"). But there may be many things in the listener's consciousness, and the speaker needs to use a form that will let the listener choose the correct one. Research has suggested that at any one moment, discourse referents differ in terms of their salience in the mental representations of discourse participants, and that less-specified forms are only used when the referent is sufficiently salient.
Yet even though the concept of salience has repeatedly been invoked in the literature, it lacks a substantive definition. Things can be salient for many reasons. For example, people may tend to notice perceptually salient objects (such as a bright light), socially relevant actions (such as their boss entering the room), and the referent of linguistic pointers (such as the exclamation *Look at that!*).

In this dissertation, I will focus on linguistic information, and investigate how it can influence the salience of a referent and choices in reference form. Past accounts of reference form have generally focused on the roles of one or more factors in establishing certain referents as salient. In contrast with past work, the purpose of this dissertation is not to investigate any single factor in great detail. Instead, I will attempt to pull together many different factors into one general framework. After reviewing past work, I will focus on five factors: Recency, Subjecthood, Focus, Parallelism, and Goal Status. The labels for these factors are for convenience only, and a full description of each term will be provided later. At the end of this chapter, I will propose a preliminary framework for understanding why all these factors influence reference form, and in subsequent chapters I will provide evidence for my proposal.

Throughout the dissertation, I will use the term "discourse" to mean any set of utterances which are meant to cohere in some way, although I use the term loosely -- a discourse may be a story, a text, a monologue or dialogue; it may consist of two clauses or it may be an hour-long discussion. I will use "anaphor" to mean a linguistic form that refers back to an entity that has been previously evoked in the discourse. The term "antecedent" refers to the linguistic form with which that entity was last mentioned, and "referent" is the entity that the anaphor refers to. For example, "He" in 1 is an anaphor.
(1) Terrence sat down. He ate lunch slowly.

The antecedent of "He" is the subject of the preceding clause, "Terrence". The referent of "He" is the person denoted by "Terrence". For simplicity, I will identify both antecedents and referents in terms of the last noun phrase used to identify them: in this case, "Terrence".

The purpose of my studies is to understand how the representations of discourse referents are influenced by properties of the linguistic expressions used to refer to them. Therefore, I will also talk about referents in terms of features of the last linguistic expression referring to them. In 1, "Terrence" is the subject and agent of the clause before "He". To express these properties, I will refer to the entity as a "subject-referent" and an "agent-referent". The anaphor and antecedent are in parallel positions, so "Terrence" is also a parallel-referent. Because the referent was mentioned recently, he is also a recent-referent.

1.1. Past work on reference

The question of how reference works linguistically and psycholinguistically is central to understanding how language works, and has been the subject of many studies in diverse fields. Researchers have suggested numerous factors and theories to account for variation in reference form. These accounts differ, but one thing they share is the concept of salience, or accessibility. Loosely speaking, all researchers have observed that pronouns are used most often when the referent is represented in a prominent way in the minds of the discourse participants, but more fully specified forms are needed when the representation of the referent is less prominent. Some of the terms that have been used to
describe this phenomenon are "salience", "accessibility", "topicality", "focus of attention", or "activation". The terms are not strictly synonymous, but they are similar in that they attribute choices in reference form to the cognitive status of the referent.

But if the explanation of reference form depends on salience, then we need to know what exactly salience is. The focus of most past research has been identifying particular factors, linguistic and otherwise, that influence the salience of referents.

In the following section I will review some of the main findings about reference form and the representation of discourse referents. Multiple independent and overlapping theories have been suggested, which I will group into four categories for the purpose of presentation: 1) Linguistic theories of Salience, Accessibility, or Topicality, 2) Psycholinguistic studies of pronoun resolution and reference form, 3) the formalized model of Centering Theory, and 4) a criticism of Centering, the Information Load Hypothesis.

1.1.1. Linguistic theories of Salience/Accessibility/Topicality

Linguists have investigated two related questions: 1) in a given instance of referring, what form will be used? and 2) given a pronoun, what is its referent? Although these questions involve somewhat different processes, researchers have discussed both in terms of the accessibility of the referent. Some authors talk about accessibility in terms of the text, some authors talk about it in terms of the cognitive status of the referents.

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2 "Focus of attention" is not the same as the term "focus" which is used in descriptions of information structure, and roughly refers to the new, highlighted information in a sentence. Instead, "focus of attention" refers to the item which is currently most salient in the discourse in terms of pronoun reference, which corresponds more to the discourse topic than the focus.
CHAPTER 1: INTRODUCTION

1.1.1.1. Topic

For the most part, people organize their speech and writing around a particular topic, they stick to that topic for awhile, and then move on to a new topic. This observation has led to the use of the category "topic" to explain various linguistic phenomena, such as intonation (Halliday, 1967), word order (Sgall, et al., 1986), and reference form (e.g., Ariel, 1990; Broadbent, 1973; Gernsbacher, 1990; Purkiss, 1978; Sanford and Garrod, 1981). However, discussing the relationship between topic and reference form is difficult to do with any precision, because of two fundamental problems with the notion of topic: 1) defining the meaning of "topic" has proven very difficult, and 2) the relationship between reference and the category "topic" (even if it can be identified) is tenuous at best. In this section, I will attempt to describe how this concept has been used, and what relationship it may have with reference form. I will conclude that the traditional concept of the category "topic" as a single entity per utterance is too problematic to make it useful. However, the idea that some entities are more topical than others has its advantages, which might be retained if topicality is considered as a gradient property, and is not limited to a single entity per utterance (Givón, 1983a).

The first problem with "topic" is that defining what it means is notoriously messy. It is often thought of as what a sentence or discourse is about (Reinhart, 1981), but it is also frequently associated with old information (Gundel 1974; Chafe 1976; Clark and Haviland 1977; Clark and Clark 1977). Researchers often distinguish between "sentence topic" and "discourse topic", depending on the level of discourse over which the "aboutness" is measured. In some languages (e.g., Japanese (Walker, Iida, and Cote, 1994), or Jacaltec Mayan (Aissen, 1992)), the sentence topic is in fact a grammatical
position, which is partially defined on pragmatic grounds. In languages with no grammaticized topic position, such as English, certain positions such as subject or initial position are considered highly topical (Reinhart, 1982). Although some researchers have proposed that no sentence can have more than one topic (Reinhart, 1982), more plausible proposals have viewed topicality as a graded property that is present in all discourse entities (e.g., Givón, 1983a). The "discourse topic" is what a given discourse segment is about. However, this relies on yet another hard-to-identify construct: the discourse segment. Discourse and sentence topics are related to each other, in that the topic of a sentence contributes to the interpretation of the identity of the discourse topic. However, the relation between the two is not clear, which makes it difficult to identify discourse and sentence topics consistently and categorically.

Among these difficulties, particularly troublesome is the traditional concept of "topic" as a single element in a given utterance (Reinhart, 1982). In many cases, it is difficult to identify a unique topic. For example, consider the sentence in 2.

(2) In your casserole dish, place layers of hominy, meat-sauce mixture, and grated cheese.

(Rosenberg, The Impoverished Students' Book of Cookery, Drinkery, and Housekeepery:12).

The topic of this sentence could reasonably be considered to be the reader, the casserole dish, the act of placing, or the list of ingredients. At a discourse level, the text is about

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3 Reinhart assumes that a sentence can have 0 topics, but may not have more than 1 (1982).
how to make a casserole, in which case the act of placing might be considered the most topical element. On the other hand, the implicit subject of all the instructions in the recipe is the reader. Although this problem might be solved with a variety of theoretical assumptions, the important point is that identifying a unique topic at either the sentence or discourse level can be problematic.

The problem of identifying the topic has two consequences for incorporating it into a theory of reference processing. In the first place, it poses problems for the researcher seeking to identify the construction of interest across diverse situations, which hinders the process of developing a solid theory about topics. In the second place, it is difficult to imagine how the listener might identify the topic during discourse comprehension, and if the listener cannot identify the topic, then it is doubtful that it could influence comprehension directly.

Despite the difficulties in developing a comprehensive definition of sentence or discourse topic in English, the term has been widely used in the psycholinguistic literature. Some examples of the use of "topic" are presented in 3.
(3) Uses of "topic" in the literature.

a. "...distant antecedents may nonetheless be very salient, as when they constitute the discourse topic," (Ariel, 1996:31).

b. "In natural discourse, however, topics (mainly discourse topics) constitute the most salient entities more often than not," (Ariel, 1990:23).

c. "Indeed, words and sentences that change the ongoing topic, point of view, or setting take substantially longer to comprehend than words or sentences that continue the topic, point of view, or setting," (Gernsbacher, 1990:26).

d. "Our convention will be to add TOPIC = X to the message, where X is the topic argument," (Levelt, 1989:98).

e. "Thus, since topical entities are also likely to be those referred to by pronouns, one factor contributing to the higher pronominalization propensity of animates might thus simply be that animates are more often topics than other referents," (Dahl and Fraurud, 1996:60).
"This finding suggests that the referent/nonreferent differences found by Gernsbacher (1989; ...) arose because the nonreferent of the pronoun was unlikely to be the topic of a following sentence, and its activation was, therefore, suppressed," (Garnham et al., 1996:531).

Most researchers who have discussed the concept of "topic" seriously have also acknowledged the difficulties in defining it. The widespread familiarity of the term and its frequent use in explanations of linguistic phenomena reflects the intuition that some things are more important to the discourse, and that those things will be more accessible psycholinguistically.

One of the properties that has been attributed to topics is that subsequent reference to the sentence or discourse topic is more likely to be pronominal, so the topic structure may influence the interpretation of ambiguous pronouns (e.g., Ariel, 1990; Dahl and Fraurud, 1996). However, the use of "topic" to account for reference form makes the problem of defining this category even more difficult. As all researchers have acknowledged, the relationship between topic and reference is not categorical. For example, Reinhart (1982) discussed the following examples from Oehrle (1981). In these sentences, intuition suggests that if the pronoun is unstressed, it refers to the antecedent in parallel position, and if it is stressed, it refers to the nonparallel antecedent. Out of context, these interpretations are highly restricted, and appear to be "independent of the topic relations in the sentences," (Reinhart, 1982:16). The indices in 4 and 5 indicate the interpretations for unstressed pronouns.
(4) Felix\textsubscript{i} hit Max\textsubscript{j} and then he\textsubscript{j} hit Bill.

(5) Felix\textsubscript{i} hit Max\textsubscript{j} and then Bill hit him\textsubscript{j}.

On the other hand, Reinhart presented Oehrle's (1981) argument that if the topic of the conjunction is specified, as in 6-8, the pronoun antecedent is identified as the topic (assuming no contrastive stress on the pronoun).

(6) As for Max, Felix\textsubscript{i} hit Max\textsubscript{j} and then he\textsubscript{j} hit Bill.

(7) a. Can you give me an exact description of Max's role in the fight?
   b. Felix\textsubscript{i} hit Max\textsubscript{j} and then he\textsubscript{j} hit Bill.

(8) As for Felix, Felix\textsubscript{i} hit Max\textsubscript{j} and then he\textsubscript{i} hit Bill.

However, this demonstration of the role of topic in pronoun interpretation is problematic. In these examples, the topic is established either through the expression "As for X", or through a question about one character. Although these methods seem to intuitively establish one character as more central than the other, the resulting discourses in 6-8 are extremely unnatural, in particular because the second mention of that character is not pronominalized. In fact, referring to "Max" in object position in 7b seems to treat this referent as less salient. Although the question asks about "Max", the speaker then starts the sentence with "Felix". This makes both "Felix" and "Max" relatively equal in prominence, which makes the use of the pronoun "he" in 7b fairly confusing.
One of the reasons that the pronoun is confusing in 7 is because of the role of grammatical subject. In several studies, the subject has been associated with topic status. In Reinhart's influential paper on topics, she pointed out that while topics and subjects are not identical, "There is a strong preference...to place the topic in subject position," (1982:8). In addition, Ariel (1990:23-24) described a study by Broadbent (1973), which also appeared to identify subjects with topics. Although Reinhart specifically focused her discussion on sentence topics, their influence on pronoun interpretation can be seen as a discourse-level effect, as with Broadbent's stimuli, such as 9.

(9) The feedpipe lubricates the chain, and it should be adjusted to leave a gap half an inch between itself and the sprocket.

In Broadbent's study, "speakers understood it as referring to the discourse topic ('feedpipe') rather than the non-discourse topic ('chain')" (Ariel, 1990:23). Although Ariel did not define how she or Broadbent meant the term "discourse topic", this example suggests that it was defined as the grammatical subject of the first clause. A similar assumption also appeared in Ariel's discussion of Purkiss (1978). As Ariel also notes, other researchers have linked topichood to features such as repeated mention (e.g., Kameyama, 1996; Levy, 1982), or globally prominent characteristics such as being the protagonist of a narrative (e.g., Francik, 1985).

1.1.1.2. The status of topic

The notion of topic does not appear to be the best mechanism for discussing reference form. In the first place, there are few cues for identifying the topic. It is often associated with the grammatical subject, but not always. Other characteristics associated
with topichood are repeated mention or identity as the protagonist, but these aren't necessary or sufficient to identify the topic either. And even if the topic can be identified, it is not a necessary condition for pronoun use.

However, despite the problems associated with the concept of topic, it is important not to throw the baby out with the bathwater. It is still true that people tend to produce discourses coherently, which usually means discussing the same referent for periods of time. This means that discourse participants will focus on some referents and actions as more important to the discourse than others. These referents and actions exhibit some of the same characteristics as what researchers have called the "topic", but one crucial difference is that there is not always a unique topic for a particular sentence or discourse segment.

1.1.1.3. Topicality as a continuum: Givón

One solution to the one-topic-per-utterance problem is to treat topicality as a continuum, as did Givón (1983a). Givón suggested that all entities are topical to greater or lesser degrees, and demonstrated that three measures of topicality correlate with the form and type of reference used. He identified the following scale of topicality, with zero anaphors as the most topical entities, and referential indefinite NPs as the least topical.⁴

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⁴ Although Givón rejected this scale of topic accessibility in favor of more specific scales (such as scales of word-order, morphology, intonation, or phonological size), he claimed that the composite scale is roughly accurate. The single scale is presented here for the sake of simplicity.
In a collection of cross-linguistic text analyses, Givón and his colleagues (1983b) correlated the forms of reference in 10 with three measures of topicality: a) referential distance (how recently the entity has been mentioned), b) potential interference (how many other potential antecedents of the referring form there are), and c) persistence (how long the entity will remain in the discourse). By using both referential distance and persistence, Givón included two features in his conception of topicality: 1) the idea that topicality that reflects the status of the referent according to the discourse thus far, and 2) that notion that the way in which a speaker refers to an entity reflects the speaker's intentions about the role of that entity in the remainder of the discourse. This idea is also a component of Centering Theory, and will form part of my proposal below.

Givón's measure of "potential interference" addresses the issue of the ambiguity of the referring form, relative to the discourse situation. One problem with this measurement, however, is defining exactly what constitutes potential interference. Givón's description is somewhat vague: "An interfering topic was counted only if it was just as semantically compatible (most commonly in terms of animacy, humanity, agentivity or semantic plausibility as object or subject) with the predicate of the clause of the topic under consideration," (1983:14, emphasis in original). This characterization, albeit loose, reflects the importance of constraining information from the predicate as a
whole, and not just the anaphor itself. For example, if one hears "The bird saw the cat before it flew away", the interpretation of "it" is assisted by the compatibility of "the bird" and "flew". By contrast, in the sentence "The bird saw the cat before it pounced," the compatibility between "pounce" and "cat" would force a different interpretation of "it".

Givón and his colleagues argued that "topicality" can be conceived of as a continuum which can be statistically correlated with reference form. Even though Givón's measures of topicality (referential distance, potential interference, and persistence) are too rough to accurately reflect the processes of language comprehension and production (see chapter 2), the combination of these and other factors may provide a tenable characterization of topicality as a complex, multifaceted characteristic that can be applied in a gradient manner to all discourse entities. In this way, it appears that we may be able to salvage the concept of "topic".

However, by including "interference" as one of the measures of topicality, it seems that Givón has stepped beyond what was originally intended by the term "topic". The topicality of an entity, even if it is a continuous notion, seems to be a characteristic that is present in the role an entity plays in a discourse. In contrast, interference from other discourse entities is only relevant insofar as it may hinder the interpretation of referring forms. Thus, Givón's conception of "topicality" has more in common with other scales of salience or accessibility than with a traditional conception of "topic".

Givón's topicality scale differs from other accounts of reference form in that his measures of topicality concern the referring expression itself, as opposed to the cognitive status of the referent. Other scholars, such as Ariel, have been concerned with the
topicality of the referent, while Givón's measures are meant to indicate the topicality of
the referring expression. Nevertheless, Givón assumes that the text properties are
associated with the cognitive status of entities, such that "What is continuing is more
predictable", and "What is predictable is easier to process" (1983a:12). To a first
approximation, then, the three measures of topicality used by Givón and his colleagues
can be interpreted as indices of the cognitive status of the conceptual referent, and in that
sense are comparable with other approaches that identify degrees of topicality with the
referent and not with the referring expression.

1.1.1.4. The Accessibility Hierarchy: Ariel

Several researchers have suggested that the cognitive status of referents can be
characterized in terms of a graded scale. One of the most comprehensive proposals is
suggested that the accessibility of a referent entity is determined by multiple factors. She
proposed that the four most important are those listed in 11.
(11) Factors affecting the Accessibility status of an antecedent (reproduced from Ariel, 1990:28, example 24).

a) Distance: The distance between the antecedent and the anaphor (relevant to subsequent mentions only)

b) Competition: The number of competitors on the role of antecedent.

c) Saliency: The antecedent being a salient referent, mainly whether it is a topic or a non-topic.

d) Unity: The antecedent being within vs. without the same frame/world/point of view/segment or paragraph as the anaphor.

The first two factors are similar to Givón's measurements of "referential distance" and "potential interference", although Ariel's description of "Competition" differs from Givón's "interference" in that it does not include a discussion of semantic compatibility.

Ariel's third factor, "Saliency", addresses the difference between topical and nontopical antecedents. Her discussion reflects an assumption that "topic" is defined in terms of the grammatical subject. She also mentioned Levy's (1982) claim that topicality is influenced by the number of anaphoric references to an entity, in particular pronominal references. Although the Accessibility hierarchy is inherently a graded scale, it appears that "topic" is treated as an all-or-nothing phenomenon, implying that an entity either is the topic or not, and that a given discourse segment has one and only one topic.

The fourth area that Ariel lists is that of "Unity". This factor reflects the effect that discourse structure can have on "Working Memory", and thus reference form. Ariel
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suggests that choices in reference form are influenced by the discourse structure, which can be influenced by things like the passage of time within the discourse or paragraph breaks in written text. She links this factor to Fox's (1987) claim that in English, 'by using a pronoun the speaker displays an understanding that the preceding sequence has not been closed down' (1987:18). Thus, pronouns are more natural for references to things from the same discourse segment, and fuller forms are used when the referent was last mentioned in a different segment.

Through text analysis in Hebrew and English, Ariel (1988, 1990) demonstrated different distribution patterns for different forms of reference, which she termed "accessibility markers". Her full Accessibility Marking Scale is reproduced in 12, with examples of English accessibility markers.
Ariel's Accessibility Marking Scale (1990:73), with examples (1988:84)\(^5\)

<table>
<thead>
<tr>
<th>Marking Scale</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full name + modifier</td>
<td>Joan Smith, the president</td>
</tr>
<tr>
<td>Full ('namy') name</td>
<td>Joan Smith</td>
</tr>
<tr>
<td>Long definite description</td>
<td>The tall and authoritative president</td>
</tr>
<tr>
<td>Short definite description</td>
<td>The president</td>
</tr>
<tr>
<td>Last name</td>
<td>Smith</td>
</tr>
<tr>
<td>First name</td>
<td>Joan</td>
</tr>
<tr>
<td>Distal demonstrative + modifier</td>
<td>that hat we bought last year</td>
</tr>
<tr>
<td>Proximal demonstrative + modifier</td>
<td>this hat we bought last year</td>
</tr>
<tr>
<td>Distal demonstrative + NP</td>
<td>that hat</td>
</tr>
<tr>
<td>Proximate demonstrative + NP</td>
<td>this hat</td>
</tr>
<tr>
<td>Distal demonstrative</td>
<td>that</td>
</tr>
<tr>
<td>Proximate demonstrative</td>
<td>this</td>
</tr>
<tr>
<td>Stressed pronoun + gesture</td>
<td>SHE (plus gesture)</td>
</tr>
<tr>
<td>Stressed pronoun</td>
<td>SHE</td>
</tr>
<tr>
<td>Unstressed pronoun</td>
<td>she</td>
</tr>
<tr>
<td>Cliticized pronoun</td>
<td>(no examples in English)</td>
</tr>
<tr>
<td>Extremely High Accessibility Markers</td>
<td>gaps, including pro, PRO and (wh) -</td>
</tr>
</tbody>
</table>
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traces, reflexives, and Agreement

Other scholars have proposed similar scales of accessibility, such as Chafe (1994) (given > accessible > new), or Gundel et al. (1993) (in focus > activated > familiar > uniquely identifiable > referential > type identifiable). These scales are similar to Ariel's Accessibility Hierarchy, but are not as comprehensive.

1.1.1.5. Prince

Another functional approach to discourse structure and referential form was provided by Prince (1992). In this paper, Prince categorized entities in terms of givenness (whether an entity is "new" or "old"), but she introduced two key concepts which are not found in Ariel (1988, 1990, 1994) or Gundel et al. (1993). First, she divided the spectrum of "givenness" into three categories: new, inferrable, and old. With the category "inferrable", Prince recognized that by referring to The Bastille, for example, certain aspects of the referent, such as the door, become more accessible than completely new items would be. Second, Prince specified that the status of a discourse entity can be assessed both with respect to the discourse and with respect to the hearer's knowledge. For example, if both hearer and speaker know someone named "Samuel Davidson", the speaker may refer to this person for the first time as "Sam", without further introduction. Thus, Prince identified 6 levels of givenness, which are only partially independent of each other:

---

5 In a few cases the Marking Scale from Ariel, 1990 did not correspond exactly to the examples from Ariel, 1988. I filled in the missing examples or categories, following her schema.

6 I am using this nonstandard spelling of "inferrable" following Prince (1992).
By distinguishing between Hearer status and Discourse status, Prince recognized the concept of "shared knowledge" discussed by Clark and Haviland (1977). In a text analysis of a letter (a relatively formal text), Prince found a tendency for grammatical subjects to be definite, and to refer to entities that were both Hearer-old and Discourse-old. However, upon analyzing her data with VARBRUL, Prince found that the correlation between Hearer-old status and subject NPs was completely dependent on the tendency for subjects to be Discourse-old, and that Hearer information status did not contribute significantly to the outcome. It is certainly true that both Inferrability and shared knowledge between the speaker and listener are crucial for describing how reference may be made when something has not been mentioned before in a particular discourse. However, these factors do not play large roles in referring to "discourse-old" entities, which are the focus of this dissertation.

1.1.2. Psycholinguistic Research

The functional approaches to the study of reference form, discussed above, are useful in that they identify some of the basic factors affecting reference form and provide a comprehensive account of a range of forms, from definite NPs to null anaphors and pronouns. What these approaches lack, however, is a detailed proposal of the specific factors involved in the processing of referring forms. But a number of psycholinguistic studies have demonstrated how pronoun interpretation is influenced by factors such as
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Implicit Causality, Subjecthood or First Mention, Parallelism, Recency, and Ambiguity.

This research complements the linguistic research discussed above. Both traditions address many of the same factors, but linguists tend to concentrate on the identification of different factors, and their relation to multiple types of reference form, while psycholinguists tend to focus on how these factors are used during language production and comprehension.

1.1.2.1. Implicit Causality and Thematic Roles

Many researchers have claimed that some verbs are biased towards either the subject or the object (e.g., Au, 1986; Brown and Fish, 1983), and that this bias influences how people interpret subsequent pronouns (e.g., Caramazza et al., 1977; Caramazza and Gupta, 1979; Ehrlich, 1980; Garvey and Caramazza, 1974; McDonald and MacWhinney, 1995). The verb bias for one type of antecedent or the other is termed the "Implicit Causality" of the verb, and represents the tendency for people to attribute the cause of the event to the subject in some verbs, and the object in others. Implicit Causality is claimed to be one factor that can reverse the general tendency for the subject or "first mention" to be the more likely antecedent (McDonald and MacWhinney, 1995:545).

Several researchers have shown that with verbs such as "blame", which highlights the object NP as the implicit cause of the event, the processing of a subsequent pronoun is facilitated when the pronoun refers to the object, and is inhibited when the pronoun refers to the subject. The opposite effect obtains with verbs such as "please", for which the referent of the subject NP is implicitly assumed to be the cause, and therefore is considered more prominent (Caramazza et al., 1977; Caramazza and Gupta, 1979; Garvey and Caramazza, 1974). Similarly, the interpretation of ambiguous pronouns has
been shown to be affected by the implicit causality of the verb (Ehrlich, 1980; Garvey and Caramazza, 1974; Grober et al., 1978; Stevenson et al., 1994). For example, in 14a the preferred interpretation of "he" is "George", but in 14b the preferred interpretation of "he" is "Walter".

(14) a. George telephoned Walter because he wanted some information.
    b. George criticized Walter because he misplaced the file.

(Grober et al., 1978)

One problem with studying implicit verb causality is determining the direction of the verb’s bias. Early studies (e.g., Ehrlich, 1980) defined the implicit causality as the most natural continuation to fragments of "because sentences", such as "Sue blamed Al for spilling the coffee, because she/he ...". Ehrlich (1980) asked 10 judges to complete sentences such as these, and used their completions as the baseline measure of implicit causality. This measure contains a basic circularity -- it uses pronoun assignment to determine what will be the most likely pronoun assignment.

The problem of defining Implicit Causality has been partially eliminated in more recent studies, in which researchers have defined the verb bias in terms of argument structure. For example, McDonald and MacWhinney (1995) compared "Experiencer-Stimulus" verbs, as in 15a, with "Stimulus-Experiencer" verbs, as in 15b, where the Stimulus is interpreted as the implicit cause of the event.
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(15) From McDonald and MacWhinney (1995), Experiment 1

a. Gary admired Alan time after time because he was so talented.

   Experiencer Stimulus

b. Gary amazed Alan time after time because he was so talented.

   Stimulus Experiencer

This independent characterization of verb bias is beneficial, particularly because it takes a step in the direction of explaining why these verbs should have this effect. Using a cross-modal priming task, McDonald and MacWhinney played sentences like 15a or b to participants, and measured the time it took them to respond to probe words like "Gary" or "Alan" at different points during the presentation. Response time was taken as an indication of the accessibility of each referent at a given point. Their biggest effect was that the first-mentioned referent was more accessible at most time points, reflecting a first-mention bias. The bias toward the stimulus-referent also had an effect, erasing the first-mention effect for stimuli like 15a, but only at the pronoun and at the end of the sentence.

Thematic roles were also used to characterize a verb's bias in Stevenson et al.'s (1994) study. They investigated the four types of sentences shown in 16.
From Stevenson et al. (1994), Experiment 1

<table>
<thead>
<tr>
<th>Verb type</th>
<th>Example</th>
<th>Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Goal/Source:</td>
<td>John seized the comic from Bill.</td>
<td>goal</td>
</tr>
<tr>
<td></td>
<td>John passed the comic to Bill.</td>
<td></td>
</tr>
<tr>
<td>b. Agent/Patient</td>
<td>Joseph hit Patrick.</td>
<td>patient</td>
</tr>
<tr>
<td></td>
<td>Patrick was hit by Joseph.</td>
<td></td>
</tr>
<tr>
<td>c. Experiencer/Stimulus:</td>
<td>Ken admired Geoff.</td>
<td>stimulus</td>
</tr>
<tr>
<td></td>
<td>Ken impressed Geoff.</td>
<td></td>
</tr>
<tr>
<td>d. Agent/goal:</td>
<td>Simon ran towards Richard.</td>
<td>agent</td>
</tr>
<tr>
<td>Agent/source:</td>
<td>Simon ran away from Richard.</td>
<td></td>
</tr>
</tbody>
</table>

Using a written sentence-completion task, they presented participants with stimuli like 17a and b, and asked them to write a continuation sentence.

(17) a. Pronoun condition: Ken admired Geoff. He .......

b. No-pronoun condition: Ken admired Geoff. ........

(Stevenson et al., 1994:527)

They analyzed sentence continuations to identify the pronoun antecedent in the pronoun condition, and to see which referent participants referred to in the no-pronoun condition.
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Their results showed that thematic roles did indeed influence the types of continuations that participants provided, such that participants referred more to the biased thematic role for each verb type. Their results were consistent with those of McDonald and MacWhinney, in terms of both the stimulus bias and their finding of a general first-mention bias.

In sum, thematic roles are useful for discussing the bias of individual verbs. At the same time, thematic roles are a relatively impoverished representation of participant roles. Although they provide a handle for studying verb semantics, they are mere representatives of the verb semantics, which are much more complex. This issue will be discussed in more detail in chapter 4, where I will also propose a new way of considering the effects of implicit causality and thematic roles.

1.1.2.2. Subject/First-Mention Bias

One of the most common generalizations about reference is the tendency to interpret ambiguous pronouns as co-referential with the subject, or first-mentioned entity. Stevenson et al.'s (1994) study, described above, also revealed a general tendency to interpret the pronoun as coreferential with the subject of the first clause, in the pronoun condition. In the no-pronoun condition, people tended to use pronouns to refer to the subject-referent, and to use names to refer to the object-referent.

In McDonald and MacWhinney's (1995) probe task, they found that subjects responded to a subject probe about 80 ms faster than they responded to an object probe. However, they also found that the subject advantage disappeared when the pronoun was interpreted as co-referential with the object NP. They suggested that the subject advantage is a "general accessibility advantage, and occurs whether or not anaphor
resolution processes are involved.... It is pervasive and is not localized to a particular point in sentence processing," (p. 560). In contrast, they claimed that factors such as Implicit Causality and gender information are specifically involved in pronoun disambiguation, and apply only at the point of the anaphor. A similar argument was made by Garnham et al. (1996), who also found a general First-Mention advantage during a probe study of Implicit Causality.

The Subject/First Mention bias constitutes one of the core generalizations about reference form and pronoun resolution. It is the most frequently mentioned characteristic in psycholinguistic studies of reference and pronoun resolution; it reflects generalizations about topicality which have been made in the linguistic domain; and it also plays a fundamental role in Centering Theory, discussed below.

1.1.2.3. Parallelism

Another factor, often confused with the subject bias, is the parallel function strategy. First suggested by Sheldon (1974), the parallel function strategy refers to the increased accessibility of antecedents in the same grammatical position in the preceding clause (e.g., subject vs. object). For example, in 18b, "Celia" should be more accessible as the antecedent for the subject pronoun, and "Sharon" should be more accessible as the antecedent for the object pronoun.

\[(18)\]

a. Celia hugged Sharon at the train station.

b. She asked her how the trip was.

Evidence for this strategy was also found by other researchers (e.g., Corbett and Chang, 1983:289; Grober et al., 1978; Springston, 1975). For example, Springston demonstrated
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that pronouns with non-parallel antecedents were harder to read than those that did have parallel antecedents.

The problem with these studies is that the "parallel function strategy" was always demonstrated with pronouns in subject position, by showing that subject antecedents are easier to resolve than object antecedents. It is unclear, therefore, whether the preference for subject-subject parallelism (subject anaphor and subject antecedent) is due to parallelism, or to a subject bias. The crucial test for parallelism is the comparison of subject and object antecedents when the referring form is in object position. The potential confound between parallelism and subject biases also throws doubt on the claim of a subject bias. In chapter 2, I will present the results of a text analysis, which simultaneously supports claims about parallelism and subjecthood. These conclusions are consistent with on-line evidence from Smyth and Chambers (1996), who demonstrated parallelism effects for both subject-subject and object-object parallelism. Thus, although the original papers on parallelism didn't adequately support their claims, it appears that parallelism is indeed a relevant factor in pronoun interpretation.

1.1.2.4. Recency/Distance

Like linguists, psycholinguists have suggested that anaphor resolution is influenced by the recency of the antecedent (also sometimes called the "distance" between the anaphor and antecedent). For psycholinguists, however, Recency is usually computed over a shorter span than for linguists, who include the preceding discourse up to as many as 20 clauses back or more (Du Bois, 1987; Givón, 1983a). For example, Clark and Sengul (1979) demonstrated that pronoun resolution was easier if the antecedent was in the previous clause than if it had occurred earlier. This finding
suggests that if an entity hasn't been mentioned for awhile, the mental representation for
it declines in activation, so it becomes less accessible.

There are several possible reasons why a conceptual referent becomes less
available as time passes. On one hand, it may be the result of a simple decay mechanism
-- if an entity hasn't been mentioned for awhile, and the representation of that entity has
not been re-activated, the activation for that representation will slowly decrease and
eventually disappear. On the other hand, the reason that entities become less accessible
over time may be the result of interference from other referents which are mentioned in
the intervening discourse. These referents may compete with the previous referents and
lead to their suppression (Gernsbacher, 1990:139).

Clark and Sengul (1979) also suggested that recency effects are not linear. They
found that referents mentioned in the previous clause were significantly easier to access
than referents from two or three clauses back. However, they found no difference
between referents from two clauses back and referents from three clauses back. They
concluded that referents from the preceding clause enjoy a privileged position, in
comparison with other referents.

1.1.2.5. Ambiguity

Another feature that both linguists and psycholinguists have acknowledged is the
role of ambiguity. When a reader/listener is confronted with an anaphoric reference, the
task of identifying the referent may involve choosing among several referents. 19 shows
an example of a naturally-occurring ambiguous pronoun, which the author chose to
disambiguate for purposes of humor.
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(19) Unspikeable Punch is a refreshing change from booze. Contrary to expectations, people will drink a lot of it. (Punch, that is.)

(Rosenberg, The Impoverished Students' Book of Cookery, Drinkery, & Housekeepery:36)

Many researchers have also noted that the interpretation of a referring form is easier when the number of possible antecedents is lower (e.g., Ariel, 1990; Givón, 1983a; McDonald and MacWhinney, 1995).

The question is, however, what qualifies as a "possible antecedent"? One way to think of pronoun resolution is as a process whereby the comprehender needs to find a conceptual referent that matches the features of the referring expression. Under this model, there are many factors that may play a role. Most psycholinguists have discussed this issue in terms of morphological ambiguity, distinguishing between "ambiguous" and "unambiguous" pronouns in English on the basis of number and gender (e.g., MacDonald and MacWhinney, 1990; McDonald and MacWhinney, 1995). That is, English "he" is only ambiguous in a context with two or more singular, male referents. However, comprehenders clearly also need to consider other aspects of the referring expression to interpret it. This observation is reflected in Givón's definition of "Potential Interference ('ambiguity')" (see §1.1.1.3.), which stresses that an expression is only ambiguous if there is more than one referent that is semantically compatible with the entire referring expression. Walker (1998:413) similarly proposes that selectional restrictions can influence the interpretation of pronouns, for example the antecedent of "he" in "he rode" must be animate.
Thus, I hypothesize that the processing of a referring expression is sensitive to the properties of expression as a whole, and the degree to which they match the properties of the referent and other potential referents. For example, the pronouns in 20a-c contrast with each other in terms of different types of information.

(20) Context: Lisa is in a diner.

a. Animacy:  • Lisa bought a slice of pie. She was very hungry.
             • Lisa bought a slice of pie. It was freshly baked and smelled wonderful.

b. Gender:   • Lisa sat down next to Ben. She ordered a slice of pie.
             • Lisa sat down next to Ben. He ordered a slice of pie.

c. Semantic fit with following predicate:

    • Lisa leaned on the counter as she ate her pie. It was all wet and her arm got soaked.
    • Lisa leaned on the counter as she ate her pie. It was very tasty and she finished it immediately.

As the examples in 20 illustrate, many different features of the referring expression can restrict the possible set of interpretations. Some of these properties are inherent in the pronoun itself, such as animacy and gender, while some features are available only after integrating the pronoun with its role in the predicate.
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However, attempts at understanding how information from the referring expression is used during processing have yielded contradictory results. For example, in McDonald and MacWhinney's (1995) third experiment on Implicit Causality, they manipulated the ambiguity of the pronoun by controlling the number of compatible referents in the discourse situation, as in 21.

(21) Gary amazed Alan/Ellen time after time because he was so talented.

As mentioned above, subjects heard these sentences and responded to probes at several points. The general finding was that the first-mentioned (subject) NP was more accessible at almost all time points. However, when the pronoun was ambiguous, the First-Mention advantage disappeared at the pronoun. They interpreted this as evidence that both participants were briefly considered as antecedents at that point. In the unambiguous pronoun condition, however, the first-mention advantage persisted at all time points, even in the case where the pronoun did not refer to the first-mentioned NP. They interpreted this result as evidence that gender information is not used at the point where the pronoun is encountered. Their final conclusions are indeterminate, suggesting that gender information may be available at the pronoun to a certain extent, but that the use of gender information may be influenced by other factors (1995:562).

In contrast, there is clear evidence that the ambiguity of the discourse situation affects language production. For example, Francik (1985) had English-speakers tell narratives based on comic strips about two characters. In one condition, the two characters were of the same sex (e.g., a man and a boy); in another, they were of different
sex (e.g., a man and a girl). An analysis of the referential forms that participants used revealed a significant tendency to use pronouns more often in the mixed-gender condition, when the pronoun was unambiguous.

1.1.3. Centering Theory

One of the most developed theories about reference and reference processing is Centering Theory, which utilizes some of the same notions of topicality and salience, but operationalizes them in a very concrete way (Grosz and Sidner, 1986; Grosz, Weinstein, and Joshi, 1995). Centering Theory grew out of artificial intelligence research, and was developed to predict the antecedent of a pronoun based on simple computations that could be implemented in a computer program. By extension, these same computations have also been considered possible mechanisms for the human language processor.

The basic idea of Centering is that all arguments in a given utterance are ranked according to their grammatical function (SUBJ > OBJ > OBJ2 > OBL). These elements are the set of "forward-looking centers", or Cfs, because they provide potential antecedents for subsequent anaphors. The Cf set contains two privileged members: 1) the "backward-looking center", or Cb, which is the entity that the utterance is "about" and which refers back to something in the previous discourse, and 2) the highest-ranked Cf, which is called the "preferred center" (Cp), and is predicted to be the Cb of the following sentence. In an ideal situation, according to Centering Theory, the Cb and the Cp are identical. Thus, Centering proposes the following four possible transitions between two
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utterances, where "CONTINUE" is predicted to be the most coherent and easiest to process, and "ROUGH-SHIFT" is predicted to be the most difficult.\(^7\)

(22) Centering Transitions (Reproduced from Walker and Prince, 1996:296)

<table>
<thead>
<tr>
<th>(Cb(U_i) = Cb(U_{i-1}))</th>
<th>(Cb(U_i) \neq Cb(U_{i-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTINUE</td>
<td>SMOOTH-SHIFT</td>
</tr>
<tr>
<td>RETAIN</td>
<td>ROUGH-SHIFT</td>
</tr>
</tbody>
</table>

By including both backward-looking centers and forward-looking centers, Centering formalizes a concept implicit in Givón's two measurements of "referential distance" and "persistence". The idea is that speakers will place an item in a prominent position, such as subject position, if it has been important in the preceding discourse, and/or if they intend it to play a prominent role in the upcoming discourse.

The question of determining how the elements are ranked has not been thoroughly explored in Centering Theory. The basic assumption is that the hierarchy of grammatical functions determines the ranking of arguments, which means that the grammatical subject is usually the center. However, Gordon et al. (1993) claim that fronted arguments (i.e., "first mentioned" NPs) are ranked higher than subjects, and Walker et al. (1994) claim that in Japanese the highest position is the topic (marked with "wa"). Centering theorists also acknowledge that other factors, such as thematic role, may influence the ranking of

\(^7\) For a more complete description of Centering Theory, see Grosz et al (1995), or papers in Walker et al. (1998).
forward-looking centers (e.g., Brennan, Friedman and Pollard 1987; Grosz and Sidner 1995; Grosz et al. 1995).

Some of these factors have been explored by researchers working within the framework of Centering Theory. One such factor is whether an entity has been mentioned more than once within a discourse, and especially if it has already been referred to with a pronoun (e.g., Kameyama 1996). The effect of pronominal reference on the topicality of discourse entities can be observed in 23, from Sidner (1983:298).

(23) a. I got a new hat and I decorated it with a big red bow.
   I think the bow will brighten it up a lot.
   If not, I think I'll still use it.

b. I got a new hat and I decorated it with a big red bow.
   I think it will brighten up the hat a lot.
   If not, I think I'll still use it.

Sidner suggests that the pronoun in the last line is most naturally interpreted as co-referential with the previous pronoun, which has a different referent in 23a and 23b.

In addition, the role of the center (as grammatical subject) has been experimentally investigated by Hudson-D’Zmura and Tanenhaus (1998), and Gordon et al. (1993), who both used self-paced reading tasks of short passages in English. Hudson-D’Zmura and Tanenhaus presented subjects with sentence pairs like those in 24, consisting of a context sentence and a second sentence in one of four conditions.
(24)  
1. **CONTEXT SENTENCE**  
   Jack apologized profusely to Josh.

2a. **SUBJ. REF. (pronoun)**  
   He had been rude to Josh yesterday.

2b. **SUBJ. REF. (name)**  
   Jack had been rude to Josh yesterday.

2c. **OBJ. REF. (pronoun)**  
   He had been offended by Jack’s comment.

2d. **OBJ. REF. (name)**  
   Josh had been offended by Jack’s comment.

There were two measurements of the appropriateness of each condition: 1) Participants rated each sentence pair in terms of whether the second sentence made sense with respect to the first, and 2) they answered a comprehension question. The major finding was that for subject-referent conditions, both coherence ratings and comprehension scores were higher when the referring form was a pronoun, and for object antecedents, both ratings and scores were higher when the referring form was a name. This result was replicated in four other experiments using variations of the same methodology.

Hudson-D’Zmura and Tanenhaus theorized that processing was impaired for pronominal objects because the antecedent was mis-assigned to the "center", or subject. A problem with this analysis, however, is that both object conditions involved a non-parallel structure, while the subject conditions had a pronoun or name referring back to the character in the parallel position. This means that their findings may have come from a tendency to follow a "parallel function strategy", which would result in the same antecedent preferences. Therefore, it may not be just the prominence of the "center" that affects antecedent assignment. When the order of reference parallels that of the previous sentence, intuition suggests that two pronouns are felicitous and indeed preferred:
(25) The Lakers beat the Celtics in the final game of the season. They had lost to them at an away game earlier in the season, so this victory was important.

Thus, the results of this experiment may have been influenced by two factors: the Subjecthood/First-Mention bias, and the Parallelism bias.

Despite problems with the Hudson-D’Zmura and Tanenhaus stimuli, however, the same "repeated-name penalty" was also found by Gordon, Grosz, and Gilliom (1993), who coined the term. In contrast, Gordon et al. used 4-sentence discourses where both the subject and object anaphors appeared in the same position as their antecedents.
(26) Sample stimuli from Gordon et al. (1993), Experiment 1. Underlines are included for presentational purposes only and were not present in the experimental stimuli.

A. NAME-NAME VERSION

1. Bruno was the bully of the neighborhood.

2. Bruno chased Tommy all the way home from school one day.

3. Bruno watched Tommy hide behind a big tree and start to cry.

4. Bruno yelled at Tommy so loudly that all the neighbors came outside.

B. PRO-NAME VERSION

1. Bruno was the bully of the neighborhood.

2. He chased Tommy all the way home from school one day.

3. He watched Tommy hide behind a big tree and start to cry.

4. He yelled at Tommy so loudly that all the neighbors came outside.

C. PRO-PRO VERSION

1. Bruno was the bully of the neighborhood.

2. He chased Tommy all the way home from school one day.

3. He watched him hide behind a big tree and start to cry.

4. He yelled at him so loudly that all the neighbors came outside.
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Using a self-paced reading task, they had participants read paragraphs such as those in 26. The stimuli were presented in one of three conditions: PRO-PRO (in which all subsequent references used pronouns) PRO-NAME (in which only references to the subject antecedent used pronouns), NAME-NAME (in which all subsequent references used names). The results showed that participants were equally fast in PRO-PRO and PRO-NAME, but slower in NAME-NAME. That is, participants read stimuli faster when references to the subject-referent were pronominal, there was no difference in reading times between versions that used pronouns or names to refer to the object-referent. This suggests a repeated-name penalty just for the subject-referent, but not for the object-referent, despite the fact that intuition suggests that the PRO-NAME condition is less natural than the PRO-PRO condition.

As is evident in the studies by Gordon et al. and Hudson-D'Zmura and Tanenhaus, one of the key features of Centering Theory is that it attributes a special status to the Cb, which shares many features with what other linguists have called the "topic". Centering claims that it is more natural to use pronouns to refer to the Cb, but it doesn't make any explicit predictions about other entities in the discourse, except to say that they do not hold the same status as the Cb. Attributing special status to the top-ranked entity is a problematic aspect of Centering, for three reasons. First, the difficulty of identifying a unique Cb or Cp in all cases makes the claim difficult to test. Second, non-subjects can often be more salient than subjects. For example, Smyth and Chambers (1996) showed that in some conditions, equal repeated-name penalties can be found for both object- and subject-referents, and that reading times for a pronoun are faster when it refers to a parallel object-referent than to a nonparallel subject-referent. Third, Centering Theory
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stipulates that if a pronoun is used to refer to the Cb, other pronouns are acceptable (but not necessary), but it makes no predictions about if or when a pronoun will be used to refer to a non-Cb. I will discuss further criticisms of Centering Theory in relation to the Information Load Hypothesis, below.

In defense of Centering, however, this line of research has offered many contributions to the study of discourse and reference form. Centering is the only extant theory that has offered a formalized account of transitions between sentences and the use of pronouns. It is also one of the few theories that simultaneously looks at how utterances relate to the preceding discourse (via the backward-looking center) and the following discourse (via the set of forward-looking centers). The theory is also expressed clearly and falsifiably. Centering has produced a wealth of research on local discourse structure (see Walker, Joshi, and Prince, 1998), focusing on distinctions in accessibility and prominence of entities in different discourse structures, both through text analysis (e.g., Hurewitz, 1998; Walker, Cote, and Iida, 1994; Walker and Prince, 1996), and experimentation (Brennan, 1995; Hudson-D'Zmura and Tanenhaus, 1998; Gordon et al., 1993). Centering has also provided a useful account of pronoun resolution for the artificial intelligence community, the purpose for which it was originally intended.

1.1.4. The Information Load Hypothesis

An additional criticism of Centering Theory is developed in Almor's (1995) Information Load Hypothesis. A major implication of this paper is that, contrary to the claims of Centering, reference to the most highly focused element in a discourse is not obligatorily pronominal. Derived from Grice's maxim of quantity, the Information Load Hypothesis claims that anaphors differ from each other in terms of the cost they put on
the processing system. Low-cost anaphors include pronouns and NP anaphors that are more general than their antecedents, for example using "the bird" as an anaphoric expression for something previously identified as "the robin". Almor's central claim is that if a speaker uses a high-cost anaphor, there must be a justification for it. He discussed two situations in which a high-cost anaphor would be justified: 1) When the antecedent is not focused, and is therefore not accessible; 2) When the speaker wishes to express additional information about the discourse referent, for example by using the phrase "the robin" to refer to a referent previously expressed as "the bird". Repeated NPs, like the ones in Gordon et al.'s stimuli, are neither low-cost, nor do they express any additional information. Therefore, they are only functionally justified when the antecedent is low in focus.

Almor demonstrated that in fact, the processing of full NP anaphors is faster when the antecedent is salient than when the antecedent is not salient. Using a self-paced reading methodology, Almor had subjects read sentence pairs such as those in 27.
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(27) Sample stimuli form Almor (1995), Experiment 1

a'. It was the robin that ate the apple.  <-- aster reading times
The bird seemed very satisfied.

a". It was the robin that ate the apple.  <-- lower reading times
The fruit was already half rotten.

b'. What the robin ate was the apple.  <-- lower reading times
The bird seemed very satisfied.

b". What the robin ate was the apple.  <-- aster reading times
The fruit was already half rotten.

The results showed that the NP anaphor in a' was read faster than the one in a", and the NP anaphor in b" was read faster than the one in b'. In contrast, when repeated NPs were substituted for the NP anaphors (e.g., "the robin" in a' and b', and "the apple" in a" and b"), the reverse results obtained -- a" was read faster than a', and b' was read faster than b". Almor concluded that the penalty observed by Gordon et al. was due to the infelicity of repeated names, and not a categorical prohibition against noun anaphors for focused referents.

While the Information Load Hypothesis challenged Centering Theory, it also confirmed the infelicity of using repeated names to refer to highly salient antecedents. However, this study differed from the work in Centering in the following way. The
experiments by Gordon et al. (1993) and Hudson-D'Zmura and Tanenhaus (1998) demonstrated the repeated name penalty for referring to the grammatical subject, a typically topical position. In contrast, Almor demonstrated that repeated names are less natural when the antecedent is focused by means of a cleft construction. This contrast is notable because topics and foci have traditionally been opposed in theories of information structure. However, these studies found that the referents of subjects and foci are more salient than other referents. This similarity will be explored in chapter 3.

1.1.4.1. Other uses of noun phrase anaphors

The results of Almor's study have an additional implication for the study of reference form, aside from issues that are specific to Centering Theory. That is, studies of reference form often ignore the possibility of using full NP anaphors for reasons of style, emphasis, or as Almor points out, adding information. However, as Almor's study demonstrated, even when a pronoun would be quite natural, the use of a pronoun is not obligatory.

More generally, it is easy to observe that full forms of reference are occasionally used for reasons of style, emphasis, to describe an individual in a different way, or even to manipulate the structure of the discourse. The following excerpt shows how repeated reference can be used for stylistic purposes.
It was after the picnic that the town began to notice things and got mad. Tea Cake and Mrs. Mayor Starks! All the men that she could get, and fooling with somebody like Tea Cake! Another thing, Joe Starks hadn't been dead but nine months and here she goes sashaying off to a picnic in pink linen. Done quit attending church, like she used to. Gone off to Sanford in a car with Tea Cake and her all dressed in blue! It was a shame. Done took to high heel slippers and a ten dollar hat! Looking like some young girl, always in blue because Tea Cake told her to wear it. Poor Joe Starks. Bet he turns over in his grave every day. Tea Cake and Janie gone hunting. Tea Cake and Janie gone fishing. Tea Cake and Janie gone to Orlando to the movies. Tea Cake and Janie gone to a dance. Tea Cake making flower beds in Janie's yard and seeding the garden for her. Chopping down that tree she never did like by the dining room window. All those signs of possession. Tea Cake in a borrowed car teaching Janie to drive. Tea Cake and Janie playing checkers; playing coon-can; playing Florida flip on the store porch all afternoon as if nobody else was there. Day after day and week after week.

(Hurston, Their eyes were watching God, 1937:105)

In this example, it seems that the narrator wanted to emphasize not only all the things that Tea Cake and Janie did together, but the fact that they did them together, and that these activities were a repeated occurrence. This effect is achieved by repeating "Tea Cake and Janie", even though both characters are highly prominent, and are additionally referred to
with pronouns and elliptical references. Another literary example of a full NP anaphor can be observed in 29, where the same character is referred to both as "Dorothy" and "the little girl".

(29) Aunt Em had been so startled by the child's laughter that she would scream and press her hand upon her heart whenever Dorothy's merry voice reached her ears; and she still looked at the little girl with wonder that she could find anything to laugh at.

(Baum, The Wonderful Wizard of Oz, 1900:12)

It has also been argued that full forms of reference can be used to manipulate the discourse structure. For example, Vonk, Hustinx and Simons (1992) suggested that non-pronominal forms of reference are one signal of a thematic shift. The evidence for this claim comes from a production study, where speakers described a cartoon which either had a thematic shift or not. Vonk et al. found that when subjects described a cartoon with a thematic shift, non-pronominal reference represented only one of several strategies that speakers used to effect the shift. When other markers were used, such as phrases signaling a change in time or place, subjects tended to use pronouns, but when no such time/place phrase was used, speakers produced a higher rate of non-pronominal reference. In addition, Vonk et al. claimed that hearers make use of information from referential form in order to deduce the structure of the discourse. They hypothesized that the appearance of a full form of reference signals a break in the thematic structure of the discourse, making preceding information less accessible than if a thematic break had not occurred. This claim was supported through two comprehension experiments, where the
use of a name (in comparison with a pronoun) caused subjects to be slower in recognizing probe words related to information from the previous sentence.

These examples, in addition to Almor's findings, suggest that any theory of reference must take into account the possibility of using full NPs or names for particular purposes. Because of this, it is important to realize in the following chapters that high activation of a discourse representation does not translate into absolute requirements for a particular form of reference. In all cases, the speaker/author has the prerogative to manipulate form of reference for a particular effect. However, the effects that are possible with a particular form result from the more general distributions of these forms, through which they come to be associated with discourse functions. Furthermore, all forms of reference are not always available choices for the speaker.

1.1.5. Summary

Theories of reference form have usually focused on the status of the referent, described in terms of a property variously termed salience, accessiblity, or focus of attention. Taken together, the many studies from psycholinguistics, functional linguistics, and computational linguistics have identified a number of factors that affect reference form. These are summarized in Figure 1. Some features not discussed here are also listed, for the sake of completeness.

This figure depicts choices in reference form as falling along a continuum, such that less specified forms are to the left, and more specified forms are to the right. The factors listed have been shown or are hypothesized to affect speaker's choices of reference form. The effect of each factor pushes the speaker's preference more toward the left (i.e., less specified forms), or more to the right (i.e., more specified forms). Many
different factors can influence choices in reference form on a given occasion, although
the relative importance of each factor may vary from situation to situation.
### Figure 1: FACTORS INFLUENCING REFERENCE FORM

<table>
<thead>
<tr>
<th>less specified form</th>
<th>more specified form</th>
<th>less specified form</th>
<th>more specified form</th>
</tr>
</thead>
<tbody>
<tr>
<td>less ----&lt;</td>
<td>A. RECENCY OF REFERENT</td>
<td>less ----&lt;</td>
<td></td>
</tr>
<tr>
<td>less ----&lt;</td>
<td>B. REFERENT TOPICALITY</td>
<td>less ----&lt;</td>
<td></td>
</tr>
<tr>
<td>less ----&lt;</td>
<td>C. FOCUS ON REFERENT</td>
<td>less ----&lt;</td>
<td></td>
</tr>
<tr>
<td>less ----&lt;</td>
<td>D. SEMANTIC PLAUSIBILITY OF REFERENT</td>
<td>less ----&lt;</td>
<td></td>
</tr>
<tr>
<td>parallel ----&lt;</td>
<td>E. PARALLELISM</td>
<td>nonparallel ----&gt;</td>
<td></td>
</tr>
<tr>
<td>less ----&lt;</td>
<td>F. AMBIGUITY OF REFERENT RELATIVE TO CONTEXT</td>
<td>more ----&gt;</td>
<td></td>
</tr>
<tr>
<td>no ----&lt;</td>
<td>G. OTHER USES OF FULL NP ANAPHORS</td>
<td>yes ----&gt;</td>
<td></td>
</tr>
</tbody>
</table>

### EXAMPLES

#### English Examples

 English Examples

---- (pronoun) ............................................................................................................. (name/NP) .....  
---- he, she ............................................................................................................. John, Mary, ..... the professor

#### Spanish Examples

 Spanish Examples

---- (null/clitic) ........................................................... (overt pronoun) ........................................... (name/NP) .....
1.2. A Processing Framework

In the section above, I reviewed a wide range of factors, all of which have been linked to speaker choices of reference form or the comprehension of referring forms. On the surface, these factors seem to have little to do with each other. Why, for example, are pronouns used more when the referent has been recently mentioned, and also when the referent has played a particular thematic role? Why do both parallel structure and the topicality of the referent influence the ease of interpreting a pronoun?

In the remainder of the dissertation, I will focus on five of the factors considered above. I will confirm past findings that pronouns and other less-specified forms of reference (like null anaphors) are more natural for all five. The five factors are presented in Table 1, along with definitions of how I will be using the terms. For a general discussion of each factor, see §1.1.
### Table 1. The labels and definitions for the five factors to be investigated

<table>
<thead>
<tr>
<th>LABEL</th>
<th>DEFINITION of the factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Recency</td>
<td>The property of a referent (i.e., an entity) of having been recently referred to in the discourse.</td>
</tr>
<tr>
<td>ii) Subjecthood</td>
<td>The property of a referent of having been last mentioned in subject position.</td>
</tr>
<tr>
<td>iii) Focus</td>
<td>The property of a referent of having been last mentioned as the focus of a cleft or cleft-like construction.</td>
</tr>
<tr>
<td>iv) Parallelism</td>
<td>The property of a referent of having been last mentioned with an NP in the same grammatical role as current referring NP.</td>
</tr>
<tr>
<td>v) Goal Status</td>
<td>The property of a referent of having been last mentioned as the goal argument of a verb.</td>
</tr>
</tbody>
</table>

The purpose of this dissertation is to address the question of what makes these five factors behave in a similar way with respect to reference form. As an answer to this
question, I will provide evidence that they all share an additional property: the referents associated with these factors are also more likely to be referred to in the following discourse than other referents. Through text and corpus analyses, I will show that there is a higher probability that speakers will refer again to recent-referents, subject-referents, focus-referents, parallel-referents, and goal-referents, in contrast with comparable referents (i.e., nonrecent-referents, object-referents, etc.). I hypothesize that the tendency toward repeated reference to certain entities is part of a more general tendency to continue to use those referents in the following interaction, whether that use is linguistic or non-linguistic. However, my findings come from purely linguistic data, and from situations with a minimum of nonlinguistic interaction (written texts and discussions from the Canadian Parliament).

Thus, I will show an association between each factor and two generalizations: a) Reference Form, such that speakers and writers tend to use pronouns and other less specified forms for subsequent reference to referents with these properties, and b) Reference Continuation, such that speakers and writers tend to refer more often overall to referents with these properties, compared to referents with contrasting properties. Throughout this dissertation, I will refer to these two generalizations as "Reference Form" and "Reference Continuation", for ease of presentation. Their relation to the five factors is depicted in Figure 2.
The finding that these factors are associated with Reference Form is not surprising. This essentially supports a series of past findings about reference form and pronoun interpretation. The novel result of my studies is that all five are also associated with an higher overall probability that these same referents will be mentioned in the subsequent discourse. This result is important, because it offers a preliminary answer the question of why these five factors behave similarly with regard to Reference Form. That is, the five factors share at least one other property, the tendency for their referents to appear again in the following discourse.

This generalization is useful, but from the perspective of discourse processing, it is not enough. It raises two additional questions: 1) Where do these discourse patterns come from?, and 2) Why are they also associated with choices in reference form? I will consider each question in turn here, and return to them in more detail in later chapters.

1.2.1. Where do discourse patterns come from?

People use language in regular ways because language is one part of human behavior, and people behave in regular ways. As Clark (1996) has argued, discourse is just one form of joint activity. One property of joint activities is that they are goal-
driven, meaning that discourse participants come to the discourse situation with a set of goals and intentions (Clark, 1996:33; Grosz and Sidner, 1986). These goals may be well defined prior to the discourse, or they may not be. The goal-oriented nature of language use offers possible explanations for numerous referential patterns.

First, speakers attempt to coordinate with their interlocutors to produce a coherent discourse (e.g., Clark, 1996; Grosz et al., 1995). People do not produce strings of unrelated sentences. Rather, they tend to talk about the same things for extended periods of time. Consequently, people refer more often to referents that have been recently mentioned than referents that have not ("i" in Figure 2, above).

The fact that speakers are pursuing larger goals also means that certain referents are more central to the speaker's intentions than others. Research has established that speakers tend to use particular constructions, such as the grammatical subject, to refer to referents that are important to the discourse (e.g., Chafe, 1976; Prince, 1992; Du Bois, 1987) or in the speaker's focus of attention (e.g., Tomlin et al., 1997). Those referents that are important to the discourse are also those referents that the speaker will keep referring back to. These facts together account for why the referents of subjects and foci are more frequently referred to than other referents ("ii" and "iii" in Figure 2, above). These facts may also account for the fourth pattern, that speakers tend to refer more often to referents in the parallel position from the preceding clause ("iv" in Figure 2, above). It is likely that referents are put in the same semantic and pragmatic roles throughout a discourse segment. For this reason, speakers tend to use the same grammatical position to refer to a particular referent in subsequent utterances.
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Why it is that speakers refer more often to goals than to sources? ("v" in Figure 2, above). This factor is different from the others, because it derives from the semantics of a proposition, rather than the forms chosen to express that proposition. That is, if John is telling a story and he says "Francine sent the final copy of her paper to the printers", he says so because this is the proposition he wanted to express. There are other ways he could have expressed it to place emphasis on one referent or another, but in all cases "the printers" would be the goal argument of the utterance. Some thematic roles reflect the perspective taken by the speaker; for example, the agent role differs for "chase" and "flee". However, the identification of a referent as a source or goal is driven purely by the semantics of the proposition (at least for verbs of transfer). Thus, the fact that speakers tend to refer more often to goals is a generalization about the things that people like to talk about. This may be because goal arguments often appear in an utterance with a source and a theme argument, where the theme moves from the source to the goal (either literally or metaphorically). If the discourse participants are concerned with what happens to the theme, then the subsequent utterance is likely to describe what the goal argument did with the theme. This pattern of reference is also sensitive to other features of the discourse structure, which I will discuss in chapter 4.

Thus, discourse patterns probably exist because of speaker's goals and intentions with regard to the discourse. But regardless of the reason, the data in the following chapters will show that these patterns do indeed exist. That is, speakers tend to continue talking about referents that have been mentioned recently, and especially referents that occurred in subject position, as the focus of a cleft, or as the goal of a verb. Speakers also tend to refer to referents in the same syntactic position as they last referred to them.
1.2.2. **Why are these factors also associated with Reference Form?**

My data will also show that all five factors are associated with Reference Form. That is, pronouns and null anaphors are used more for subject-referents, focus-referents, recent-referents, parallel-referents, and goal-referent, in contrast with referents that lack these properties. Why is this, and what is the relation between Reference Form and Reference Continuation? The answer, I suggest, is that it is easier for comprehenders to access referents with these properties during the interpretation of a subsequent anaphor. And when comprehension is facilitated, speakers can use less-specified forms of reference. One reason these factors facilitate comprehension is because of their association with Reference Continuation. This association influences two related aspects of discourse processing: 1) it helps comprehenders interpret the goals and intentions of the speaker, and 2) this process and the probabilistic information associated with each factor aid comprehenders during anaphor resolution.

### 1.2.2.1. **Interpreting the speaker's intentions**

The purpose of language is to communicate. This means that comprehension does not merely involve parsing each utterance and resolving the anaphors, but also requires interpreting the contribution of that utterance relative to the discourse as a whole and the speaker's intentions (H. Clark, 1996). For example, the sentence "Samantha drank all the milk" might introduce the need for someone to buy more milk, it might begin a description of Samantha's love for milk, or it might initiate a diatribe about her inconsiderate household habits. Depending on the speaker's intentions, one referent or the other might be more important to the discourse.
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Although listeners do not know the speaker's intentions, they can guess them from the context of the discourse. There are several ways a comprehender can infer the intentions of the speaker. In this example, the speaker's facial expression or intonation might indicate whether the speaker was annoyed or not, or the speaker may have prefaced this utterance with "That blasted housemate of mine!" But even in the absence of specific cues like these, listeners can still rely on information from the linguistic context, and the discourse properties associated with each referent. Following researchers like Bates and MacWhinney (1989); Du Bois (e.g., 1985, 1987), Prince (e.g., 1978, 1981, 1992), and Ward and Birner (e.g., 1995, 1996), I claim that one aspect of learning a language involves learning how different linguistic constructions are associated with the discourse status of the referent. One way of learning this association is through observing that referents in certain positions are often taken up in the following discourse: when referents of a certain type are frequently important to the following discourse, people learn an association between that type of referent and a certain level of discourse prominence.

In the example "Samantha drank all the milk," listeners may not know whether Samantha or milk was more important to the speaker's intentions on that occasion until they have observed the speaker's following actions. If the speaker followed up with "So let's buy some at the store", it would indicate that "milk" was more important on that occasion. It is also possible that the following interaction could be non-linguistic. For example, the speaker could then shake her fist at Samantha, thus indicating her displeasure. While the action is not linguistic, it is associated with the prior mention of
Samantha linguistically, and thus becomes part of the listener's knowledge of the discourse properties of linguistic expressions.

Through a lifetime of experience with language, individuals learn the discourse properties of referents that are most likely to be continued in the following discourse. That is, they learn the association between each factor and Reference Continuation. In this way they learn to infer the importance of a given referent on the basis of its discourse properties. As I will show in the following chapters, subject-referents, focus-referents, recent-referents, parallel-referents, and goal-referents are more frequently continued in a discourse than other referents. Through these frequent associations, people learn that these discourse properties are useful for discovering which referents are more important to the speaker. Learning discourse patterns like these is essentially learning generalizations about the world, specifically those generalizations that are useful for language processing.

However, these discourse properties do not provide categorical information about the speaker's intentions. When the speaker refers to Samantha using a subject or focus NP, for example, this may indicate that Samantha is important for the following discourse, but not necessarily. Instead, this information is probabilistic. People learn that when a referent has been mentioned as subject or focus, or when it appears in certain thematic roles, it has some probability of being important to the following discourse. Similarly, simply having been mentioned more recently gives a referent some probability of being continued in the discourse. These four factors (Recency, Subjecthood, Focus, Goal Status) combine with each other to yield a probabilistic interpretation of the
importance of each referent to the speaker's intentions, and thus how likely it is to be 
mentioned or otherwise used in the following interaction.

The fifth factor, Parallelism, works similarly to the other factors, but on a much 
smaller scale, and its effects are transitory. Given an anaphor in object position, for 
example, it is more likely that the referent was last mentioned in object position of the 
preceeding clause. Therefore, at the point where the listener knows the position of the 
anaphor, Parallelism provides probabilistic information that the speaker will refer to the 
parallel-referent from the preceding clause, such that parallel-referents are more probable 
than nonparallel-referents. Thus, it is different from the other factors because it does not 
provide information about where the discourse is going, or what the speaker's general 
goals and intentions are. However, Parallelism does aid comprehenders in determining 
the speaker's intended reference at a specific point during language comprehension.

1.2.2.2. Using probabilistic information during referent resolution

Once a person has learned the associations between linguistic constructions and 
discourse patterns, those linguistic associations become useful for interpreting the 
speaker's meaning. Among other things, they facilitate the process of interpreting 
anaphoric references. I further propose that one of the reasons these five factors facilitate 
anaphor resolution is that they are probabilistically associated with repeated mention of 
certain referents. This proposal rests on several assumptions about discourse processing, 
and is best described in terms of an activation metaphor of cognitive processes. I will 
describe these assumptions, and then propose how probabilistic information influences 
referent resolution.
First, I assume that discourse processing, and indeed all cognitive processes, involve mental representations of the discourse elements (e.g., Gernsbacher, 1990; Kintch, 1988; Morrow and Bower, 1989; Morrow et al., 1987; etc.). Psychologists have often distinguished between two levels of representation: 1) long term memory, and 2) working memory. For ease of presentation, I will continue to make the same distinction. Long-term memory is where knowledge is stored. This knowledge includes both conceptual information and linguistic knowledge (e.g., Kintch, 1988).

Discourse representations are usually assumed to be located in "Working Memory", which is a processing space that contains information about currently relevant information and processes (e.g., Baddeley, 1981, 1983; Baddeley and Hitch, 1974; Daneman and Carpenter, 1980, 1983). A crucial aspect of Baddeley’s model is that working memory is a cognitive space that contains both the storage and processing of currently relevant information.

Among other things, working memory contains a model of the information shared between interlocutors, or the "common ground" (H. Clark, 1996). One part of the common ground is the discourse representation. Clark stresses the fact that a discourse includes both linguistic and non-linguistic interaction, he uses the term "discourse" only to emphasize that language is a part of it. I continue this perspective here, using "discourse" as an event including language, but not restricted to it. A model of the discourse representation is presented in Figure 3.
Working Memory is also where language comprehension processes take place. The linguistic input is briefly represented, long enough to parse it into syntactic structures. This information is represented in the text model, or textual representation, and is used to update the situational representation. However, the linguistic information itself does not persist for long in memory (see Fletcher, 1990, for an overview).

The situation model includes mental representations of the discourse referents and the relations between them. For example, upon hearing "The detective called the restaurant manager," a listener would minimally form a representation of the detective, the manager, and the calling event. The representation may also include inferred aspects of the situation (e.g., Kintch, 1993; Long et al., 1992; Prince, 1992).

The discourse record is a representation overlain on the text and situation models. This is a privileged section of the model, and represents the "official states and events in the current joint activity," (H. Clark, 1996:54). The information in the discourse record is that which is mutually known by all discourse participants. For example, after a transaction between a bank teller and a customer, the discourse record for each participant contains the content of their transaction. If the customer glanced at her watch
CHAPTER 1: INTRODUCTION

during the transaction, however, this event may not be part of the discourse record. In my discussion in the following chapters, I will focus primarily on representations within the discourse record. For simplicity, I will refer to the "text model" and "situation model" aspects of the discourse record, and will not explicitly discuss the discourse record itself, except when relevant.

Entity representations are best discussed in terms of their levels of activation in the situation model. That is, each entity representation in the mind of each discourse participant is "lit up" to varying degrees at each point of the discourse. One way of thinking of activation is in terms of a spotlight on a dramatic scene. At any given point the spotlight centers on the most important characters and/or props at that moment. Other characters and props may be at the edge of the spotlight, thus only partially lit up. Other characters are on stage, but not in the spotlight, and others are in the wings, having recently departed the stage. The spotlight/stage metaphor does not capture all the properties of discourse processing, but it provides a real-world analogue of the activation metaphor.

There are several ways that a representation can become activated. When a speaker decides to say something, it requires activating a conceptual representation of the desired message, and then activating a corresponding linguistic representation. The conceptual representation of the speaker's message may become activated for many reasons, including being triggered by something that someone else said.

Discourse comprehension also involves activating the referents. The first time a referent is mentioned, a representation is activated in the situation model. If it is mentioned a second time, this causes the listener to re-activate the representation.
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time goes by, that activation decays gradually, and if the entity is not evoked again, its representation will eventually disappear from the situation model. At any given point during the decay process, the referent will be partially activated. An important characteristic of activation is that it may be partial, and therefore entity representations can vary in degree of activation at any one point.

Another important characteristic of activation is that it changes dynamically as language processing occurs over time. This means that activation rises and falls continuously as new information is encountered and integrated, and that the process of accessing a referent (for example, for the purpose of anaphor resolution) is not instantaneous.

There are a number of reasons I am adopting activation for discussing referent processing. First, I thereby continue a long tradition of using activation as a metaphor for cognitive processes. Information processing is often discussed in terms of the activation of representations at multiple levels, including both conceptual and linguistic representations. The degree to which a representation is activated reflects the ease of accessing that information, remembering it, or integrating it with other information.

For example, Marslen-Wilson (1990) discussed spoken word recognition as a process whereby lexical representations become activated dynamically through time on the basis of the phonetic input and word frequency. For example, the fragment "ele" would initially activate both "elevator" and "elephant", with the more frequent word receiving slightly more activation. As the input is processed, it eventually supports only one as the correct interpretation, resulting in full activation for that lexical item. Many researchers have also used activation to account for lexical or syntactic ambiguity
resolution, where the different syntactic or semantic representations associated with an ambiguous form become activated during processing (e.g., MacDonald et al., 1994).

The activation metaphor has also been widely used in accounts of discourse processing. For example, Gernsbacher discussed discourse processing in terms of building mental representations. She claimed that the building blocks of these representations are "memory cells", which become activated by incoming stimuli (1990:1-2). Chafe (1994) suggested that discourse processing is sensitive to how referents are represented in an individual's "consciousness" (similar to an individual's situation model). He distinguished between three levels of representation: active, semi-active, and inactive. Other researchers have also discussed referent representation in terms of degree of activation (e.g., Morrow et al., 1989).

The activation metaphor also plays a central role in connectionist models of language processing (e.g., Kawamoto, 1988; McClelland and Rumelhart, 1981; Seidenberg and McClelland, 1989). These models discuss language processing as patterns of activation over nodes. Each node represents information at one level of abstraction. For example, some nodes might represent parts of lexical meanings and pronunciations (Seidenberg and McClelland, 1989), others might represent components of the syntactic structure (see Chater and Christiansen, in press, for an overview). In these implementations, activation is a real number that varies, for example between 1 and -1.

An activation framework also has advantages over similar concepts like "salience" or "attention". The concept "salience" can be used to describe a property of the linguistic/textual structure, as opposed to a property of the mental representation of the discourse. In contrast, "activation" more clearly supports the assumption that the
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production and comprehension of reference form are driven by the cognitive status of
discourse entities, and continues the psycholinguistic tradition of discussing mental states
in terms of active and inactive information.

  It is probable that activation is related to global processes like attention, in that
elements in the focus of attention are also highly activated. However, I do not mean to
suggest that the processes I discuss are under the conscious control of the speaker or
listener. "Activation" is more appropriate for my purposes, because it is typically used
for unconscious processes. In contrast, "attention" is often thought of as a conscious
process, as in the request "Pay attention to what I am saying".

  A further advantage to using activation for discussing reference processing is that
it is conducive to considering referent status as a continuously graded phenomenon. This
view, similar to those of Ariel (1990) and Givón (1983a), has several advantages over a
categorical approach to salience. The first advantage is that it makes predictions about
reference to all entities, not just the most salient one. Categorical approaches claim that
one entity in every utterance enjoys a privileged status as the most salient entity, and
focus on the differences between this entity and the others. This perspective is evident in
Centering Theory, which claims that the Cb (backward-looking center) is the most salient
item in an utterance. The idea of a unique, prominent referent is also implicit in Almor's
work, where he states that "...the assumption [is] that the focused discourse entity is the
default antecedent because it is kept in working memory," (1995:15). Although in many
cases one entity may stand out as the most highly focused one, this approach makes no
predictions about pronominal reference to other entities, such as "her eyes" in 30.
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(30) The sun and wind had changed her [Aunt Em], too. They had taken the sparkle from her eyes and left them a sober gray; they had taken the red from her cheeks and lips, and they were gray also.

(Baum, The Wonderful Wizard of Oz, ch. 1)

Activation can also be construed as a categorical concept, as Chafe does with his three levels of activation (1994). However, the concept of activation can also be easily used to describe continuously graded differences in referent status. At the same time, an activation framework can still account for the generalization that there is usually only one entity at a time with high activation, through the concept of competition. Referent representations compete for activation, so that as one representation gains activation, others lose it.

Neither does the activation metaphor require a ranking mechanism for the cognitive statuses of different referents. Centering Theory represents differences in salience in terms of a hierarchy of discourse referents (the list of forward-looking centers). This approach is computationally straightforward, but it raises the question of when the re-ranking process takes place. Currently Centering suggests it takes place at sentence boundaries, but this conflicts with the known incremental nature of language processing. In contrast, activation is a property that can vary for each individual entity, at any point during processing.

Following the preceding assumptions about activation and discourse processing, I propose that anaphor resolution works in the following way. The first time a referent is mentioned, the comprehender accesses a representation of that referent and instantiates it in a situation model. If the referent is mentioned again, the comprehender must activate
CHAPTER 1: INTRODUCTION

the representation a second time. Re-activation can be easier or harder, depending on two things: a) the degree to which the representation is already activated, and b) the degree to which the input supports that entity as the anaphor referent. In fact, these two processes can be described as one, which I will discuss further in chapter 5.

In both cases, the activation of referent representations is influenced by the probabilistic information carried by the five factors discussed here: Recency, Subjecthood, Focus, Parallelism, and Goal Status. My data show that these factors are associated with Reference Continuation. At one level of abstraction, this means that comprehenders can use these factors as gauges of how likely it is that a referent is central to the speaker's intentions (along with other relevant sources of information).¹ I propose that the degree to which comprehenders consider a referent to be central to the speaker's intentions is reflected in the degree to which that referent representation is activated in their situation model. Thus, referents with a high probability of being central to the following discourse, like subject-referents, have more highly activated representations than those with a low probability, like object-referents.

At a different level of abstraction, these five factors can also facilitate the process of anaphor resolution itself. When comprehenders encounter an anaphor, the processing system begins trying to identify the referent. This process is influenced by many types of information, in particular the identifying information carried in the anaphoric form. For example, if the anaphor is "John", the referent must be one that is identified by this name; if the anaphor is "he", the referent must be male. But anaphor resolution is also

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¹ In a global sense, only four of these factors (Recency, Subjecthood, Focus, and Goal Status) are good indicators of the speaker's intentions. Parallelism is only a good indicator of the speaker's "intentions" at a very specific point during processing. For further discussion of this point, see §2.4.3.
influenced by other factors, including the five mentioned above. Each factor supplies probabilistic information about the identity of the referent: it is more likely to be a recent-referent than not, it is more likely to be a subject-referent than an object- or oblique-referent, it is more likely to be a focus-referent than a nonfocus-referent, it is more likely to be a goal-referent than a source-referent, and it is more likely to be a parallel-referent than a nonparallel-referent. Each of these pieces of information will influence the anaphor resolution process. When the referent is one that is highly probable, resolution will be easier than when it is less probable. In addition, to the extent that these factors inform the listener about the speaker's intentions, some referents may already be more activated than others. When the referent representation is already activated, accessing it will also be facilitated.

1.2.2.3. The link between comprehension and production

The facilitation of anaphor resolution is important, because it allows speakers to use shorter, more attenuated forms to communicate with their interlocutors. Therefore, speakers can use pronouns and null anaphors more for referents with the properties listed above. For referents without these properties, comprehension will be relatively more difficult, so speakers will choose the fuller forms of reference that their addressees need.

One might ask why I am drawing a connection between the facilitation of comprehension and the speaker's choices of reference form. This is a natural connection to make. Comprehension and production are merely two sides of the communicative coin. As argued by Clark (1996), language is one type of joint activity. Speakers do not speak just to speak, they speak to perform certain actions, to achieve certain goals. This has multiple implications for how language is used, one of which is that speakers want
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their speech to be understood as easily as possible. Speakers design their utterances for their addressees, and choose forms of reference that will be understood. The joint nature of communication has the additional consequence that it requires the interlocutors to coordinate their actions at every level. One of the things they must coordinate is their mutual knowledge of what has happened during the discourse, including the cognitive status of each referent. Thus, it is plausible to assume that discourse participants will develop similar mental representations about the shared discourse events and referents. In many cases, these representations must be developed on the basis of linguistic information. The degree to which speakers keep track of their addressee's mental models is not fully known. However, evidence suggests that discourse participants usually achieve some degree of coordination (H. Clark, 1996).

The communicative nature of discourse means that speakers can take advantage of the cases when they expect that comprehension will be facilitated, and have the option of using more efficient, shorter forms. Furthermore, it has been established that speakers do make use of this option. For example, Anderson et al. (1997) showed that speakers pronounce individual words less clearly during face-to-face conversation, in comparison with cases when the discourse participants can not see each others' faces. They argue that their result arises because the speaker's face provides visual information that facilitates speech comprehension, such as place-of-articulation information about consonants (e.g., McGurk and MacDonald, 1976), making certain aspects of the acoustic input less needed. Another example of this type is Lieberman's (1963) study, which showed that speakers pronounced words less clearly when they were more predictable from the sentence context. For example, the word "nine" was pronounced more clearly in 31a than in 31b.
a. The word you are about to hear is *nine*.

b. A stitch in time saves *nine*.

Speakers are sensitive to the different types of information that are available to their interlocutors, and they produce their utterances accordingly. This same idea of listener accommodation provides the basis for interpreting the results of this dissertation.

1.3. A look ahead

In the following chapters, I will report on five factors: Recency, Subjecthood, Focus, Parallelism, and Goal Status. For each of these, I will provide evidence for the double association in Figure 2. First, I will confirm that they are associated with an increased use of less specified forms of reference. Although reference can be made using a wide variety of forms, the distinctions I am principally concerned with are between full NP anaphors, overt pronouns, and null anaphors. Second, I will demonstrate that for all five factors there is an increased probability that certain referents will continue in the following discourse. This evidence comes from analyses of written texts and spoken corpora, from rating questionnaire, and from a discourse-completion experiment.

In chapter 2, I will present text analyses in three languages of the distribution of forms of reference, with respect to Recency, Subjecthood, and Parallelism. In chapter 3, I will focus on the contrast between subjects and the foci of clefts in English. With a rating questionnaire and corpus analysis, I will demonstrate that subjects and foci have similar functions, and suggest some implications for theories of information structure. In chapter 4, I will discuss source and goal arguments, and their relation to both Reference
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Form and overall Reference Continuation. The data in this chapter come from a discourse-completion experiment and a corpus analysis.

In chapter 5, I will return to the question of the underlying motivation for the double association between reference form and overall subsequent reference. I will propose a more detailed account of how probabilistic information from these five factors influences anaphor resolution. This proposal will be largely speculative, but will build on constraint-based models of language processing (e.g., MacDonald et al., 1994, Trueswell and Tanenhaus, 1994; Tanenhaus and Trueswell, 1995). I will suggest that probabilistic information about discourse patterns is a characteristic that gets stored with abstract linguistic representations, and thus becomes available for use during language processing.

Throughout this dissertation, I assume that choices in reference form are influenced by multiple constraints. I am only investigating five factors here, but there are clearly other factors that are relevant to reference form. Some other factors are linguistic, such as the ambiguity of potential referring forms. Others may be nonlinguistic, such as the prominence of visual information available to all discourse participants. My approach shares features with Accessibility Theory (Ariel, 1990), which also suggests that multiple factors influence the choice of reference form. The primary difference between my work and other studies is that I will show that these five linguistic features share the characteristic that they are frequently associated with subsequent reference.
The framework for this dissertation, presented in chapter 1, assumes that choices in reference form depend on multiple factors. What are these factors? Are all of them necessary? It is costly to investigate many different factors with psycholinguistic experiments, and any attempt to do so risks an uninterpretable outcome. Text analysis is useful as an exploratory tool, since it affords the simultaneous investigation of multiple structures.

A second advantage to text analysis is that it allows the comparison of several languages, as I will do here by investigating English, Spanish, and Mapudungun. This
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methodology is particularly useful for looking at Spanish and Mapudungun, which would be more difficult to study experimentally. Neither language has a long tradition of experimental studies to provide the foundation for experimentation. Furthermore, in the United States it would be virtually impossible to find native speakers of Mapudungun, which is spoken by the Mapuche people of southern Chile and Argentina.

Throughout this chapter, I will demonstrate in detail the correlation of multiple factors with reference form. The constraints I will discuss stem from very different sources of information, but the one thing that they have in common is that they can be interpreted in terms of their influence on the reader's mental representation of referents in the text.

The main findings of these studies will show that reference form in all three languages is correlated with three of the factors described in chapter 1: a) Recency, b) Subjecthood, and c) Parallelism. I will also show that subsequent reference is more likely to occur a) when the referent was mentioned recently, b) when the referent was last mentioned in subject position, and c) when the anaphor and antecedent are in parallel positions. These findings together will support the claim I set out in chapter 1, that these three factors are associated with both Reference Form and Reference Continuation.

2.1 About the text analysis methodology

These text analyses follow in a tradition of similar analyses on reference form and discourse structure. Such analyses are particularly popular among functional linguists, and have been conducted on texts in a number of different languages with diverse structures. For example, Du Bois (1985, 1987) and others working within the theory of Preferred Argument Structure have shown for many languages that grammatical
functions are specialized in terms of pragmatic function. Givón and his colleagues (1983b) demonstrated that reference form correlates cross-linguistically with three features of "Topic Continuity": a) the recency with which an entity has been mentioned in the text, b) the level of competition (i.e., how many entities could conceivably be the referent for a particular form), and c) the referent's level of "persistence" - that is, how long the entity persists throughout the following discourse, as a measure of how important the speaker considers the entity to be. The constraints of competition and recency have also been demonstrated for Hebrew and English by Ariel (1988, 1995).9

The role of text analysis in the study of language has grown over the last two decades, in part due to improved technologies that can mechanize some aspects of the analysis; this has made possible the investigation of large, multi-million-word corpora (Gibson et al., 1994). The terms "text analysis" and "corpus analysis" are both used to refer to distributional studies of texts, using spoken or written data. I will use the term "text analysis" to refer to the analysis of a narrative text as a whole, where nearly every reference is coded and analyzed. In chapters 3 and 4, I will also present what I call "corpus analysis", namely, the study of a selected sample of utterances from a much larger corpus.

Both text analysis and corpus analysis have been used for multiple purposes. For example, the correlation between structure and function, even if it is not one-to-one, is typically taken as an indication that the structure is used for that function. Since pronouns frequently refer to the subject-referent of the previous clause, Subjecthood is assumed to influence the use of pronominal reference. As a result, distributional

9 For more information about these constraints, see the discussion in chapter 1.
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frequencies are often assumed to be a reflection of the psycholinguistic processes that underlie language use. This type of evidence has been brought to bear in many studies of reference and discourse, such as Du Bois (1987), Givón (1983b), Ariel (1988), or other studies such as Hawkins (1994), Siewierska (1993), and Wasow (1997).

A second function of text or corpus analysis is as a measure of the frequencies of particular structures or meanings. Estimations of "real" frequency information (where "real" means the frequency of use that an individual might encounter) are important because recent models of language processing have claimed that listeners make use of frequency during language processing (e.g., Bates and MacWhinney, 1989; MacDonald et al., 1994; Trueswell and Tanenhaus, 1994). For example, some ambiguous words, such as "ball", have one meaning that is more frequent than other meanings (in this case, the "ball as round object" meaning is more frequent than the "ball as a formal dance party" meaning). The frequency of each meaning affects lexical processing, in that it is easier to access the more frequent meaning than the less frequent ones (e.g., Rayner and Frazier 1989). In addition, some syntactically ambiguous structures are resolved more frequently with one meaning than another. In sentences such as 1a or b, the "with-
phrase is temporarily ambiguous, and could modify either the verb or the object NP.
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(1)  a. The woman expected the bus with air-conditioning but was at the wrong stop.
    b. The woman expected the bus with anticipation but was at the wrong stop.

(Spivey-Knowlton and Sedivy, 1995)

Since prepositional phrases more frequently modify the verb phrase than the object NP, verb-modifying PPs are usually easier to understand than object-modifying PPs (Spivey-Knowlton and Sedivy, 1995). In order to test claims about how frequency of word meaning or syntactic structure affects processing, however, researchers need independent measures of frequency. In this regard corpus analysis plays an important role, since it provides one estimate of the structural and lexical frequencies that people experience. This purpose for corpus analysis will surface again in chapters 3 and 4.

The text analyses in this chapter fulfill both the functions to some degree. The primary goal was to investigate the correlations between certain variables and reference form. I hypothesized that any correlations between reference form and different factors would indicate factors relevant to the production and comprehension of reference form. I investigated texts in several languages to make possible a cross-linguistic comparison of these factors. Second, I used these text analyses to provide supporting evidence for the primary theme of this dissertation. That is, I looked for general patterns of reference. Which types of referents are mentioned more often? Are certain factors also related to the probability that certain referents would be continued in the following discourse? That is, are there factors that correlate with Reference Continuation?
CHAPTER 2: CROSS-LINGUISTIC EVIDENCE

After describing the particular methods used in this study, I will present the results for all three analyses.

2.2 Methods

In order to investigate reference form in English, Spanish, and Mapudungun, I performed three text analyses, one in each language. The corpora used for these analyses were collections of written narrative texts that contained mostly third-person referents. The few references to first or second person were excluded from the analyses. The reason for focusing on third-person referents was that I am primarily interested in how linguistic, textual characteristics affect reference form. Discourse structure and reference form can also be affected by nonlinguistic features such as eye gaze, physical location or context, and the identity of the discourse participants. By looking only at written texts and only third-person referents, however, I have limited the analysis to cases where the reference form is primarily affected by linguistic information.

The texts chosen for this study were all narratives, primarily traditional tales or children's stories. These narratives are ideal for this kind of study because the clause structure is typically simpler than in other written genres, and most instances of reference concern concrete people and objects, rather than complex abstract ideas. These properties simplified the analysis. Another reason for using this genre was that there is not a wide variety of published texts in Mapudungun, but there is a sizable collection of traditional tales. In all cases, the texts were published in written form. Some of the Mapuche tales were originally told orally, and published in transcription. However, these texts appear with fully formed sentences with no disfluencies, indicating that the oral
narratives were edited before publication, and for this reason fall into the category of "written text". The narratives used for each language are listed in Table 1.
### Table 1. Texts used

<table>
<thead>
<tr>
<th>STORY</th>
<th># clauses&lt;sup&gt;10&lt;/sup&gt;</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>English</strong> (1378 clauses total)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peter Pan, chapter 2 (pp. 25-29)</td>
<td>174</td>
<td>- classic children's story</td>
</tr>
<tr>
<td>The Wonderful Wizard of Oz, chapter 1</td>
<td>161</td>
<td>- classic children's story</td>
</tr>
<tr>
<td>Georgie the Gentle Ghost</td>
<td>160</td>
<td>- children's narrative tale</td>
</tr>
<tr>
<td>Sylvester and the Magic Pebble</td>
<td>228</td>
<td>- children's narrative tale</td>
</tr>
<tr>
<td>The Terrible Hodag&lt;sup&gt;11&lt;/sup&gt;</td>
<td>270</td>
<td>- traditional tale (Wisconsin)</td>
</tr>
<tr>
<td><strong>Spanish:</strong> (524 clauses total)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caipora, el Padremonte&lt;sup&gt;3&lt;/sup&gt;</td>
<td>121</td>
<td>- traditional tale (Mexico)</td>
</tr>
<tr>
<td>El Irupe</td>
<td>62</td>
<td>- traditional tale (Argentina)</td>
</tr>
<tr>
<td>El Palto del Anima (<em>The Widow's Avocado Tree</em>)</td>
<td>53</td>
<td>- traditional tale (Chile)</td>
</tr>
<tr>
<td>Las Lágrimas de Potira (<em>Potira's tears</em>)</td>
<td>60</td>
<td>- traditional tale (Brazil)</td>
</tr>
<tr>
<td>María Tolete</td>
<td>117</td>
<td>- traditional tale (Venezuela)</td>
</tr>
<tr>
<td>Las Lágrimas del Sombrerórón</td>
<td>111</td>
<td>- traditional tale (Guatemala)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mapudungun:</strong> (731 clauses total)&lt;sup&gt;12&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Füta peñi ka kude pangküll (<em>Big Brother and Female Lion</em>)</td>
<td>72</td>
<td>- traditional Mapuche tale</td>
</tr>
<tr>
<td>Kuse pangküll ngürü engu (<em>The old female puma and the fox</em>)</td>
<td>177</td>
<td>- traditional Mapuche tale</td>
</tr>
<tr>
<td>Kiñe wentru lanturkei (<em>A widowed man</em>)</td>
<td>144</td>
<td>- traditional Mapuche tale</td>
</tr>
<tr>
<td>Missionary</td>
<td>60</td>
<td>- traditional Mapuche tale</td>
</tr>
<tr>
<td>An Old Man</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>10</sup> The number of clauses in each database includes quotes and other clauses which were excluded from the final analysis. Quotes count as a single clause, regardless of the length of the quote.

<sup>11</sup> It is interesting to note that "The Terrible Hodag" and "Caipora, el padremonte" have similar themes, even though they are in different languages and from distant cultures. Both stories are about lumbermen who go into the forest and encounter mythical beasts of the forest who help only the good men, the ones who treat the forest well.

<sup>12</sup> All examples in Mapudungun will be written in the Unified Alphabet, one of the standard alphabets used in Chile for Mapudungun. Most of the characters are the same as the IPA, except for the following.

<table>
<thead>
<tr>
<th>Unified Alphabet</th>
<th>IPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>ü</td>
<td>ø</td>
</tr>
<tr>
<td>ll</td>
<td>λ</td>
</tr>
<tr>
<td>ng</td>
<td>N</td>
</tr>
<tr>
<td>d</td>
<td>Q</td>
</tr>
<tr>
<td>q</td>
<td>χ</td>
</tr>
</tbody>
</table>

Underlined characters (n, l, t) denote dentals (e.g., n denotes a dental nasal).
The analyses in each language followed similar procedures, although the analysis for English, which had the largest database, was also more detailed than the other two. The Spanish analysis was also slightly more detailed than that for Mapudungun. I will first describe the methods for analyzing English, and then briefly describe the differences in the Spanish and Mapudungun analyses.

2.2.1. English text analysis methodology

The purpose of this study was to analyze how different forms of reference were used, according to different properties of the referent. Therefore, the first thing I looked at was the form of each referring NP. I was particularly interested in the choice between pronouns and full names or descriptions. Other forms were sometimes used (e.g., reflexive, elliptical, null, or possessive), but these were excluded from the final analysis. The full set of codings for NP form is listed in Table 2.

<table>
<thead>
<tr>
<th>CODING</th>
<th>DESCRIPTION</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>full NP</td>
<td>names or descriptions</td>
<td>Sylvester, the woman, an amazing pebble</td>
</tr>
<tr>
<td>pronouns</td>
<td>personal pronouns and demonstratives</td>
<td>it, she, he, they, him, her, them, this, that</td>
</tr>
<tr>
<td>reflexive</td>
<td>reflexive pronouns</td>
<td>himself, herself, itself, themselves</td>
</tr>
<tr>
<td>elliptical</td>
<td>a deleted argument in a conjoined phrase</td>
<td>Aunt Em dropped her work and Ø came to the door.</td>
</tr>
<tr>
<td>Ø</td>
<td>a null argument that's</td>
<td>• He ran about the room,</td>
</tr>
</tbody>
</table>
CHAPTER 2: CROSS-LINGUISTIC EVIDENCE

controlled by another argument. now here, now there, Ø barking loudly.

• Each day, he and the other lumberjacks went into the forest Ø to cut down trees.

possessive (full NP or name) Dorothy's eyes

possessive (pronominal) her eyes

Each instance of reference was also coded for a number of additional properties, including a) the grammatical function of the anaphor (i.e., the NP itself), b) the grammatical function of the antecedent (i.e., the grammatical function of the NP with which the conceptual referent was last mentioned) if it was in the previous clause, and c) the recency with which the referent was last mentioned. A full list of these codings is presented in Table 3.

Table 3. Codings for additional properties

A. Grammatical Function of Anaphor

<table>
<thead>
<tr>
<th>CODING</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject</td>
<td>They took the rockers from the Whittakers' porch . . .</td>
</tr>
<tr>
<td>Object</td>
<td>They took <em>the rockers</em> from the Whittakers' porch . . .</td>
</tr>
<tr>
<td>Oblique</td>
<td>They took the rockers from the <em>Whittakers' porch</em> . . .</td>
</tr>
</tbody>
</table>

B. For references to something last mentioned in the previous clause (or last main clause): What was the Grammatical Function of the antecedent?

<table>
<thead>
<tr>
<th>CODING</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject-referent</td>
<td>But <em>Georgie</em> never scared anybody.</td>
</tr>
<tr>
<td></td>
<td><em>He</em> was much too shy for that.</td>
</tr>
<tr>
<td>Object-referent</td>
<td>They took <em>the rockers</em> from the Whittakers' porch because <em>they</em> were old and antique.</td>
</tr>
</tbody>
</table>
Oblique referent  They belonged to a huge creature. It had the head of an ox, the feet of a bear, the back of a dinosaur, and the tail of an alligator.
## C. Recency of last reference to the same entity

<table>
<thead>
<tr>
<th>CODING</th>
<th>DESCRIPTION/ EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>same clause</td>
<td>She took off her hat.</td>
</tr>
<tr>
<td>1 clause back</td>
<td>Through the branches, he saw a giant red eye. Then he saw another red eye.</td>
</tr>
<tr>
<td>last main clause(^{13})</td>
<td>The referent was not in the previous clause, but only subordinate clauses intervene. Example:</td>
</tr>
<tr>
<td></td>
<td>&quot;Timber!&quot; they shouted</td>
</tr>
<tr>
<td></td>
<td>as each tree crashed to the ground.</td>
</tr>
<tr>
<td></td>
<td>The men worked hard from sunup to sundown.</td>
</tr>
<tr>
<td>1 clause plus quote</td>
<td>Ole Swenson told them.</td>
</tr>
<tr>
<td></td>
<td>&quot;Who is he?&quot; asked the lumberjacks.</td>
</tr>
<tr>
<td>2 clauses back</td>
<td>As he got close to the Hodag's den</td>
</tr>
<tr>
<td></td>
<td>he felt the ground shake.</td>
</tr>
<tr>
<td></td>
<td>Suddenly he saw the giant beast...</td>
</tr>
<tr>
<td>2 clauses plus quote</td>
<td></td>
</tr>
<tr>
<td>3 clauses back</td>
<td></td>
</tr>
<tr>
<td>3 clauses plus quote</td>
<td></td>
</tr>
<tr>
<td>4 clauses back</td>
<td></td>
</tr>
<tr>
<td>4 clauses plus quote</td>
<td></td>
</tr>
<tr>
<td>5 clauses back</td>
<td></td>
</tr>
<tr>
<td>5 clauses plus quote</td>
<td></td>
</tr>
<tr>
<td>6 or more clauses back</td>
<td></td>
</tr>
<tr>
<td>new</td>
<td>hasn't been mentioned before</td>
</tr>
<tr>
<td>generics</td>
<td>Note: Generics were combined with &quot;new&quot; for the analysis, because they do not have a true antecedent in the discourse. Examples:</td>
</tr>
<tr>
<td></td>
<td>To his great surprise the rain stopped. It didn't stop</td>
</tr>
</tbody>
</table>

\(^{13}\) The inclusion of the category "last main clause" meant that some references had two possible codings for Recency. For example, the referent of "he" in d was last referred to as the null subject of the preceding clause, and also as the subject of the last main clause, in a.

a. He was thinking so hard  
b. he forgot  
c. Ø to watch out for the Hodag.  
d. Suddenly he looked up.

In cases like these, main clauses always took precedence over subordinate clauses, so this one was coded as "last main clause".
gradually, as rains usually do.

They sniffed the rock on Strawberry Hill, but it smelled like a rock.

EXCLUDED: The analysis of Recency did not include cases where an anaphor referred to the entire previous clause, a superset of previously mentioned entities, or a subset of a previously mentioned referent.

the entire previous clause  
All day they cut the branches off the trees and put logs into piles.  
It was hard work.

superset  
But Georgie and Miss Oliver went to be with the cow in the meadow. When they got to the barn, they all knew...

subset  
...to cut down trees... as each tree crashed to the ground.

For the purposes of the analysis, a clause was defined as the maximal phrase headed by a VP (under some analyses of syntactic structure). A clause could be finite or nonfinite, matrix or subordinate. The grammatical functions of noun phrases were determined according to whether the NP was an argument of the verb or not, and if so, which position it filled. Each clause was also identified in terms of the type of clause, according to the distinctions in Table 4.

Table 4. Codings for type of clause

<table>
<thead>
<tr>
<th>CODING</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>main</td>
<td>But when he said the same thing, holding the pebble in his hoof, the sky turned black.</td>
</tr>
<tr>
<td>subordinate-finite</td>
<td>But when he said the same thing, holding the pebble in his hoof, the sky turned black.</td>
</tr>
<tr>
<td>subordinate-nonfinite</td>
<td>But when he said the same thing, holding the pebble in his hoof, the sky turned black.</td>
</tr>
</tbody>
</table>
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Some NPs were excluded from analysis. Predicate nominatives, as in 2, below, and appositives, as in 3, were excluded, since these NPs were not used referentially.

(2) Sylvester was a rock.

(3) And there was Sylvester, a rock on Strawberry Hill, with the magic pebble lying right beside him on the ground, . . .

Some NPs were excluded from the analysis because they did not form a part of a clause, as in 4b.

(4) a. while Mrs. Duncan set out the picnic food on the rock --
    b. alfalfa sandwiches, pickled oats, sassafras salad, timothy compote.

The dummy subjects of atmospheric verbs, such as "it rained" or "it was cold" were also excluded, as were noun phrases that referred to time, such as "yesterday", or "three hours later". In addition, reference to first or second person (I, you, we) was excluded, for the reasons mentioned above.

When deciding how recently an entity was mentioned, I included cases where an entity was previously referred to with a different noun phrase (in contrast with Brown, 1983:319, who excluded these cases, which he called "synonyms"). 5 illustrates an example of anaphoric reference with a different NP.
As he got close to the Hodag's den
he felt the ground shake.

Suddenly he saw the giant beast.

The decision to include these cases follows logically from the view that reference is a cognitive event. Although my focus is on linguistic reference, the linguistic form is interpreted relative to the listener's representation of the discourse. The interesting thing about reference is that it can take place with a wide variety of forms, for example using "Clinton", "Bill", "he", or "the president" to refer to the same person. Since the purpose of this study is to understand which factors influence the choice among referring forms, it follows that NP anaphors, as well as pronouns, should be included as one of the many choices for reference.

2.2.2. Spanish text analysis methodology

The text analysis of Spanish was similar to that of English, except in the following ways. The system of reference in Spanish differs from that in English, in that there are at least three possible forms of reference: full noun phrase, pronoun, and null ("pro-dropped") subjects or cliticized objects. These three forms of reference offer increasingly less information -- the full noun phrase or name provides specific information as to the identity of the referent, and pronouns provide person, number and gender information (e.g., third singular female). In the case of null subjects, the morphological marking on the verb indicates the person and number of the verb,\(^\text{14}\) such as

\(^{14}\) In some tenses and moods, the morphology is ambiguous for person. For example, in the present subjunctive, the same forms are used for 1st and 3rd person singular, and in all tenses and moods the same forms are used for 3rd person singular and the formal 2nd person singular (usted).
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first singular (1sg), or third plural (3pl). Cliticized objects are categorized with null subjects because both forms represent the least marked form of reference that is commonly used. In the case of indirect objects, clitics also provide only person and number information, although direct object clitics additionally provide gender information.

(6) Full Noun Phrase (denotes a specific entity)

a. Subject- El gato miró al ratón.

_The cat looked-at(3sg) PREP-the rat._

b. Object- El gato miró al ratón.

_The cat looked-at(3sg) PREP-the rat._

(7) Pronouns (person, number, and gender)

a. Subject- El miró al ratón.

_He looked-at(3sg) PREP-the rat._

b. Object- El gato miró a él.

_The cat looked-at(3sg) PREP him._
(8) Null/ Clitic (person, number and occasionally gender)

a. Subject- Ømiró al ratón.

Ølooked-at(3sg) PREP-the rat.

b. Object- El gato lo miró.

The cat him looked-at(3sg).

Because I am interested in the choice among these three forms of reference, only subjects and objects (both direct and indirect) were included in the study. Although oblique arguments can vary between full NPs and pronouns, null or clitic reference types are not
possible with oblique arguments\textsuperscript{15}.

Apart from the coding of the referring form, the Spanish text analysis was similar to the English analysis, but less detailed. One difference was that recency was only coded according to the four categories in 9.

\begin{enumerate}
\item previous clause
\item 2-5 clauses back
\item 6 or more clauses back
\item new
\end{enumerate}

In addition, quotations were discounted when ascertaining recency, because the size of the Spanish corpus was too small to investigate subtle differences like the effect of quotations on recency. This simplification undoubtedly leaves some variation unaccounted for, since the investigation of quotes in English demonstrates that quotes do contribute to recency effects on reference form (see §2.3.1.4 below).

A second difference between the English and Spanish methodologies was that in Spanish, there was no category "last main clause". This difference is only relevant in

\textsuperscript{15} Note that double-object verbs in Spanish have two objects: a direct object (theme) and an indirect object (goal). Both objects can be expressed as full NPs, pronouns, or clitics. An example is:

\begin{align*}
\text{Abrió el morral, sacó un atado de tabaco} & \quad \text{Opened(3s) the pack, took-out(3sg)a bundle of tobacco} \\
\text{y se lo alcanzó.} & \quad \text{and 3sg(goal) 3sg(theme)reached(3s).}
\end{align*}

\textit{He opened the pack, took out a bundle of tobacco, and handed it to him.}
cases like 10c, where a subordinate clause intervenes between an anaphor and its antecedent.

(10)  a. Cada mañana, muy temprano, dos compadres iban juntos al monte

Every morning, very early, two companions went together to the mountain peak

b. a cortar leña.

to cut wood.

c. El monte era una belleza.

The mountain peak was a beauty.

In the Spanish analysis, the last reference to the concept "el monte" in 10c is coded as occurring 2 clause back. In contrast, in the English analysis it would have been coded as "oblique of last main clause".

2.2.3. Mapudungun text analysis methodology

The Mapudungun analysis was similar to the Spanish analysis, except that it only included main clauses. There are several types of subordinate clauses in Mapudungun, some of which allow specification of all arguments, and other types of clauses where the subject argument is controlled by a higher clause. Since this study investigated the variation between null referents and full NPs, I did not want to include cases where a full NP argument was disallowed. It was beyond the scope of this study to identify which subordinate clauses allowed explicit subject arguments and which did not, so only references that occurred in matrix clauses were analyzed.
However, references in subordinate clauses were still included for the purpose of analyzing the last mention of a referent, as in 11.

\[(11)\]

\[\begin{align*}
\text{a. } & \text{dew nie-lu mapu} \\
& \quad \text{Once have-verbal.noun land} \\
& \quad \text{After he got his land,}
\end{align*}\]

\[\begin{align*}
\text{b. } & \text{dewma-y } \tilde{n}i \text{ ruka} \\
& \quad \text{make-3s } \text{poss(3s) house} \\
& \quad \text{He built his house.}
\end{align*}\]

In this example, the clause in 11a is nonfinite, so the references corresponding to "he" and "land" are not included in the analysis. However, the clause in 11b contains a reference to "he", the person last mentioned in the previous clause. The information in the subordinate clause is relevant for this purpose, and the reference to "he" in 11b is coded as having the last reference as subject of the previous clause.

Mapudungun is a language with a rich set of verbal suffixes that mark, among other things, person and number for both subject (obligatorily) and object (optionally). This system of person/number marking is one of the features that allows Mapudungun to have both subjects and objects that are null, just like subjects in Spanish. Pronouns also exist in Mapudungun, but are used only for subjects. As in the Spanish analysis, I only investigated references in subject and object position, since oblique arguments occur only as full NPs. Thus, in Mapudungun I looked at the form of reference, which could be a null referent, a pronoun (for subject only), or a full NP.
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The most salient feature of Mapudungun is that it displays an inverse system, which means that there are two sets of person/number morphemes for transitive verbs, with the choice between these two determined by the relative prominence of the arguments. The generalization is that the more prominent argument must be the grammatical subject at all times, where prominence is determined by means of the hierarchy in 12.

(12) Prominence Hierarchy for Mapudungun:

1st person, 2nd person > 3rd person proximate > 3rd person obviative

The term "proximate" simply refers to the argument that is more salient in the discourse, and "obviative" refers to the argument that is less salient. This distinction is not morphologically marked, nor does it depend on animacy or other features. Instead, the choice between proximate and obviative is gleaned from the discourse structure. A complete definition of how the more salient argument is chosen is beyond the scope of this study, but roughly speaking, it can be said that choice between direct and inverse form is sensitive to the same factors that influence reference form: the more salient character must have appeared previously in the discourse, usually recently. In contrast, the less salient character is often new or has not appeared recently in the discourse. In addition, global discourse factors affect relative ranking, so the main character of a story is usually ranked higher than other characters. However, this generalization can be modified if a secondary character becomes locally prominent during certain discourse segments (for an example, see Rivano-Fischer 1991:126-127). Although higher-ranked
characters tend to be animate, it is also possible for inanimate entities to be ranked higher than animates (see Arnold, 1996).

The relative ranking of two arguments in a transitive clause determines whether the verb will appear in the direct voice, or the inverse voice. In most cases the verbal form is pre-determined, since 1st and 2nd person are always considered “more salient” than 3rd persons, and thus must always be the grammatical subject. This means that whenever one chooses to express the proposition “She saw me” (for example), the inverse construction must be used. To say “I saw her,” on the other hand, the direct form of the verb is obligatory. With two 3rd-person arguments, the verbal form depends on their relative salience. The distribution of the direct and inverse forms in Mapudungun is shown in 13.

\[
\begin{array}{ll}
\text{Direct:} & \text{Inverse:}\textsuperscript{16} \\
\text{Actor} & \text{Actor} \\
\text{Undergoer} & \text{Undergoer} \\
1 \ldots \ldots \ldots \ldots \ldots \ldots \ldots 3 & 3 \ldots \ldots \ldots \ldots \ldots \ldots \ldots 1 \\
2 \ldots \ldots \ldots \ldots \ldots \ldots \ldots 3 & 3 \ldots \ldots \ldots \ldots \ldots \ldots \ldots 2 \\
3 \text{ prox} \ldots \ldots \ldots \ldots \ldots \ldots \ldots 3 \text{ obv} & 3 \text{ obv} \ldots \ldots \ldots \ldots \ldots \ldots \ldots 3 \text{ prox} \\
& 1 \ldots \ldots \ldots \ldots \ldots \ldots \ldots 2 \\
& 2 \ldots \ldots \ldots \ldots \ldots \ldots \ldots 1 \\
\end{array}
\]

For example, if I wished to say “I called my mother”, I would use the direct form:

---

\textsuperscript{16} Interactions between 1st and 2nd person also fall into the category "Inverse", although their morphology is slightly different from other forms. For a fuller discussion, see Arnold (1994).
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(14) Mutrüm-fi-n ēni ūuke
Call-OBJ(3)-SUBJ(1s) POSS mother

I called my mother.

On the other hand, to say “My mother called me,” I would need to use the inverse form:

(15) Mutrüm-e-n-ew ēni ūuke
Call-INV-SUBJ(1s)-OBJ(3) POSS mother

My mother called me.

In both cases “I” is the subject, and “my mother” is the object.

The inverse system in Mapudungun affects the current text analysis in three ways. First, it is doubly important to exclude 1st and 2nd person references from the analysis (or analyze them separately, which was beyond the scope of this study), since these references are not only limited to null or pronominal forms, but are also required to be the subject of a transitive event. These grammatical restrictions are likely to interact with the pragmatic features of interest to this study and obscure their effect. Second, since the relative prominence of two arguments affects the whole clause, it was necessary to exclude not just 1st or 2nd person references, but the entire clause they appeared in. Third, the grammaticization of pragmatic factors for grammatical functions means that generalizations about the role of Subjecthood in choosing reference forms are expected to be heightened in Mapudungun, since the grammatical function itself is defined by many of the same pragmatic considerations that underlie variation in reference form.
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2.3. Results and Discussion

Three factors emerged from my analyses. The first was the recency with which an entity has been mentioned. While some researchers have discussed recency in terms of the distance an anaphor must travel to find a textual antecedent, a more plausible interpretation of recency is as a measure of how activated or accessible the referent is in the minds of the discourse participants. In §2.3.1, I will show how recency of mention correlates with reference form in all three languages, and develop a detailed picture of various aspects of recency in English.

The second and third factors reflect structural properties of the referent and referring form. In §2.3.2, I will demonstrate how the grammatical function of the anaphor and the relative positions of the anaphor and antecedent are correlated with choices in reference form. Although these factors are often confounded in experimental studies, this analysis considers the effect of each one.

2.3.1. Recency

As mentioned in chapter 1, scholars from many traditions have studied reference form and described it in terms of the cognitive status of the referent. It is acknowledged that pronouns are interpretable only when their referent is retrievable based on context, which usually means that the referent is present in the listener's focus of attention. But what causes something to be in the focus of attention? One factor is the recency with which the referent was last mentioned.

The results from the analyses of English, Spanish, and Mapudungun are shown in Table 5. In this table, as in the rest of the results section, the results about reference form are presented in terms of the percentage of pronouns or null anaphors. The reason for
comparing pronouns (in English) and null anaphors (in Spanish or Mapudungun) is that these are the least-specified forms of reference for each language. In Spanish and Mapudungun, as in other languages with null reference (e.g., Sacapultec, Du Bois (1987:814)), overt pronouns are rarely used. The percentages for each case are calculated over the entire set of references for each category. In English, the entire set of references includes pronouns and full names or descriptions. In Spanish and Mapudungun, the entire set of references includes null anaphors (i.e., only verbal morphology), pronouns, and full names or descriptions.

Table 5. Correlations between reference form and recency of mention.

<table>
<thead>
<tr>
<th>A. ENGLISH</th>
<th>( \chi^2 = 616, \text{DF}=3, p&lt;.001 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>%pronoun</td>
</tr>
<tr>
<td>previous clause/ last main clause</td>
<td>336</td>
</tr>
<tr>
<td>2-5 clauses back</td>
<td>174</td>
</tr>
<tr>
<td>6+ clauses back</td>
<td>197</td>
</tr>
<tr>
<td>new</td>
<td>257</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. SPANISH</th>
<th>( \chi^2 = 394, \text{DF}=3, p&lt;.001 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>%null</td>
</tr>
</tbody>
</table>


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<table>
<thead>
<tr>
<th>Previous Clause</th>
<th>n</th>
<th>% Null</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous clause</td>
<td>228</td>
<td>79%</td>
</tr>
<tr>
<td>2-5 clauses back</td>
<td>111</td>
<td>28%</td>
</tr>
<tr>
<td>6+ clauses back</td>
<td>107</td>
<td>3%</td>
</tr>
<tr>
<td>New</td>
<td>246</td>
<td>0%</td>
</tr>
</tbody>
</table>

C. MAPUDUNGUN

$\chi^2=278$, DF=3, p<.001

<table>
<thead>
<tr>
<th>Previous Clause</th>
<th>n</th>
<th>% Null</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous clause</td>
<td>393</td>
<td>78%</td>
</tr>
<tr>
<td>2-5 clauses back</td>
<td>93</td>
<td>22%</td>
</tr>
<tr>
<td>6+ clauses back</td>
<td>22</td>
<td>5%</td>
</tr>
<tr>
<td>New</td>
<td>111</td>
<td>0%</td>
</tr>
</tbody>
</table>

These results support previous claims (e.g., Du Bois, 1987; Ariel, 1988; Givón, 1983a) that reference to entities which have recently appeared in the discourse is more likely to be null or pronominal. This correlation between recency and form of reference supports hypotheses that entities that have occurred recently in the discourse are more accessible, and more in the focus of attention. From a processing perspective, their accessibility can be considered in terms of having more highly activated mental representations in the minds of the discourse participants.
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2.3.1.1. The choice of categories in text analysis: a methodological issue

One striking aspect of the analyses for English and Spanish is that most of the variation in reference form occurs when the referent has been mentioned within the last five clauses. In English, there is a only one instance of a pronoun referring to something which has not been mentioned for more than 5 clauses, shown in 16.

(16) **Dorothy** felt as if she were going up in a balloon. The north and south winds met where the house stood, and made it the exact center of the cyclone. In the middle of a cyclone the air is generally still, but the great pressure of the wind on every side of the house raised it up higher and higher, until it was at the very top of the cyclone; and there it remained and was carried miles and miles away as easily as you could carry a feather. It was very dark, and the wind howled horribly around her, but Dorothy found she was riding quite easily.

(Baum, The Wonderful Wizard of Oz, 1900:15)

However, even this example may be explained away by claiming that this usage is in fact an example of cataphora, referring forward to "Dorothy". There are also several properties of this example that allow a post-hoc explanation of why such long-distance reference is possible: Dorothy is the main character of the narrative, and in that sense may be said to be more accessible (Morrow et al., 1989). Also, all intervening referents are inanimate, so the pronoun is not ambiguous in this context. Furthermore, this entire section is about the same event, and the intervening material provides a description which is implicitly from Dorothy's perspective.
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In any case, as Table 5 shows, the majority of pronominal references occur when the referent has been mentioned within the previous five clauses. This suggests that researchers should look here for the relevant correlations between reference form and recency of mention, and therefore several recent studies of reference have clearly looked in the wrong places. For example, researchers in Centering Theory have claimed that pronominal reference depends on how an entity was last mentioned, but they consider only the previous clause, both theoretically (Grosz et al., 1995) and experimentally (Hudson D'Zmura and Tanenhaus, 1998; Gordon et al., 1993). But, as Table 5 shows, this limitation misses the difference between referents mentioned in the previous clause and referents mentioned before that.

While it is possible to focus too narrowly, as Centering does, it is also possible to focus too broadly, and miss much of the interesting detail. This is the case in Du Bois (1987), who followed Chafe's tripartite system of coding reference as either "new" (= it had not appeared in the text), "accessible" (= it had appeared but not within the last 20 clauses) or "given" (= it had appeared within the last 20 clauses) (see Chafe, 1994, chapter 6, for an updated description). By distinguishing only between entities that had been mentioned within the last 20 clauses and those which had not been mentioned for 20 clauses, Du Bois missed the fact that there is a large, graded effect of recency for referents mentioned within a space of 5 clauses or so, but not for referents that haven't been mentioned for more than 5 clauses.

2.3.1.2. A closer look at English

The data in Table 5 showed that pronouns were almost never used in English when the referent had not been mentioned for more than 5 clauses. But what patterns of
pronoun use occur for referents mentioned 2-5 clauses back? A closer look at the English data reveals that the percentage of pronominal references falls off steadily as the distance to the last mention increases, as shown in Figure 1.17

17 The data in Figure 1 exclude all cases of reference where there is a quote intervening. This issue will be discussed in detail in §2.3.1.3. This analysis contrasts with the earlier analysis of Recency in all languages, which simply ignored quotes for purposes of measuring Recency.

As in the previous analysis, the category "one clause since last mention of referent" includes the category "last main clause", in which the referent was mentioned in the last main clause, with one or more subordinate clauses intervening.
As time passes, pronouns are used less and less, and full names or descriptions are used more and more. Since recency of mention can be assumed to affect the activation or accessibility of the representation of an entity, these data provide a detailed picture of how reference is made to entities of differing activation.

This picture is consistent with the data on written English presented by Brown (1983) in Givón's volume on Topic Continuity. However, the methodology of my study differed from that in Brown's. Brown, along with the other authors in Givón (1983b), used recency as a dependent, rather than an independent variable, and investigated the distribution of recency for each type of referring form. In contrast, I counted the referential form as the dependent variable, investigating the variation in reference form under different conditions, like recency.
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There are three reasons why my methodology is preferable. First, it is more natural than that of Givón and his colleagues (1983b), since it reflects the theoretical direction of causality: production of a referring form occurs in the context of information such as how recently an entity had been mentioned. Therefore it is reasonable to believe that recency of mention affects the form of reference, and not that the form of reference affects recency of mention.

Second, the choice of methodology affects the information it reveals. For example, Brown reported that in his corpus, the average "referential distance" was 1.72 for unstressed pronouns and 2.27 clauses for demonstrative pronouns. From this we as readers know that the antecedent of most pronouns was within 1 or 2 clauses, but we don't know what the maximum referential distance is, nor what the preferred form of reference is in a particular situation. In contrast, the data in Figure 1 tell us that reference to something last mentioned in the previous clause is overwhelmingly pronominal, and reference to something that hasn't been mentioned for 6 clauses is almost always a full name or description.

The third advantage of my methodology is that it demonstrates the graded nature of recency. In many text analyses that investigate recency, most authors have distinguished between just a few categories of recency. The most basic contrast is that of "given" (i.e., it has been mentioned before) versus "new" (i.e., it has not been mentioned in this discourse). Most authors contrast at least three levels of recency, for example Chafe's system of "given" vs. "accessible" vs. "new" (1994). This system might suggest that there are three discrete cognitive categories for discourse referents. However, my analysis suggests that the effect of recency is graded.
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2.3.1.3. The privileged status of the previous clause

Even though recency displays graded properties, the results in Figure 1 show that the relationship between recency and reference form is not completely linear. When recency is measured in terms of number of clauses, the percentage of pronominal reference decreases at a slower and slower rate as the recency of the last mention decreases. The greatest difference occurs between one clause and two clauses back, suggesting that there is something special about the cognitive status of information in the previous clause. This observation is consistent with Clark and Sengul's (1979) argument that entities mentioned in the previous clause have a privileged position. They found in their first experiment that people read passages faster when the referents of pronouns or definite NPs were mentioned in the previous clause, but found no reliable difference between reading times for referents mentioned 2 or 3 clauses back.

Clark and Sengul also found evidence that the privileged position was the previous clause, rather than the previous sentence. Their second experiment showed that when the referent had been mentioned two clauses prior to the anaphor, there was no difference whether that clause was part of the previous sentence or not. Furthermore, their third experiment showed that entities in the previous clause were more accessible than other entities, regardless of whether they were in a main or subordinate clause. This supports Givón's claim that the clause is the basic unit of processing (1983a:7).

The results of my text analysis provide further support for the claim that clause type has little or no effect on the privileged position of the previous clause. I looked at reference to entities in the previous clause, and compared cases where the previous clause was a main clause with cases where it was a subordinate clause. Table 6 shows that when
the referent was last mentioned in the previous clause, pronouns were used about 90% of the time, with no significant difference between main and subordinate clauses ($\chi^2(1)=2.8$, $p=.1$).

<table>
<thead>
<tr>
<th>Table 6. Referents in main vs. subordinate clauses</th>
</tr>
</thead>
<tbody>
<tr>
<td>previous clause (main)</td>
</tr>
<tr>
<td>previous clause (subordinate)</td>
</tr>
</tbody>
</table>

While there is no difference between these two categories, together they have a higher rate of pronoun use than the next category, "last main clause", described below ($\chi^2(1)=4.7$, $p<.02$).

At the same time, there is evidence that main and subordinate clauses have different influences on the accessibility of referents that were mentioned before the previous clause. To investigate this difference, I compared two categories of anaphoric reference. First, I looked at cases where the referent was not mentioned in the previous clause, but was mentioned in the last main clause. 17 illustrates the "last main clause" type of reference, where the only intervening clause is a subordinate one.

(17) "Timber!" they shouted [as each tree crashed to the ground]. The men worked hard from sunup to sundown.

In some cases there was more than one clause intervening, but all were subordinate. I compared this category with cases where the referent had not been mentioned for two
clauses, and the intervening clause was a main clause. The data in Table 7 show that when a main clause intervenes between an anaphor and its antecedent ("two clauses back"), pronoun use is lower than when one or more subordinate clauses intervene ("last main clause") ($\chi^2(1)=5.24, p<.02$).

Table 7. Intervening clauses: main vs. subordinate clauses.

<table>
<thead>
<tr>
<th></th>
<th>total</th>
<th>% pro</th>
<th>p&lt;.02</th>
</tr>
</thead>
<tbody>
<tr>
<td>last main clause</td>
<td>34</td>
<td>79%</td>
<td></td>
</tr>
<tr>
<td>two clauses back</td>
<td>44</td>
<td>55%</td>
<td></td>
</tr>
</tbody>
</table>

It is clear from these data that recency does not affect reference form in a linear fashion: main clauses produce more interference with the accessibility of referents than subordinate clauses.

One explanation for this finding is that information in subordinate clauses is interpreted as supporting the propositions in the main clause. Thus, a new main clause forces listeners to shift their focus of attention to a new topic, whereas subordinate clauses maintain the focus of attention of the previous clause. When the focus of attention remains on the information in the main clause, it is easier for the listener to access that information. An alternative explanation for the data in Table 7 could be that by mentioning something in a main clause, the speaker or writer indicates that it will play an important role in the upcoming discourse. This could result in higher activation for the referents in the readers' mental representation, which would interfere with information from preceding clauses. In contrast, information from subordinate clauses
may be less activated and interfere less. However, if this were the case, one would also expect more pronoun use for reference to entities a preceding main clause than entities in a preceding subordinate clause. But this was not the case in the English text analysis, as Table 6 shows.

2.3.1.4. The effect of quoted utterances

With respect to recency, an additional question whether quotations interfere with the accessibility of referents as much as nonquoted utterances. According to some theories, discourse is structured in a hierarchical fashion, with some segments embedded inside others (e.g., Grosz and Sidner, 1986; Polanyi, 1994; and Fox, 1987). This view is formalized in Grosz and Sidner's (1986) description of Centering Theory, which consists of a) the discourse structure, b) the intentional structure, and c) the attentional structure. The discourse structure is composed of hierarchically organized discourse segments that correspond to discourse segment purposes in the intentional structure, and focus spaces in the attentional structure.

The attentional structure in Centering Theory is a model of the speaker and listener's focus of attention at each stage of the discourse. It is linked to the intentional structure: at any point in the discourse, the focus of attention is on referents that are relevant to the current intention. The intentional and attentional structures are defined by means of a focus stack, which consists of focus spaces for different segments of the discourse. The focus space is defined as that which constrains referring expressions like definite NPs, and limits the listener's search for referents for anaphoric elements (such as pronouns). The focus space that is on the top of the stack at any given moment constrains reference in the current discourse. When the discourse enters an embedded segment, a
new focus space is layered on top of the one for superordinate discourse segments. When an embedded segment ends, the focus space is "popped" off the stack, leaving the superordinate focus space at the top. The claim is that returning to the higher focus space allows pronominal reference to something that is hierarchically recent but which has not been mentioned for some time. An example of how pronominal reference can "ignore" an embedded structure is shown in 18.


   a. C: Okay Harry, I have a problem that uh my - with today's economy *my daughter is working*,
   b. H: I missed your name.
   c. C: Hank.
   d. H: Go ahead Hank
   e. C: *as well as her uh husband.*

   They have a child

   and they bring the child to us every day for babysitting.

In this example, C says "...my daughter is working," and then H interrupts with a side-sequence, which runs for three turns. After the side-sequence ends in 18d, C picks up the utterance from 18a, and uses the pronoun "her" as if there had been no interruption.

   In contrast, there is also evidence to support the idea that as additional material is added to the discourse, accessing a distant referent becomes more difficult, regardless of
the discourse structure. Walker (1998) argued that although pronominal reference can "ignore" an embedded structure as in 18, the same dialogue feels less natural if the interruption is longer, as in 19.


a. C: Okay Harry, I have a problem that uh my - with today's economy my daughter is working,

b. H: I missed your name.

c. C: Hank.

d. H: Is that H A N K?

e. C: Yes

f. H: Go ahead Hank

g. C: as well as her uh husband.

They have a child

and they bring the child to us every day for babysitting.

Through an analysis of several naturally-occurring examples, Walker showed that both pronouns and full NPs can occur under four different conditions of hierarchical and linear recency. She argued that Grosz and Sidner's stack model of hierarchical discourse structure does not predict choices between pronouns and fuller forms, and argues instead for her "cache model". The cache model, essentially an implementation of Baddeley's working memory, is a limited capacity storage area for currently relevant information. Referent representations in the cache model are extremely accessible. As new
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information comes into the cache model, old information gets pushed out into "main memory".

Walker argued that processes of Centering (see §1.1.3) take place with respect to information in the cache. This proposal contrasts with the claim of hierarchical models that they take place with respect to information in the focus space at the top of the focus stack (Grosz and Sidner, 1986). The primary evidence for the focus stack model comes from cases like 18, called "return pops", where a pronoun is used to refer to something hierarchically but not linearly recent. Walker argues the cache model can account for these cases, as well as reference to linearly recent referents. In the case of a return pop, the information from the hierarchically recent segment is retrieved into the cache, making it more accessible. At the same time, the information from the linearly recent segment remains in the cache until it is displaced by new information. Thus, Walker claimed that the accessibility of discourse referents can be influenced by both linear and hierarchical recency.

Walker (1998) was primarily concerned with the possible forms of reference under different conditions of discourse structure, and so she concluded that the stack model does not accurately predict where pronouns are an option. At the same time, she pointed out the need for future work to investigate how discourse structure relates to the frequency of different forms of reference. The present corpus analysis is ideal for investigating this question.

Although Walker (1998) and Groz and Sidner (1986) discussed focus spaces in terms of the discourse intentions, identifying the intentional structure can be difficult. For this reason, I chose instead to examine quoted material as clearly marked examples of
embedding. Quotes constitute a separate plane of discourse from the baseline story; they contain different referents, represent different speakers, and often take place at a different time than the main narrative event. In addition, writing conventions have developed punctuation specifically for setting quotes apart from the main discourse. For these reasons, one can argue that quotes are distinct discourse segments, embedded within the main narrative line.

There are three different predictions about how embedded material should influence pronoun use. Hierarchical theories of discourse structure would predict that quotes should be discounted from an analysis of the main flow of discourse, since they represent a separate plane of discourse. That is, a hierarchical theory would predict that there should be no difference whether a quote intervenes between an anaphor and its antecedent or not. This could be called the strong version of the Invisible Embeddings hypothesis. However, as Walker observed, linear recency can also play a role, in combination with hierarchical recency. This could be called the weak version of the Invisible Embeddings hypothesis. Finally, a theory of recency as a linear phenomenon would predict that quotes should behave like nonquoted passages in all respects.

I investigated these hypotheses in the English corpus by coding both a) the number of nonquoted clauses since the referent was last mentioned, and b) whether there were one or more quotes intervening as well. The results reported in Figure 1 only include nonquoted clauses. The percentage of pronominal references in each category of recency, with and without quotes, are presented in Table 8 and Figure 2. These data show that when a quote increases the linear distance between an anaphor and the last time it was mentioned, the percentage of pronominalization falls. The comparison between
"no quote" and "plus quote(s)" was significant for "one clause", "two clauses", and "three clauses" ($\chi^2(1)'s > 4, p's < .05$), although not for the categories "four clauses" and "five clauses" ($\chi^2(1)'s < 1, p's > 1$).

<table>
<thead>
<tr>
<th></th>
<th>no quote</th>
<th>plus quote(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>one clause</td>
<td>90% (n=288)</td>
<td>60% (n=48)</td>
</tr>
<tr>
<td>two clauses</td>
<td>55% (n=44)</td>
<td>26% (n=31)</td>
</tr>
<tr>
<td>three clauses</td>
<td>38% (n=40)</td>
<td>7% (n=14)</td>
</tr>
<tr>
<td>four clauses</td>
<td>22% (n=23)</td>
<td>11% (n=9)</td>
</tr>
<tr>
<td>five clauses</td>
<td>9% (n=11)</td>
<td>0 (n=2)</td>
</tr>
</tbody>
</table>

Table 8. The effect of quotes on reference form (English)
The strong version of the Invisible Embeddings hypothesis would predict that pronouns would be used equally as often in cases where a quote intervened and cases where none did. However, pronouns were used less often in each category of recency when quoted material intervened. The results suggest that it is incorrect to make strong about the ability of anaphoric reference to "skip over" embedded segments, thus providing evidence against the strong version of the Invisible Embeddings hypothesis.

Neither do these results strongly support the weak version of the Invisible Embeddings hypothesis. This version would predict that the presence of quoted material between an anaphor and the antecedent would reduce the rate of pronominalization, but not as much as the presence of another clause. The crucial comparisons are depicted in Figure 3. The weak Invisible Embeddings hypothesis would predict that the differences between each pair should be negative.
However, only two of these comparisons showed negative differences, and more importantly, none of these comparisons was significant (all $\chi^2$s < 1). It could be that the low cell totals contributed to this nonsignificance. But as they stand, these data suggest that quoted material may interfere with the accessibility of previously-mentioned referents as much as non-quoted material.

In sum, these data supported neither the strong nor the weak version of the Invisible Embeddings Hypothesis for quoted material. It is possible that quotes do not function the same way as other types of embeddings. This question would have to be investigated through an explicit comparison of different types of embedded structures. If they do function similarly, however, these results would indicate that the accessibility of discourse referents is influenced more by linear recency than hierarchical recency.

2.3.1.5. Recency: Conclusion

The results of a text analysis in three languages support the idea that reference form depends on how recently the referent was last mentioned in the discourse.
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Underspecified forms such as pronouns or null anaphors are more natural when the referent was mentioned in the previous clause, but fuller forms are needed when the referent hasn't been mentioned for more than 5 clauses. A closer look at English reveals a detailed picture of recency, including the difference between main and subordinate clauses, and the dominance of linear recency over hierarchical recency. Figure 4 brings all of these features together, and presents an overall picture of how recency correlates with the rate of pronominalization in English.
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Figure 4: The effect of Recency on reference form in English

![Bar chart showing the effect of recency on reference form in English.]
2.3.2. Subjecthood and Parallelism

I now turn to the second and third factors observed in this text analysis: Subjecthood and Parallelism. The following data show that structural properties of the anaphor and antecedent correlate with choices in reference form.

2.3.2.1. Subjecthood

Past research on reference form has claimed that entities mentioned in subject position are more salient and more accessible than other entities, and the comprehension of reference to these entities is easier when the referring expression is a pronoun than when it is a full NP (e.g., Gordon et al., 1993; Hudson-D'Zmura and Tanenhaus, 1998). A related claim grants privileged position to First-Mentioned referents (e.g., Stevenson et al., 1994; Gernsbacher and Hargreaves, 1988, 1992), reflecting claims that sentence-initial referents are highly topical (Reinhart, 1982). The higher accessibility of grammatical subjects may be due to either their grammatical position or initial sentence position, but investigation of this issue is beyond the scope of this study. Teasing these two factors apart is difficult, for different reasons in each language. In English, Subjecthood and First Mention are highly correlated, making a distributional comparison of the two difficult. Word order is more flexible in Spanish and Mapudungun, but the relative position of NPs can only be measured when arguments are overt. Since both languages have a high rate of null reference, the influence of sentence position on reference form is difficult to ascertain. Therefore, I only looked at Subjecthood in this analysis.

I also limited this analysis to cases where the referent was last mentioned in the previous clause or last main clause, because I expected that the effect of Subjecthood
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would be biggest in the immediately following clause. My analysis compared cases where the referent had last been mentioned as a subject with cases where it had last been mentioned as an object or oblique. I will call these "subject-referents", "object-referents", and "oblique referents", respectively. Because the Mapudungun database only included cases where the anaphor was in the main clause, the data in this figure from English and Spanish are also restricted to main clauses. However, analyses of all clauses in English and Spanish yield similar results.  

A analysis of all clauses in English and Spanish yields a similar result to the data in Figure 4. Both comparisons are significant (English: $\chi^2=4.87$, DF=1, $p<.05$; Spanish: $\chi^2=11.3$, DF=1, $p<.001$).

<table>
<thead>
<tr>
<th>GF of referent</th>
<th>% pronominal/null</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>English</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject</td>
<td>89%</td>
<td>246</td>
</tr>
<tr>
<td>Object/Oblique</td>
<td>77%</td>
<td>90</td>
</tr>
<tr>
<td><strong>Spanish</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject</td>
<td>84%</td>
<td>168</td>
</tr>
<tr>
<td>Object/Oblique</td>
<td>65%</td>
<td>63</td>
</tr>
</tbody>
</table>
Figure 5 shows that the percentage of pronominal or null references is higher for reference to subject-referents than object- or oblique-referents in English ($\chi^2=4.87$, DF=1, p<.05), Spanish ($\chi^2=11.3$, DF=1, p<.001), and Mapudungun ($\chi^2=43$, DF=1, p<.001). Assuming that less-specified forms of reference are used more often when the antecedent is more accessible, these data support claims that the subject is a prominent position.
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2.3.2.2. Parallelism

A second claim that has appeared in the literature on reference form and pronoun resolution is that parallel structure between an anaphor and its antecedent facilitates pronominal reference. For example, in 20a, the pronoun is claimed to be easier to resolve because it refers to something in parallel position, whereas in 20b, it is more difficult because the reference is not parallel.

(20)  a. In line at the post office, Jane tapped Emily on the shoulder.
        She just wanted to point out that the line was moving forward.

   b. In line at the post office, Jane tapped Emily on the shoulder.
        She turned around and glared at her before moving forward.

One problem with this claim, however, is that in 20a (the parallel version) the antecedent is the subject, and in 20b (the nonparallel version) the antecedent is the object. This raises the question of whether claims of parallelism are merely a re-characterization of the subject bias, and conversely, whether the subject bias is in fact the result of parallelism.

I addressed this question with the text analysis by investigating reference form in terms of the grammatical function of both the anaphor and the antecedent, including all grammatical functions. Examples of parallel reference between subjects, objects, and obliques are shown in 21.
CHAPTER 2: CROSS-LINGUISTIC EVIDENCE

(21)

a. Subject Parallelism

As he was studying this remarkable pebble,

he began to shiver, probably from excitement, . . .

(Steig, Sylvester and the Magic Pebble, 1969)

b. Object Parallelism

Then Ole Swenson tied all the carts to the Hodag's tail.

The Hodag pulled them through the forest to the sawmill.

(C. Arnold, The Terrible Hodag, 1989)

c. Oblique Parallelism

At last she crawled over the swaying floor to her bed,

and lay down upon it; . . .

(Baum, The Wonderful Wizard of Oz, 1900:15)

I conducted this analysis in all three languages. Again, since the Mapudungun database only included cases where the anaphor was in a main clause, I restricted the English and Spanish analyses to main clauses as well, for comparison (but see footnote 11, below).

If both Parallelism and Subjecthood influence reference form, then one would expect to see a combined effect of the two factors, such that reference form is pronominal or null more often both when the antecedent is parallel and when the antecedent is the subject. The results, displayed in Table 9, support this prediction. There is a significant effect of parallelism in all three languages, but for English and Spanish the parallelism effect only shows up for subject-to-subject reference (where "subject-to-subject" means
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that the anaphoric referring form occurs in subject position, and refers to something last mentioned in subject position as well). In Mapudungun there is evidence for both subject and object parallelism, but the effect is stronger for subject-to-subject reference. These data suggest that there is a general subject bias, but that parallelism between an object or an oblique and its referent can neutralize the subject bias by increasing the rate of null/pronominal reference to parallel objects and obliques. In Mapudungun the effect of parallelism is even stronger, and even overpowers the subject bias in the case of object-to-object reference. Yet even for Mapudungun, the rate of null reference for object-to-object reference is not as high as for subject-to-subject reference, suggesting that both Subjecthood and parallelism are influencing the outcome.
Table 9. Parallelism effects in English, Spanish, and Mapudungun

<table>
<thead>
<tr>
<th>Language</th>
<th>Type</th>
<th>Relation</th>
<th>% pronoun</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>English</strong></td>
<td>Subject</td>
<td>Subject-to-Subject</td>
<td>88%</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subject-to-Object/Obl.</td>
<td>59%</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Object</td>
<td>Object-to-Object</td>
<td>92%</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Object-to-Subject/Obl.</td>
<td>86%</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Oblique</td>
<td>Oblique-to-Oblique</td>
<td>100%</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oblique-to-Subject/Obl.</td>
<td>81%</td>
<td>16</td>
</tr>
<tr>
<td><strong>Spanish</strong></td>
<td>Subject</td>
<td>Subject-to-Subject</td>
<td>83%</td>
<td>102</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subject-to-Object/Obl.</td>
<td>21%</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Object</td>
<td>Object-to-Object</td>
<td>83%</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Object-to-Subject/Obl.</td>
<td>92%</td>
<td>26</td>
</tr>
<tr>
<td><strong>Mapudungun</strong></td>
<td>Subject</td>
<td>Subject-to-Subject</td>
<td>86%</td>
<td>328</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subject-to-Object</td>
<td>14%</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Object</td>
<td>Object-to-Object</td>
<td>75%</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Object-to-Subject</td>
<td>15%</td>
<td>13</td>
</tr>
</tbody>
</table>

The only problem with investigating each type of parallel reference was that it yielded small totals in some cells. Therefore these data are only suggestive. This problem was
compounded by limiting the analysis to cases where the anaphor was in a main clause. However, an analysis of all clauses in English and Spanish yielded similar results.19

2.4. The discourse patterns of Recency, Subjecthood, and Parallelism

The preceding results show that Reference Form in three languages is correlated with three of the factors mentioned in chapter 1: a) Recency of mention, b) Subjecthood, and c) Parallelism. These results support other findings of Recency (e.g., Givón, 1983a; Clark and Sengul, 1979), Subjecthood (e.g., Gordon et al., 1993), and Parallelism (e.g., Sheldon, 1974). This type of finding has typically taken as evidence that entities that have been mentioned recently, in subject position, or in parallel position are somehow more prominent than other entities, so that less-specified forms of reference are preferred.

The question remains, however, why are these three factors associated with prominence? Recency, Subjecthood, and Parallelism have very little in common, other than the fact that they are all associated with choices in reference form. Why do they all have similar effects on language use?

19 The pattern shown in Table 9 is not limited to only main clauses. For English and Spanish it is possible to include all clauses in the analysis, in which case a similar pattern emerges:

<table>
<thead>
<tr>
<th></th>
<th>English</th>
<th></th>
<th>Spanish</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% pronoun</td>
<td>N</td>
<td>%null/clitic</td>
<td>N</td>
</tr>
<tr>
<td><strong>Subject</strong> ($\chi^2$'s (1)&gt;14, p's &lt;.001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject-to-Subject</td>
<td>90%</td>
<td>213</td>
<td>85%</td>
<td>136</td>
</tr>
<tr>
<td>Subject-to-Object/Obl.</td>
<td>69%</td>
<td>59</td>
<td>42%</td>
<td>24</td>
</tr>
<tr>
<td><strong>Object</strong> ($\chi^2$'s (1) &lt;1.0, n.s.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Object-to-Object</td>
<td>92%</td>
<td>13</td>
<td>90%</td>
<td>21</td>
</tr>
<tr>
<td>Object-to-Subject/Obl.</td>
<td>88%</td>
<td>26</td>
<td>92%</td>
<td>25</td>
</tr>
<tr>
<td><strong>Oblique</strong> ($\chi^2$(1)=.71, n.s.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oblique-to-Oblique</td>
<td>100%</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oblique-to-Subj./Obj.</td>
<td>79%</td>
<td>19</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The data in the following sections will show that all three factors share an additional property: they also correlate with the most frequent types of reference. All discourse referents are not equal. Some are mentioned once, and disappear. Others are more important to the discourse. At any given point in a text, there are many referents that have already been mentioned, but some of them are more likely to be mentioned again than others. I will show that in all three languages, writers use attenuated forms for precisely those referents that they also tend to refer to more often. These data will provide the first pieces of support for my central claim, that these factors display a double association with Reference Form and Reference Continuation.

2.4.1. Recency

The results in §2.3.1 showed that writers tend to use less-specified forms of reference for entities that have been mentioned recently. Why does recency have this effect? At a general level, and as many researchers have argued, it is because the more recently mentioned referents are more accessible than those that have not been mentioned for a while. More recently mentioned referents are more in the focus of attention of the discourse participants, and are thus more accessible.

One way of thinking of recency is as the result of a decay mechanism. That is, when something is mentioned, the discourse participants are forced to access that entity and integrate it into their mental models of the discourse. As time goes by, if that entity is not mentioned again, the mental representation of it will begin to fade and ultimately disappear, especially if new information is competing for limited attentional resources. When the representation of a discourse entity is freshly activated, less-specified forms of reference are more natural, but as time goes by and the representation fades, more fully
specified forms of reference are needed to re-access the referent. Such a view is consistent with connectionist models that have been proposed to account for other aspects of language processing (e.g., McClelland and Rumelhart, 1981; Seidenberg and McClelland, 1989), and is implicit in the use of the term "decay" for this phenomenon (Givón, 1983a).

While this view is likely to contain some truth, it may not be the entire story of why recently mentioned things are salient. Instead, the influence of recency may stem from the fact that people tend to talk about the things that they were just talking about. As I mentioned in §1.2, discourses tend to be organized around the goals and intentions of the participants. For this reason, people tend to talk about ideas for extended periods of time, rather than stringing unrelated sentences together. This results in a pattern whereby people refer to recently mentioned things more than they refer to other things.

This generalization is supported by observing the patterns of reference in the corpus analyses in English, Spanish, and Mapudungun. In all three languages, reference to entities last mentioned in the previous clause is the most frequent type of reference. That is, of all the references in each database, a large percentage refer to entities in the previous clause. Table 10 shows the percentage of all references to entities, according to how recently they were mentioned. Here the number of references includes all references. References to a subset or superset of recently mentioned entities are excluded, as are references to entire clauses.
Table 10. The distribution of references according to the recency of the referent.

<table>
<thead>
<tr>
<th>Recency of mention</th>
<th># refs</th>
<th>% of all references</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. ENGLISH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>previous clause/ last main clause</td>
<td>336</td>
<td>35%</td>
</tr>
<tr>
<td>2-5 clauses back</td>
<td>174</td>
<td>18%</td>
</tr>
<tr>
<td>6+ clauses back</td>
<td>197</td>
<td>20%</td>
</tr>
<tr>
<td>new</td>
<td>257</td>
<td>27%</td>
</tr>
<tr>
<td>B. SPANISH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>previous clause</td>
<td>231</td>
<td>33%</td>
</tr>
<tr>
<td>2-5 clauses back</td>
<td>108</td>
<td>16%</td>
</tr>
<tr>
<td>6+ clauses back</td>
<td>107</td>
<td>15%</td>
</tr>
<tr>
<td>new</td>
<td>246</td>
<td>36%</td>
</tr>
<tr>
<td>C. MAPUDUNGGUN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>previous clause</td>
<td>434</td>
<td>63%</td>
</tr>
<tr>
<td>2-5 clauses back</td>
<td>83</td>
<td>15%</td>
</tr>
<tr>
<td>6+ clauses back</td>
<td>22</td>
<td>4%</td>
</tr>
<tr>
<td>new</td>
<td>111</td>
<td>18%</td>
</tr>
</tbody>
</table>

As the data in Table 10 show, the largest percentage of references to something which has appeared previously in the discourse refers to something in the previous clause. This tendency is strongest in Mapudungun, where this category represents 63% of all references. In English and Spanish the effect is smaller, but in these languages approximately one third of all references have referents that were mentioned in the previous clause. This is the largest portion of all the references to given information.

The correlation between Recency and Reference Continuation may be difficult to appreciate from the figures in Table 10, which presents recency in terms of 4 categories. It is highly implausible to suppose that the language processing system categorizes recency of mention in terms of "one clause back", "2-5 clauses", or "6 or more clauses". The actual system is probably continuous, but the results of the discourse analysis can
only be presented categorically. A finer-grained analysis of recency in English supports the claim that frequency of subsequent reference drops off gradually over time since the last mention, as shown in Table 11.

<table>
<thead>
<tr>
<th># of clauses since last reference</th>
<th># of references</th>
<th>% of all references</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>336</td>
<td>35%</td>
</tr>
<tr>
<td>2</td>
<td>75</td>
<td>8%</td>
</tr>
<tr>
<td>3</td>
<td>54</td>
<td>6%</td>
</tr>
<tr>
<td>4</td>
<td>32</td>
<td>3%</td>
</tr>
<tr>
<td>5</td>
<td>13</td>
<td>1%</td>
</tr>
<tr>
<td>6+</td>
<td>197</td>
<td>20%</td>
</tr>
<tr>
<td>new</td>
<td>257</td>
<td>27%</td>
</tr>
</tbody>
</table>

I did not conduct a clause-by-clause analysis for the category "6+", but is probable that if I did, the percentage of references would continue to drop off asymptotically.

Tables 10 and 11 show that the probability of subsequent reference is correlated with recency. Table 5 in §2.3.1 showed the same correlation between pronominalization and recency. This parallelism provides the first piece of evidence for the main claim of this dissertation: Recency is associated with 2 things: a) Reference Form, and b) Reference Continuation. That is, writers use pronouns more for the type of referents that they tend to mention again: recent referents.

Why can writers do this? It is because they know that recently mentioned referents are more activated in the mind of the reader, which facilitates the comprehension of the anaphoric forms. The more activated the referent, the easier it is to interpret pronouns and null anaphors. Since speakers and writers desire efficient
CHAPTER 2: CROSS-LINGUISTIC EVIDENCE

communication, they choose attenuated forms only when referents are activated for the listener or reader.

The data presented here also provide another way of thinking about why referents become activated for the reader. During text comprehension, readers are trying to retrieve the message that the writer intended. At one level, this involves constructing a mental representation of the discourse referents. From the writer's perspective, some referents are more central to their message and therefore are more activated than others in their minds. Because the activated referents are the ones that are central to the writer's message, they are the ones that the writer intends to mention in the following sentences. The tendency for writers to continue to refer to referents that have been recently mentioned stems from their attempt to present a coherent text.

During text comprehension, the reader tries to construct a representation of these referents that is similar to what the writer intended. But without knowing what was in the writer's head, the reader can only go by information from the text, such as the recency of referents. When a referent has been mentioned recently at a given point in the discourse, the reader knows it has a high probability of being central to the writer's message, and that it has a high probability of being mentioned again. Therefore, it is to the reader's advantage to consider that referent highly activated.

This view is not mutually exclusive with the decay mechanism described above, because it also assumes that activation automatically decays if the representation is left "unattended", as it were. But this account suggests why the language processing system has evolved a sensitivity to recency. That is, discourse participants focus on certain characters and items as likely elements in the upcoming discourse. When a referent has
just been mentioned, it is highly activated, because there is a high probability that it will play a role in the immediately following discourse. However, as time goes by and the writer does not mention this character, it becomes increasingly less probable that it will be mentioned again. This gets translated into lower activation for the reader's representation of that referent.

Further support for this position comes from evidence that the effects of recency are not linear (Clark and Sengul, 1979). A simple recency-as-decay account would predict that the rate of pronominalization would fall steadily as recency decreases, without consideration of other factors. However, the analysis in English showed that the effects of Recency are modulated by other aspects of the discourse structure (see Figure 4). First, pronouns were used in English more often when one or more subordinate clauses intervened between the anaphor and antecedent than when one main cause intervened. Second, data on the effects of Subjecthood and Parallelism show that when the referent appeared in the previous clause, these factors overpowered any effect of Recency.

A nonlinear view of Recency is also supported by research on the hierarchical nature of discourse (e.g., Walker, 1998; Grosz and Sidner, 1986; Polanyi, 1994; Fox, 1997). Although my results did not support a hierarchical analysis of quotes, examples like 18 (§2.3.1.4) suggest that some embedded segments can pose less of a threat to the main flow of the discourse than non-embedded sections. This suggests that the activation of discourse entities does not slip away at a constant rate, but rather is regulated by other factors.
Further support comes from Greene et al.’s (1994) study on text comprehension. They studied texts in which two characters become separated, and later reunited. They argued that readers keep track of information that is shared by two characters in a text, and that when the characters reunite, the information in their common ground becomes more accessible. They found that in these situations, readers were able to use the character's common ground to interpret pronouns that had no recently mentioned referent.

2.4.2. Subjecthood

The results of the text analyses in all three languages showed that Reference Form was also associated with the grammatical function of the last reference to the conceptual referent. Less specified forms of reference were used most often when the last reference to that entity was in subject position. This raises the question of why it is that subject-referents should be more accessible than other referents.

Again, the data show that writers tend to refer more often to the referents of subjects, in comparison with the referents of objects or obliques. Table 12 shows that the number of subsequent references to the subject-referents far exceeds the number of references to the object- or oblique-referents. This pattern is especially pronounced for Mapudungun, but this may stem from the fact that the Mapudungun analysis did not include oblique arguments or any referring forms from subordinate clauses.
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Table 12. Patterns of reference by grammatical function

<table>
<thead>
<tr>
<th>Grammatical Function of Referent</th>
<th># of refs</th>
<th>% total references</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>English</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject</td>
<td>246</td>
<td>73%</td>
</tr>
<tr>
<td>Object/Oblique</td>
<td>90</td>
<td>27%</td>
</tr>
<tr>
<td><strong>Spanish</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject</td>
<td>168</td>
<td>73%</td>
</tr>
<tr>
<td>Object/Oblique</td>
<td>63</td>
<td>27%</td>
</tr>
<tr>
<td><strong>Mapudungun</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject</td>
<td>341</td>
<td>88%</td>
</tr>
<tr>
<td>Object</td>
<td>52</td>
<td>13%</td>
</tr>
</tbody>
</table>

These results show that the referents of subjects are far more likely to receive subsequent reference than other referents. These data do not tell us why this pattern exists, but some clues can be found in past research. As many researchers have noted, there are certain characters and objects which are more central to a discourse at any given point (e.g., Ariel, 1990; Chafe, 1994; Grosz et al., 1995). It has also been well-established that speakers choose certain constructions, depending on the discourse status of the referents (e.g., Givón, 1983a; Ward and Birner, 1996). In particular, speakers and writers tend put central characters in subject position (e.g., Du Bois, 1987; Prince, 1994; Tomlin et al., 1997), a position which has also been associated with the sentence-level topic in English (Reinhart, 1982). It has also been established that speakers and writers refer more often to characters that are central to the discourse (Francik, 1985). Thus, it seems natural that subject-referents are subsequently mentioned more often than other characters.

Considering the results from Recency and Subjecthood together, a general pattern of reference emerges. Writers are more likely to refer to something that was mentioned
in the previous clause than other referents. In particular, they are more likely to refer to something that was last mentioned in subject position of the preceding clause. These results are compatible with the corpus analysis results in chapter 3, where the Subjecthood factor will be discussed further.

2.4.3. Parallelism

The text analyses, described above, also showed that when the anaphor and its antecedent are in the same grammatical position, the use of pronouns and null reference increases. This effect combined with the effect of Subjecthood, such that pronominal and null reference was especially frequent when both anaphor and antecedent were in subject position. When Subjecthood and Parallelism led to different preferred forms of reference, the effect of Subjecthood was weakened in English and Spanish, and nullified in Mapudungun. But why does Parallelism play the role it does?

As with Recency and Subjecthood, the text analyses reveal a double association with Reference Form and Reference Continuation. Figures 6-8 show that for each anaphor position, the highest proportion of references have parallel antecedents. This pattern holds for English ($\chi^2(4)=25$, $p<.001$), Spanish ($\chi^2(2)=33$, $p<.001$), and Mapudungun ($\chi^2(1)=27$, $p<.001$).
CHAPTER 2: CROSS-LINGUISTIC EVIDENCE

Figure 6: Patterns of Reference by Parallelism in English

Figure 7: Patterns of Reference by Parallelism in Spanish
Figures 6-8 reveal an overall effect of the Subject Bias. In all three graphs, the subject antecedent cluster is the tallest. This shows that writers referred to the referents of subjects more often than other referents. However, this effect is the strongest in the case where the reference is parallel, when both anaphor and antecedent are in subject position.

In the cases of the object and oblique anaphors, the bias to refer to the subject is reduced, and there is an increased rate of anaphoric references to antecedents in parallel position.

These data show that parallel reference is statistically more frequent than nonparallel reference. Why does this pattern exist? It could be that people tend to place things in similar roles in successive sentences. That is, if something was mentioned as an object or an oblique, it is likely to be playing a role in the discourse that will make it likely to appear again in the same grammatical role. For example, in 22 "the puppy" gets passed from one person to another, playing the same thematic (and grammatical) role in each utterance.
(22) Carol picked up the puppy and passed it to John, who held it for awhile. Then Susie took it out for a walk. By the end of the evening everyone had handled the animal at some point or another.

At the same time, by using the same grammatical role for repeated references to a particular referent, the speaker also maintains the discourse status of that referent, relative to other entities. In both cases, maintaining the same semantic and discourse perspectives on a referent promotes coherence within a discourse segment.

The increased tendency for anaphors to have parallel antecedents mirrors the finding in §2.3.2.2 that pronouns are used more for parallel antecedents than non-parallel ones. That is, parallelism is doubly associated with both Reference Form, and Reference Continuation. What is the relationship between these findings?

As with Recency and Subjecthood, I argue that writers use pronouns more for parallel reference because it is easier for readers to process parallel reference than nonparallel reference. The reason it's easier is because parallel reference is a more common discourse pattern than nonparallel reference. Readers know that writers tend to refer to referents using the same grammatical positions in subsequent utterances. Therefore, with respect to any given anaphor, parallel-referents are more probable than nonparallel-referents.

For example, when readers come to the end of 23a, they may know that the subject of the following sentence is imminent. Even if they don't, once they encounter the anaphor, they identify it as an NP in subject position. This knowledge, combined with the knowledge that writers tend to maintain parallel reference, will cause the subject of 23a to become partially activated.
(23)  a. Fluffy clouds of smoke chugged out of the engine's smokestack.

      b. They reminded him of the Hodag.

      (C. Arnold, The Terrible Hodag, 1989:20)

As the reader continues to process 23b, inferential processes will support the
interpretation of the referent of "they" as the subject-referent. Because the parallelism
information supports the same interpretation as subsequent inferential processes, the
referent is relatively easy to access.

A similar phenomenon happens in 24; as readers access the verb "showed" in 24b,
they access the knowledge that it is almost always used as a transitive verb. Therefore
they know that the following word is probably a grammatical object, so their experience
with parallelism may begin to activate the object-referent from 24a. As the anaphor itself
is encountered, the reader becomes certain that it is in object position, so parallelism
effects become even stronger.

(24)  a. They found the boss man

      b. and showed him

      c. that they had finished their job.

      (C. Arnold, The Terrible Hodag, 1989:28)

25b shows an example of parallel oblique reference. In this case, the word "upon" signals
the imminence of an oblique reference, and may begin the activation of the parallel
oblique referent from 25a.
(25) a. At last she crawled over the swaying floor to her bed,  
   b. and lay down upon it;  

(Baum, The Wonderful Wizard of Oz, 1900:15)  

In all of these examples, the parallelism effects are both weak and transitory. They are not sufficient by themselves to identify the correct referent, but they can facilitate or inhibit the process of referent resolution.  

Note that Parallelism is a different kind of factor than Recency or Subjecthood. For the two latter factors, it is reasonable to think of them as indicators of the salience of their referents. That is, readers can infer that subject-referents or recently mentioned referents are likely to have been actively represented in the writer's mind. In contrast, it is harder to defend the claim that parallel referents are more important to the writer's goals than nonparallel referents. A writer knows the importance of any given entity from the moment it is mentioned (or before), but parallelism information does not become relevant until the position of the anaphor is known. In example 24, above, the referent of "the boss man" in 24a would not have been less salient if the anaphor in 24b were put in subject position.  

Therefore, a connection between Parallelism and Reference Form cannot be made via a global concept like salience. However, the account I presented above shows how Parallelism can influence how readers represent parallel referents during anaphor resolution: Since parallel referents are probabilistically more likely to be the referents, their representations become partially activated when the anaphor position is identified. This momentary and partial activation facilitates the comprehension of the referring form.
Writers know that parallelism facilitates comprehension, and therefore they are able to use less-specified forms of reference for parallel referents. In this way, parallelism effects on reference form can be explained in terms of general patterns in discourse structure, and not an idiosyncratic function that says "Use a pronoun to refer to something in the same position, otherwise use a fuller form".

2.4.4. Overall picture of reference form

The data in this chapter provide the first pieces of evidence for my hypothesis. For three factors, and in three different languages, I found striking parallels. Each factor was associated with two things: a) an increased use of less-specified forms (Reference Form), and b) an increased probability of subsequent reference to the same referents (Reference Continuation). This pattern of results is depicted in Figure 9, following the schema from chapter 1.

Figure 9: The double association for Recency, Subjecthood, and Parallelism

For each of these three factors, I have speculated on different motivations for why there is an increased probability of subsequent reference. For Subjecthood, there is evidence that the pragmatic function of subject position makes it specialized for highly accessible referents. For Recency, this pattern falls out of the more general tendency to
CHAPTER 2: CROSS-LINGUISTIC EVIDENCE

talk about things for extended periods of time. For Parallelism, discourse referents may tend to play the same semantic and discourse roles across utterances, which results in subsequent references in the same grammatical positions. In all cases, however, the fundamental generalization is that speakers aim to be coherent. This general goal underlies all observed discourse patterns.

The fact that all these patterns exist has strong implications for language comprehension. As H. Clark (1996) has argued, one of the tasks that discourse participants need to accomplish is the coordination of the shared information in the discourse. At one level, this means that discourse participants need to coordinate their representations of common information in the discourse, including the relative "salience", or activation of each representation. How can they do this?

The double association depicted in Figure 9 suggests a mechanism for this coordination. During language comprehension the reader or listener is trying to construct a mental model that approximates that of the speaker or writer. Thus, comprehenders need to find out what elements are activated in the mind of the writer, or in other words, what elements the writer is intending to talk about. Clues to this activation are present in the text, as measured for example by Recency or Subjecthood. Referents with these properties are the ones likely to be mentioned again, and therefore should be represented with high activation. Parallelism effects are smaller, and only become relevant when the reader encounters the anaphor. But Parallelism also helps the reader interpret the anaphor in the way the writer intended, by partially activating parallel referents, the types of referents writers tend to refer to in that situation.
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The higher the activation of a referent representation, the easier it will be for the reader to access it as the referent of an anaphor. Thus, comprehension will be facilitated. When comprehension is facilitated, as I argued in chapter 1, the speaker/ writer has the option of using less specified forms of reference, which have the added benefit of making communication more efficient for all discourse participants.

The proposal, at this point, is necessarily incomplete. There are multiple questions about the representations involved. In particular, how do the speaker's representations relate to the listener's representations? How do referents become activated? These questions will be addressed in more detail in chapter 5.

The main conclusion so far is this: text analyses have shown a similarity between the referents of subjects, recently mentioned NPs, and parallel NPs. In all cases, there is a double association with Reference Form and Reference Continuation. Furthermore, this pattern was replicated across three different languages, with three different systems of reference. In the following chapters, I will present further evidence for Subjecthood, as well as evidence that this double association extends to the factors Focus and Goal Status.
Chapter 3

Topic, Focus, and reference form

In this chapter I will investigate the ways in which the categories of "topic" and "focus" affect choices in reference form. These categories of information structure deserve special attention because they are invoked to explain many phenomena, yet are notoriously difficult to define. Furthermore, an inspection of past research reveals a discrepancy between linguistic analyses of information structure and psycholinguistic studies on reference: while linguists have treated "topic" and "focus" as opposing categories, psycholinguistic experiments suggest that comprehenders represent the referents of both topic and focus in similar ways, such that both are more activated than other referents in the discourse. The studies in this chapter will address this discrepancy,
and propose an explanation for why the categories of topic and focus have similar effects on language processing.

First I will describe a rating experiment that directly compared grammatical subjects with the focus of clefts, two constructions that have been associated with "topic" and "focus", respectively. I will demonstrate that both categories make their referents more salient, such that it is more natural to use a pronoun for subsequent reference. I will then describe a corpus analysis that investigated the similarity between these categories, and show that the referents of both subjects and the focus of clefts are more likely than other entities to be mentioned in the following discourse. This finding will corroborate the results from chapter 2, which showed that grammatical subjects are doubly associated with Reference Form and Reference Continuation. The findings from this chapter will also show that the same characteristics apply to the foci of clefts, thus providing evidence of this double association for two of the factors presented in chapter 1: Subjecthood and Focus.

3.1. Topic and Focus: similar or different?

To investigate the categories of "topic" and "focus", I will look at grammatical subjects and the foci of clefts, as instances of these categories. "Topic" and "focus" are particularly worth comparing, because they have traditionally been contrasted in the linguistic literature. Although the category "topic" lacks a clear-cut definition, it is often thought of as the "given" portion of an utterance (Gundel, 1974; Chafe, 1976; Tomlin et al., 1997), and is often contrasted with the focus (e.g., Sgall et al., 1986; Vallduví, 1993; see de Swart and de Hoop, 1995, for an overview)
In contrast to the topic, the focus traditionally refers to the new, informative part of the utterance. One prototypical example of focus occurs with cleft constructions. Clefts are generally assumed to exhibit a clear differentiation between what is new, the "focus", and what is given or presupposed (e.g., Chomsky, 1970). Examples are given in 1.

(1) a. What I found on the desk was a three-volume series on starfish.
   |____|                     |___|
   given/ presupposition    focus

   b. It was the book on mollusks that I found in the drawer.
   |___|                     |___|
   focus                     given/ presupposition

In addition, the focus of clefts is often contrasted with more topical constructions, for example in Givón's (1983a) proposed scale of "topicality", presented in chapter 1. In this scale, the focus of clefts is in the second lowest category on the scale, reflecting the fact that the element in this position is usually new or contrastive, and usually expressed with a full description or name. For a review of focus see Tomlin et al. (1997) or Vallduví (1993); see also the discussion in chapter 1.

At the same time, research has suggested that subjects and foci may have similar effects during language processing, such that the referents of both are more salient than other referents. First, there is a wealth of evidence that subject-referents are more salient than other referents in non-clefted utterances. This generalization is supported by the text
CHAPTER 3: TOPIC, FOCUS, AND REFERENCE FORM

analysis in chapter 2, which showed an effect of Subjecthood in English, Spanish, and Mapudungun. This result is also consistent with the findings of past research (e.g., Gordon et al., 1993; see chapter 1). Second, there is growing evidence that the focus-referent is more salient than other referents in a clefted utterance. As discussed in chapter 1, Almor's (1995) experiments showed in sentences like "What the bird ate was the fruit", the referent of the focus ("the fruit") was more accessible than the nonfocus ("the bird"). Almor's results are consistent with Just and Carpenter's (1977) findings and Sidner's (1983) discussion of the focus of clefts.

Thus, there is a discrepancy between linguistic work on information structure and psycholinguistic experiments. The former treats topics and foci as different, the latter suggests they may be similar. One reason for this discrepancy may be that linguistic studies of clefts have generally been concerned with the discourse conditions necessary for the cleft construction (e.g., Prince, 1978), or the discourse properties of the referents of subjects (e.g., Prince, 1992). In contrast, psycholinguistic studies have investigated the effect of grammatical function and cleft construction on the cognitive status of the referents and how this affects subsequent references (e.g., Almor, 1995; Gordon et al., 1993).

The studies in this chapter investigated the hypothesis that the grammatical subject and the focus of clefts are similar, in the sense that they both increase the accessibility of their referents. This comparison is important to make, for two reasons. First, psycholinguistic research has looked at either subjects (e.g., Gordon et al., 1993) or the focus of clefts (e.g., Almor, 1995), but not both. Second, while Almor's findings suggest that the foci of clefts are more accessible than nonfoci, his study did not
explicitly investigate reference form. In the first part of this chapter, I will report on a discourse rating study that demonstrates a parallel between the factors Subjecthood and Focus.

3.2. Experiment: Topic and Focus

The study of categories like "topic" and "focus" is only beneficial to the extent that these categories are well defined. Although sentential topics are not always the same as grammatical subjects, they have often been associated with this role, especially when they are in sentence-initial position (Lambrecht, 1994:131; Reinhart, 1982). For this reason, I will use the grammatical subject in this study as an operationalization of sentential topic. To avoid confusion, I will use the term "grammatical subject" during the discussion of this experiment. Similarly, I will operationalize the category "focus" as the focus of cleft-like constructions such as "the one she saw was Ann". Although this is not strictly a wh-cleft, it has been called a "cleft with a lexical head" (Prince, 1978), and the term "pseudo-cleft" has been used for both this construction (Chafe, 1976) and wh-clefts (Akmajian 1970). For the purposes of this study, I will categorize this construction with wh-clefts.

3.2.1. Methods

3.2.1.1. Procedure

The method for this experiment was a rating questionnaire that elicited off-line judgments about naturalness. Participants were asked to read short paragraphs and rate them for naturalness on a 7-point scale. Each item was a three-sentence story. The first

20 The instructions to the participants were these:
sentence set the context, but didn't mention any character by name. The second sentence introduced two characters by first name, either with or without a cleft construction. The third sentence started with an anaphoric reference to one of the characters from the second sentence, either as a pronoun or a name. A sample stimulus set is shown in Figure 1.

**Figure 1: Sample stimuli for the Topic/ Focus experiment**

A. Without cleft

i. The guests were nervously standing around in the living room, trying to decide which person to talk to.

ii. Ann decided to say hi to Emily first.

iii. Emily/She looked like the friendliest person in the group.

iii’. Ann/She hated to be in a room full of people where no-one was talking.

B. With cleft

i. The guests were nervously standing around in the living room, trying to decide which person to talk to.

ii. The one Ann decided to say hi to first was Emily.

iii. Emily/She looked like the friendliest person in the group.

iii’. Ann/She hated to be in a room full of people where no-one was talking.

There were 12 items, which were combined with 10 fillers. The fillers also had three sentences, but followed a different structure from the stimulus items. The stimuli and fillers were combined in three different orders for each list, to avoid ordering effects.

Thus, the experiment followed a (2x2x2) design, where the factors were 1) focus construction (yes vs. no); 2) 3rd-sentence continuation (1st mention vs. 2nd mention),

Please read the following paragraphs. Some of them sound better than others. Rate each paragraph on how natural it sounds. If it sounds like something you'd say easily, circle 7. If it sounds like something really unnatural, something that you'd never say and you wouldn't expect anyone else to say
3) type of reference for 3rd-sentence subject (noun vs. pronoun). There were 8 versions of each item, which were presented in a factorial design. That is, all items appeared an equal number of times in each condition, but only once for a given participant. Half the participants saw stimuli with "the one..." constructions, and half saw stimuli with no focus construction.

Based on the findings of Gordon et al. (1993) and others, I expected that for the non-focused stimuli, the pronominal versions would be rated higher when the referent was the 1st mentioned character of the second sentence (the subject-referent), but not when the referent was the 2nd mentioned character. Given the findings of Almor (1996), I expected the opposite pattern for the focused stimuli, where I expected the pronominal versions to be rated higher for the 2nd mentioned entity (the focus-referent).

3.2.1.2. Participants

144 participants rated 12 stimuli and 10 fillers in exchange for one candy bar. Time of participation was approximately 10 minutes.

3.2.2. Results

Some participants were excluded from the analysis. One participant was excluded because he was not a native speaker of English, and one was excluded because he was a native speaker of South African English, not American English. "Native speaker" was defined as having begun to learn English by age 5. Two participants were excluded because they rated all stimuli items equally, and four random participants were excluded.
in order to make the cells even. The total number of participants included in the analysis was 136.

The ratings for each participant were first normalized to eliminate any variation in the baseline ratings for each subject. That is, some participants tended to rate the sentences higher overall than others. The noise resulting from this variation was reduced by taking advantage of the fact that all participants saw the exact same set of filler stimuli. Each individual's average score for all the filler stimuli was subtracted from the average filler score for all the participants, and this normalization score was then added to each stimulus score for that individual. The normalized scores were then submitted to a three-way ANOVA analysis. When a participant skipped an item for some reason, the average score for that person's stimuli items was substituted.

The results of the ANOVA showed a main effect for focus construction (F1 (1,134) =5.469, p< .03; F2(1,11)=38.638, p<.001) and a main effect for 3rd-sentence continuation (F1(1,134)=8.996, p< 0.005; F2(1,11)=4.736; p<.06). The crucial result, however, was the three-way interaction among focus construction, pronominalization, and 3rd-sentence continuation, which was significant by subjects (F1(1,134)=6.690, p<.02). The interaction did not quite reach significance by items (F2(1,11)=4.047, p<.07), but the small number of items (12) suggests this is due to low power. No other factors were significant (p's >.1). The average ratings are shown in Table 1.

<table>
<thead>
<tr>
<th>Table 1. Normalized average scores for each category in the Topic/Focus experiment. The higher rating is underlined.</th>
</tr>
</thead>
<tbody>
<tr>
<td>WITHOUT-CLEFT</td>
</tr>
<tr>
<td>pronoun name</td>
</tr>
</tbody>
</table>
The average ratings for each category showed that when the second sentence contained an explicit focus construction, pronouns were rated higher for referring to the 2nd mentioned character, which was the focused entity, while names were preferred for referring to the nonfocused entity. Examples are shown in Figure 2.

**Figure 2: Examples of preferences in Topic/Focus experiment in the With-Cleft condition**

**A. NP1 referent (nonfocus-referent)**

**PRONOUN VERSION**
The guests were nervously standing around in the living room, trying to decide which person to talk to. The one Ann decided to say hi to first was Emily. She hated to be in a room full of people where no-one was talking.

**NAME VERSION**
The guests were nervously standing around in the living room, trying to decide which person to talk to. The one Ann decided to say hi to first was Emily. Ann hated to be in a room full of people where no-one was talking.

**B. NP2 referent (focus-referent)**

**PRONOUN VERSION**
The guests were nervously standing around in the living room, trying to decide which person to talk to. The one Ann decided to say hi to first was Emily. She looked like the friendliest person in the group.

**NAME VERSION**
The guests were nervously standing around in the living room, trying to decide which person to talk to. The one Ann decided to say hi to first was Emily. Emily looked like the friendliest person in the group.

In contrast, when the second sentence did not contain the focus construction, the preferences were reversed: pronominal stimuli were rated higher for the 1st mentioned
entity (the topic), and the stimuli with names were rated higher for the 2nd mentioned entity. Examples are shown in Figure 3.

Figure 3: Examples of preferences in Topic/Focus experiment in the Without-Cleft condition

A. NP1 referent (subject-referent)

<table>
<thead>
<tr>
<th>PRONOUN VERSION</th>
<th>NAME VERSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>The guests were nervously standing around in the living room, trying to decide which person to talk to. Ann decided to say hi to Emily first. She hated to be in a room full of people where no-one was talking.</td>
<td>The guests were nervously standing around in the living room, trying to decide which person to talk to. Ann decided to say hi to Emily first. Ann hated to be in a room full of people where no-one was talking.</td>
</tr>
</tbody>
</table>

B. NP2 referent (nonsubject-referent)

<table>
<thead>
<tr>
<th>PRONOUN VERSION</th>
<th>NAME VERSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>The guests were nervously standing around in the living room, trying to decide which person to talk to. Ann decided to say hi to Emily first. She looked like the friendliest person in the group.</td>
<td>The guests were nervously standing around in the living room, trying to decide which person to talk to. Ann decided to say hi to Emily first. Emily looked like the friendliest person in the group.</td>
</tr>
</tbody>
</table>

The results for this experiment show that readers preferred stimuli that used pronouns for both topical referents (subject-referents) and focused referents (the focus of "the one" constructions), but they preferred stimuli that used names for references to other entities. These results corroborated the findings of Almor (1996) and Gordon et al. (1993). If these preferences for reference form are assumed to reflect the mental representations of the referents, they suggest that the referents of both subjects and the focus of clefts are more activated than other arguments. Thus, despite the traditional
opposition between topic and focus, the two categories may be more similar to each other than previously thought.

At the same time, the results of this study raise the question of why it should be that both constructions increase the accessibility of their referents. It is this question that the following corpus analysis aimed to answer.

3.3. Corpus Analysis: Subject vs. Focus

The results of the Subject/Focus questionnaire suggested that both subjects and the focus of clefts lead their referents to be more prominently represented than other referents in an utterance. What is it about these two constructions that does this? A common explanation for these two facts cannot depend on either properties of topics or properties of foci. An explanation in terms of "aboutness" or "givenness" would only account for the prominence of subjects, and an explanation in terms of the prominence of new information would only account for the foci of clefts.

The hypothesis that I investigated with this corpus analysis was that both subjects and the focus of clefts signal that there is a high likelihood that their referents will be mentioned again in the subsequent discourse. That is, both constructions may be pointers to the topic of the following utterance. In a "normal", nonclefted utterance, the best bet for the topic of the following utterance is the topic of the current one, since speakers usually talk about the same thing for extended periods of time. On the other hand, a clefted utterance is a marked construction that the speaker may employ to indicate that the topic will shift to the referent of the focus. This hypothesis is consistent with Sgall et
al.’s proposal (1986:58) that the focus of one utterance is related to the topic of the next. If this is the case, I expected that after nonclefted utterances, speakers would refer to the referent of the subject more often than to other elements in the utterance, but that after clefted utterances, speakers would refer more often to the focus of the cleft.

To investigate this hypothesis I conducted a corpus analysis, using the Aligned-Hansard Corpus from 1986. The Aligned-Hansard corpus is a collection of transcripts from the Canadian Parliament, so the discourse it represents is natural and communicative, albeit formal. The discourse is spoken, although one might imagine that the speakers may have had prepared notes at their disposal. However, the transcripts are doubtlessly edited, as they contain no disfluencies or partial sentences, and some segments may be translated from French.

Using the Aligned-Hansard corpus, I compared nonclefted utterances, as in 2a, with object-clefted wh-clefts, as in 2b.

(2)  
   a. We must have legislation and charters which will allow people to come before the courts with their concerns and grievances with some effect and justice.
   b. What we called for in the committee were five different principles to be enshrined in this particular piece of legislation.

My hypothesis was that speakers would refer to the subject-referents and focus-referents more frequently than to other referents from the preceding utterance.

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22 This proposal is undoubtedly influenced by a similar comment by Weil, an earlier scholar in the Prague school tradition (1844, 1887, as cited by Tomlin et al., 1997).
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3.3.1. Method

I analyzed the 1986 Aligned-Hansard corpus by extracting two types of utterances: wh-clefts (also sometimes called "pseudo-clefts") and nonclefted sentences. To find wh-clefts I searched for "What" (with a capital W) that was not followed by a question-mark. I only considered those utterances that clefted the object or object-of-PP, because I was interested in the comparison between the embedded subject and the focused NP. I also discarded cases where there was no following utterance, or where the following utterance belonged to another speaker. This method yielded 146 total examples of wh-clefts. The comparison set of data was a random sample of non-clefted sentences, which I assembled by opening each file from 1986, scrolling down three pages, and taking the utterance where my cursor landed. In this set I excluded questions, sentences with dummy subjects or nonreferential subjects (like the generic "one"), and cases where there was no following sentence by the same speaker. This method resulted in 263 examples.

For each sentence in my sample, S1, I identified the next "independent" utterance, S2. I defined "independent utterance" as a clause which is finite, not a sentential complement of the matrix clause, and not a relative clause. I then coded S2 for the first reference to something that had been referred to in S1 (if any). The categories I found in this analysis are presented in Table 2.
Table 2. Identity (in S1) of the referent of the first referring NP in S2

**Nonclefted Sentences (S1)**

1. Subject
   - matrix clause Subject
2. Part of Subject
   - part of matrix clause subject (e.g., "I" when previous subject was "my Party")
3. Related to Subject
   - something related to the matrix clause subject, such as another member of a set
4. Object/Obj of PP
   - matrix clause object or object of PP
5. Part of Object
   - part of matrix clause object
6. Subordinate Subject
   - subject of a subordinate clause
7. Subordinate Other
   - another part of the subordinate clause
8. Whole
   - the whole sentence, or an entire non-NP constituent within the sentence (such as an entire PP, VP, or subordinate S).
9. None
   - there is no referent in common with S2

**Clefted Sentences (S1)**

1. Embedded Subject
   - subject of embedded clause (e.g., What we need is...)
2. Related to Embedded Subj.
   - Related to subject of embedded clause
3. Focused NP
   - NP in the focus of the Wh-cleft
4. Part of Focused NP
   - part of the NP in the focus of the Wh-cleft
5. Related to Focused NP
   - related to the NP in the focus of the Wh-cleft
6. Embedded Object
   - object of embedded clause
7. Unclear
8. Whole
   - the whole sentence, or an entire non-NP constituent within the sentence (such as an entire PP, VP, or subordinate S).
9. None
   - there is no referent in common with S2

As mentioned above, I looked at S2 to find the first NP that had the same referent as any of the NPs in S1, and if so, which one. The hypothesis behind this methodology was that
certain categories (namely, subjects and focused NPs) may be indicators that their referents are likely to be mentioned again in the following discourse. If more than one referent from S1 was mentioned in S2, only the first one was analyzed. Once a referent was identified, I noted how it had been referred to in the first utterance (S1) -- that is, what the grammatical function of the referring expression was in S1. The following examples show how particular cases were coded.

### Table 3. Examples from Corpus Analysis

<table>
<thead>
<tr>
<th>first referent</th>
<th>example</th>
</tr>
</thead>
</table>
| subj           | S1: The charter is giving individuals a new opportunity to seek redress when their rights are infringed upon.  
S2: It also imposes on all an obligation to be tolerant of the rights of others. |
| subj           | S1: Actually, the countries of South-East Asia have recently penetrated the fur market.         
S2: Are we going to let them have a free rein?                                                  |
| obj of PP      | S1: I have talked to other whites who have worked in the South African police force and through them I have learned something about the enormously tragic environment of the prison system in South Africa and the harshness of the treatment to which many . . . |
| focus          | S1: What the Government finally got was a deck hand whose name is Mr. Lander.                  
S2: He has been busying himself rearranging the deck chairs on the deck of the Titanic.       |
| focus          | S1: What we have now is a breath of fresh air,                                                  
S2: and the people of Canada welcome it.                                                        |

The codings for each utterance were tabulated in terms of four categories. For nonclefted utterances, these categories were: 1) Subject, 2) Object, 3) Other (references
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to other referents or the whole utterance in S1), and 4) No referent from S1. For clefted
utterances, the categories were: 1) Embedded Subject, 2) Focus, 3) Other, and 4) No
referent from S1 or Unclear. The categories Subject, Embedded Subject, Object, and
Focus included cases termed "part of Subject/ Focus/ etc." or "related to Subject/ Focus/
etc.". Examples of these categories are provided in Table (4).
Table 4. Examples of "Part of" and "Related to" codings.

(1) Part of Subject
   a. The unfortunate aspect of the dilemma facing our producers is that the problem is not of their own doing. Our farmers are the innocent victims of the costly madness of subsidies which has gripped the European Economic Community and,

   b. From time to time my Party speaks about the need to democratize these centres of power and put them in the hands of ordinary Canadians. I suggest that those are some constructive and positive means by which we could seek to do that.

(2) Part of Object
   I would like to quote the words of the Hon. Member, the Liberal health critic. He said: "Higher prices might be justified if it led to more drug research in Canada. ...."

(3) Part of Focus
   What the Hon. Member has not answered with respect to Challenge '86 '86, has not refuted, is the allegation, the observation, that there has been a significant shifting of funds from the non-profit service and municipal sector to private enterprise. I have no problem with funding training opportunities in private enterprise.

(4) Related to Embedded Subject
   What the Government is entering into now is a bilateral negotiation by appointing trade envoys. The U.S. administration said to Canada that . . .

(5) Related to Focus
   What we are really talking about is a farm crisis. Just the other day the Committee on Agriculture met with Dr. Lillian Walker and Dr. James Walker.

One might wonder about the rationale for categorizing cases where the speaker makes reference to a part of an argument or something related to an argument. The idea behind this choice is that this corpus analysis is measuring discourse patterns -- that is, how often speakers continue talking about the referents of subjects, and how often
speakers continue talking about the referents of the focus of clefts. Whatever the
speaker's choice for continuing a discourse, the listener will interpret the following
utterances in terms of what came before, looking for coherence in the discourse. In some
cases coherence is established by means of reference to something previously mentioned,
in some cases comprehenders engage in what Clark and Haviland (1977) call bridging
inferences. If the speaker mentions something that represents only a subpart of the
referent of an NP in the previous sentence, or something that relates to a referent in the
first sentence, the listener will need to access the representation of that referent in order to
establish a connection (Loewenstein et al., 1998). This idea is also reflected in claims by
Almor (1995:33) and Prince (1981:251) that suggest that reference to one member of a
set causes the listener to access the other members of the set as well. Therefore, to
understand how discourses are frequently continued, it is necessary to include cases
where an argument is the topic of the discourse, even if it is not explicitly or fully
mentioned.

3.3.2. Results

I tabulated the number of continuations in each of the categories mentioned
above. For nonclefted utterances, I calculated the percentage of continuations with
subject-referents, object-referents, other-referents, or no referents from S1. For clefted
utterances, I calculated the percentage of continuations with embedded-subject-referents,
focus-referents, other-referents, or no referents from S1. I compared clefted and
nonclefted utterances with each other, comparing the categories subject-referent with
embedded-subject referent, and the categories object-referent with focus-referent. A chi-
squared analysis of this distribution showed that these four categories behaved differently
with respect to nonclefs and clefts ($\chi^2(3)=82, p<.001$).

The Reference Continuation patterns for Clefts and Nonclefs are presented in
Figure 4, illustrating that the most frequent type of continuation for nonclefted utterances
is with reference to the subject-referent, but for clefted utterances it is with reference to
the focus-referent. The percentages of each bar do not add up to 100%, because they
were calculated out of all references in each category. However, here I am only showing
references to the subject or object in nonclefted utterances or the embedded subject or
focus in clefted utterances.

This figure shows that wh-clefted and nonclefted utterances are associated with quite
different patterns in discourse. For nonclefted utterances, the subject-referent (usually the
first-mentioned referent) has a much higher probability of being mentioned in the following clause than any other referent, whereas for clefted utterances, it is the focus-referent (usually not the first-mentioned referent) that has the highest probability of being mentioned in the following clause. The corpus analysis thus parallels the experiment in showing a similarity between the categories subject and focus.

3.4. Discussion

There were two main findings in this chapter. First, the rating experiment showed that readers preferred passages that used pronouns to refer to the subject-referents of nonclefted sentences and the focus-referents of cleft or cleft-like constructions. Second, the corpus analysis showed that the referents of both subjects and foci were the entities most likely to be referred to again in the following sentence. These results indicate that the factors Subjecthood and Focus are both associated with two things: a) Reference Form, and b) Reference Continuation. This association, depicted in Figure 5, follows the same pattern that emerged in the studies in chapter 2.

**Figure 5: The double association for Subjecthood and Focus**

These results raise a number of questions. Why are both factors associated with Reference Form? I conducted the corpus analysis to try to understand why pronouns were considered more natural for reference to both subject-referents and focus-referents.
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The corpus analysis showed that both were also associated with Reference Continuation. But why do speakers refer more often to the referents of subjects and foci? And why does Reference Continuation consistently pattern with Reference Form? I will consider each of these questions separately.

3.4.1. The relationship of Subjecthood and Focus with Reference Continuation

First I will address the question of why speakers refer more often to subject-referents and focus-referents. That is, why do the patterns found in the corpus analysis exist? I argue that they arise because language use is a joint activity (H. Clark, 1996:23). There are two properties of joint activities that drive patterns of reference: 1) joint activities are goal-driven, and 2) joint activities require the coordination of common ground. These properties lead to the following four generalizations:

1. For any given discourse participant, some referent representations are highly activated.
2. The highly activated referents are the ones that participant will refer to more.
3. The highly activated referents are the ones that participant will refer to using subjects and foci.
4. Other discourse participants can use the speaker's choice of words as an indication of the speaker's representation of the discourse referents, and construct their own representations to match the speaker's.

I will address each of these claims in turn, and discuss why they result from the generalization that language use is a joint activity.
3.4.1.1. *For any given discourse participant, some referent representations are highly activated.*

Joint activities are goal-driven (H. Clark, 1996). Because of this, they are organized around certain themes, and certain referents will play more important roles than others. For example, in a discussion about how to make Turkey Tetrazzini, "turkey" is more important than "pot". In a discussion about painting, "paint" is more important than "water". In any given joint activity, there may be many goals, some private and some public. Crucially, however, there is one principal goal, which H. Clark calls the "domain goal". This is the publicly established goal that all participants in the activity are nominally working towards (H. Clark, 1996:34).

What does this mean in terms of the speaker's mental representation? Speakers do not merely interact with the world; they also maintain mental representations of the objects and events in the current situation, both those that are physically present and those that are described linguistically. This level of representation is sometimes called a "mental model", or "situation model" (H. Clark, 1996:53). The cognitive representations of discourse entities may be understood via the mechanism of activation, introduced in chapter 1. Thus, speakers come to a discourse situation with a conceptual representation of their goals and intentions, in which some referents are more highly activated than others. As the discourse proceeds, the activation of referents will change, as the speaker's goals and intentions change.

3.4.1.2. *The highly activated referents are the ones that are frequently referred to.*

The goal-driven nature of language use has a further consequence: the conversation will revolve around the referents that are important to the goals of the
CHAPTER 3: TOPIC, FOCUS, AND REFERENCE FORM

speaker. Since those referents are also the ones that are highly activated for the speaker, this means that speakers will refer more to the referents that are highly activated for them. Thus, in a discussion about how to make Turkey Tetrazzini, "turkey" will be mentioned more often than "pot", and in a discussion about painting, "paint" will be mentioned more often than "water".

Consider the following illustration of how activation and frequency of reference relate to each other. Imagine a couple, Jane and Mark, who are planning a dinner party. Jane says to Mark, "Marsha called. She can't come tonight, because she has the flu." As Jane initiates the conversation, she has a set of goals and intentions. These goals and the referents associated with them are present in her mind. That is, they are activated. But she may have many things in her mental representation, and not all are equally activated. She may also be thinking about vacuuming the house, or the implications of Marsha not coming (for example, perhaps Marsha was supposed to give another guest a ride). The representations of the vacuum and the other guest are also active, but less so than her representation of Marsha. As Jane begins the conversation, she intends to talk about Marsha, so her representation of Marsha is highly activated. This is also the referent she will most likely repeatedly refer to during the conversation that ensues.

Thus, from Jane's perspective we have the following scenario. Certain referents are more activated in her mind, because they are important to her goals and intentions. Because these referents are important to the situation, she will tend to refer to them more frequently than to less important referents.
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3.4.1.3. People use subjects and foci for referents that are highly activated in their models

The fact that language is a joint activity leads to a third generalization about language use: the highly-activated referents in the speaker's mind are the ones the speaker will refer to in subject or focus position. The reason for this lies in the most basic property of joint activities: they necessarily take place between 2 or more people, who need to coordinate with each other at multiple levels. In linguistic exchanges, participants need to coordinate to establish reference (Clark and Marshall, 1981; Clark and Wilkes-Gibbs, 1986), negotiate the meaning of their utterances (H. Clark, 1994, Part IV), and establish other aspects of the common ground (H. Clark, 1996). One of the things they need to coordinate is the discourse status of each referent.

In the preceding discussion, I focused on the speaker, Jane, and the representations she has as a result of her goals and intentions as she starts a conversation. But this picture ignores what is going on in the mind of Mark, her interlocutor. Mark does not have the same representations as Jane, but in order for communication to be successful, the two of them must believe that their mental representations are fairly similar (see H. Clark, 1996:49). For their representations to be similar, they also must coordinate the cognitive status of each referent. How can they do this?

Linguistic expressions offer one tool for Jane and Mark to coordinate the cognitive status of discourse referents. As many researchers have noted, linguistic expressions are pragmatically specialized (see, among others, Du Bois, 1985, 1987; Prince, 1992; Ward and Birner 1995, 1996). Speakers choose particular forms and expressions according to the discourse role of the information they are expressing. Two
types of such pragmatically specialized expressions are grammatical functions and cleft constructions.

Grammatical functions have received much attention, both in terms of their pragmatic specialization and their psychological effect on discourse comprehension. In particular, subject position is associated with referents that are topical (e.g., Reinhart, 1982), given (e.g., Du Bois, 1987; Prince, 1992), and psychologically salient (e.g., Gordon et al., 1993). The focus of cleft-like constructions has received less attention, but has also been noted as an informationally specialized position (e.g., Prince, 1978), that is also psychologically salient (e.g., Almor, 1995; Sidner, 1983).

Although subjects and foci play different pragmatic roles, my results demonstrate that their roles have some properties in common. The results of the elicitation experiment are consistent with previous claims that both subjects and foci make their referents more salient, since pronoun usage has generally been linked with the salience of referents. The results of the corpus analysis further suggest that the referents of subjects and foci are highly likely to be referred to again. Because subjects and foci share this property, they are both useful mechanisms for the discourse participants to coordinate their mental representations.

To illustrate this coordination, let's return to the example above. Jane knows which referents are central to her goals and intentions, and therefore which referents are highly activated for her. Mark has his own representations, but he doesn't know what Jane is thinking until she speaks. When Jane says "Marsha called," Mark knows that "Marsha" is the subject of the sentence, and therefore is highly activated for Jane. In order to cooperatively participate in the conversation, Mark also instantiates a highly
active representation of Marsha in his mind. In this way, Jane and Mark have achieved a
certain level of coordination in their conversation.

Just as there are two participants in this fictitious interaction, there are also two
sides to their coordination. First, let's consider the processes for the speaker. The results
of the corpus analysis revealed that speakers tend to refer again to the referents of
subjects and clefts. As I said earlier, speakers tend to refer to some referents more often
because they are important to their goals and intentions. This means that speakers use
subjects and clefts more often to refer to referents that are important, and therefore highly
activated.

So why do speakers choose subjects and foci to refer to expressions that are
activated? This issue has two underlying questions. The first question is a diachronic
one: why did the grammatical function and the cleft construction evolve to have the
functions they do? I can merely speculate on the answer to this question. The salience of
subjects may derive from the fact that they are often used to indicate the agent role of a
proposition. If agents are salient, salience could have become grammaticized into the
grammatical subject.

The second question is one of on-line processes of language production. Why do
speakers choose subject and focus position on any given occasion? Many factors are
likely to influence this choice, but two are particularly notable. First, grammatical
constraints in a language restrict the range of options available for expressing a particular
idea. For example, there is a limited number of ways to express the idea "Marsha called
(me)," which might include "I was called by Marsha," or "That was Marsha on the
phone." Second, the speaker is influenced by the pragmatic function of the available
expressions. One reason for this may be that their pragmatic specialization may result from the cognitive processes of language production. Constraints on planning and production may lead speakers to produce highly activated referents early in an utterance (Arnold et al., 1998; Tomlin et al., 1997), or in a prominent place like focus position. A second reason that the speaker places important referents in subject or focus position may be as a signal to the listener that those referents should have highly activated representations (Clark and Haviland, 1977). In either case, the result is that speakers use subject and focus positions more often for referents that are highly activated in their mental representations.

3.4.1.4. Listeners are sensitive to the pragmatic role of subjects and foci

The other side to coordination during discourse concerns the listener. How does the listener discover which referents are more activated for the speaker? One way is by attending to the speaker's use of expressions like subjects and foci: once a referent has been mentioned in these positions, the listener knows that it should be represented with high activation. But why do subjects and foci play this role?

This question can be answered at one level in terms of topicality. Topical referents are those that the discourse is about (Reinhart, 1982). From the perspective of one discourse participant, these are the referents most central to his or her goals and intentions. Subjects are often used for highly topical referents, those that the discourse is about. While foci are not topical like subjects are, they might signal a topic shift, such that the focus will be the topic of the following utterance (Sgall et al., 1986:58). But this story raises another question: how do these constructions come to be associated with discourse patterns like this?
The answer, I propose, is through an individual's experience with the language. For example, Jane's experience with English leads her to realize that at any given point in a discourse, some referents are more central than others. She realizes this because some referents get referred to more often than others. The reference may be indirect, as with the categories "part of" and "related to" in the corpus analysis.23 Thus, her understanding of "topical" is directly related to her understanding of how often an entity is referred to during a discourse segment. This conception of "topical", similar to Givón's topicality continuum (Givón, 1983a), allows referents to be topical to varying degrees. It also treats topicality as a dynamic property: the relative importance of discourse referents varies over time. Furthermore, referent activation varies as discourse participants negotiate the topic of the discourse, the perspective they take on it, and the direction the discourse is going. This dynamic nature of language use adds several degrees of complexity to the discussion of these issues, so I have simplified the example above by considering only a single point in time at the beginning of a conversation.

With this conception of topicality, I propose that people learn an association between subjects, foci, and the way their referents are used in discourse. One thing they have in common is that both subject- and focus-referents are very likely to be mentioned in the following discourse. Each time a person hears a subject or focus used, this constitutes an exemplar of that category. Through a lifetime of collecting exemplars of subjects and foci, people develop categories that include the information about how they

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23 The "reference" may also be non-linguistic, such as pointing at something or otherwise bringing it to the attention of the other discourse participants. See §5.3.2.3 for a discussion of this point.
are used in discourse. In other words, people learn that subject-referents and focus-referents are associated with a high degree of topicality in the following discourse.

An important feature of this association is that it is probabilistic. That is, subjects and foci are not always used for referents that will be topical in the following discourse. Thus, it would not be efficient for people to draw a categorical association between these categories and topichood. Instead, the relationship is partial and probabilistic, and the categories for subjects and foci should include this information. Furthermore, my conception of topicality is not the traditional one. Topicality here is an index of the degree to which referents are central to the goals and intentions of the speaker.

I further propose that the regular association of Subjecthood and Focus with Reference Continuation makes the choice of these expressions informative for the listener. This interpretation draws on recent proposals for constraint-based models of language processing. These models suggest that as people gain experience with language, they also gain experience with how words and structures are associated with particular meanings and functions. In discourse processing, this idea can be extended to consider that people also learn through experience to associate structures with particular discourse patterns. This information is stored as a part of the subject and focus categories, and is available for use in novel discourse situations.

This proposal applies to the problem of coordination as follows: From the listener's perspective, once a referent has been mentioned in subject or focus position, there is a relatively high probability that it will be mentioned again. This information is

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24 I am leaving it open whether the process of category construction continues throughout the life of an individual, or whether it slows down or ceases in adulthood. It is possible that once a critical number of examples has been encountered, the category is so robust that further exemplars do little to change it.
co-extensive with knowing that the referent is important to the speaker: if the referent is important to the speaker, it is likely to be mentioned repeatedly during the conversation, and vice versa. Thus, once a referent is mentioned as subject or focus, the listener can infer that it is important to the speaker. With this knowledge, the listener can instantiate a representation of the referent with high activation. In this way, speakers and listeners coordinate the activation of discourse referents.

3.4.1.5. Summary

In sum, I have argued for several generalizations on the basis of language use as a joint activity. Speakers refer more often to things that are important to their goals and intentions, which are the things that are activated in the speaker's representation. They also tend to use pragmatically specialized expressions, like subject and focus, to refer to those things. The regularity of using subjects and foci for highly activated referents is stored in the categories subject and focus. This makes these expressions good tools for the coordination of the cognitive status of referents in the representations of speakers and listeners. In the following section I will address the question of how this influences the choice of reference form for subject-referents and focus-referents.

3.4.2. The relationship of Subjecthood and Focus with Reference Form

The results of the rating experiment raise the question of why readers prefer pronouns for referring to both subjects and foci. This question is relevant to the issue of why speakers use pronouns on some occasions, but fuller forms of reference on others.

In chapter 1, I showed how this question has been addressed by appealing to concepts such as salience or accessibility. In this dissertation I have appealed instead to activation as the mechanism for representing the cognitive status of referents. While
there are many reasons for a referent to become activated in the mind of the speaker, one way is when it is central to the speaker's goals and intentions.

I have also presented the problem of reference as a problem of coordination, following H. Clark and his colleagues (e.g., H. Clark, 1996; Clark and Marshall 1981; Clark and Wilkes-Gibbs, 1986). Subject, focus, and other expressions all provide tools for coordinating the activation of mental representations for each discourse referent. One reason that subjects and foci can function as tools in this way is because the referents associated with these positions have a higher probability of being referred to again than other referents. This probability allows the listener to infer which referents are activated for the speaker, and thereby allows speakers and listeners to coordinate the level of activation for each discourse referent.

An important part of this proposal is that the association of subject- and focus-referents with high activation develops through the association of their categories with frequent subsequent reference, and thus the perception that these referents are topical for the speaker. Therefore, once a referent has been mentioned in subject or focus position, there is a relatively high probability that it will be mentioned again in the following utterance. This property facilitates the processing of a subsequent reference, if it does occur.

There are two reasons that reference processing is facilitated for subject- and focus-referents, both based on the assumption that reference processing involves activating the referent of the anaphor. First, when the anaphor itself is encountered, there is a higher probability that the subject- or focus-referent is the referent of that anaphor. The probabilistic information associated with these categories is relevant at this point in
processing, such that subject- and focus-referents will become partially activated, based on the probability that they are the referent of that anaphor. Thus, if the anaphor does indeed refer to the subject-referent or focus-referent, processing will be facilitated. If it doesn't, anaphor resolution will be inhibited.

Second, the process of activating the referent is easier if the referent is already activated. As I argued above, discourse participants work to coordinate their representations of the discourse entities. The referents of subjects and foci are often the ones that are activated for the speaker, because they are often the ones that are important to the speaker's goals and intentions for the following discourse. The listener expects the speaker to produce a coherent discourse, such that subsequent utterances should relate to each other in some way. Thus, it is advantageous for the listener to construct similar representations of the discourse referents. Although the listener does not know for sure which ones are activated for the speaker, probabilistic information associated with subject and focus categories allows the listener to make good guesses about the speaker's representation. Listeners therefore partially activate subject- and focus-referents even before a subsequent anaphoric reference is encountered.

The ease of accessing subject- and focus-referents has important implications for the speaker's choice of reference form. When comprehension is facilitated, the listener needs less specific information to correctly access the speaker's intended referent. Therefore, less specific forms of reference, like pronouns, will work. Previous research on speech processing has shown that speakers do in fact take advantage of the ability to use less specified forms when comprehension is facilitated. The referents of subjects and
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foci are easier to access, therefore these positions are associated with an increased use of pronouns for subsequent reference.

3.5. Conclusions

3.5.1. Summary

Speakers talk about things because they are trying to communicate a message, and certain referents are more central to that message than others. This results in a consistent pattern of discourse in which speakers refer to certain referents more often than to others. Speakers also use certain structures, like subjects and foci, for those same referents that they tend to refer to again. Thus, the referents of subjects and foci are associated with a high probability of subsequent mention. From the listener's perspective, this high probability makes subsequent references easier to understand. And, where comprehension is facilitated, the speaker can use less specified forms of reference to communicate with the listener.

To illustrate this proposal, let's return to the conversation between Jane and Mark. When Jane initiates the conversation with Mark, she has certain goals and intentions. The referents that are central to Jane's goals will be highly activated in her mind, and the referents that are less central to her goals will be less activated, but still present in her mental representation of the situation. As before, let's assume that Jane has two goals: one is to communicate the contents of her conversation with Marsha, and one is to vacuum the house. At this point, however, Jane knows that these referents are only active for her, and are not part of her common ground with Mark. A partial representation of their situation models is shown in Figure 6. For simplicity I have listed referents using
names and phrases, but in actuality these are meant to be non-linguistic, conceptual referents. Referents with relatively high activation are represented with capital letters.25

Figure 6: Some objects in Jane and Mark's situation model

<table>
<thead>
<tr>
<th>SNAPSHOT 1: IMMEDIATELY PRIOR TO THE CONVERSATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MARSHA need to vaccum</td>
</tr>
<tr>
<td>Common Ground</td>
</tr>
<tr>
<td>MARK</td>
</tr>
<tr>
<td>Some objects in Jane's situation model</td>
</tr>
<tr>
<td>JANE</td>
</tr>
<tr>
<td>MARK</td>
</tr>
<tr>
<td>Common Ground</td>
</tr>
<tr>
<td>chicken in the oven</td>
</tr>
<tr>
<td>...</td>
</tr>
<tr>
<td>Some objects in Mark's situation model</td>
</tr>
</tbody>
</table>

At the beginning of the conversation, Mark also has a certain set of referents activated in his situation model. For example, he may be concerned about a chicken that he has in the oven. When Mark and Jane come in contact with each other, they also begin to keep track of information that is shared between the two of them. That is, they begin to construct a common ground (H. Clark, 1996). At this point, descriptions of Jane's and Mark's situation models become increasingly complex. However, some features of their interaction are supported by my findings. At the start of their conversation, Jane says to Mark "Marsha called." As she says this, this statement becomes a part of their common ground, and draws attention to their common acquaintance, Marsha. At the same time, they both know that Jane has referred to Marsha in subject position. This is one of the cues from which Mark can infer that

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25 The simplified representation of activation in this figure should not be taken to imply any commitment to the relative activation of the discourse referents. That is, activation is likely to be graded, but the binary
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Marsha is likely to play a part in the following discourse, so this referent becomes highly activated for Mark.

Figure 7: Some objects in Jane and Mark’s situation model

| SNAPSHOT II: AFTER JANE UTTERS "MARSHA CALLED." |
|-------------------------------------------------
| Some objects in Jane's situation model | Common Ground | Some objects in Mark's situation model |
| need to vacuum . . . | MARK | chicken in the oven . . . |
| Common Ground | MARSHA | called |
| Common Ground | JANE | MARSHA |
| called |

After Jane has established Marsha as a mutually activated referent, either she or Mark can refer to Marsha with only a pronoun, and expect that the reduced form of reference will be adequate for communication. In this way, the association of Marsha with subject position mediates the status of Marsha in Jane and Mark's common ground.

3.5.2. Theoretical implications of this approach

This account explains how the association of Subjecthood and Focus with Reference Continuation also results in the association of these factors with Reference Form. This account is summarized in Figure 8.

Figure 8: How subject and focus coordinate the cognitive status of a discourse referent for discourse participants

distinction between capital and lowercase fonts only allows for two levels of activation, a simplification sufficient for the present purposes.
I have used activation as a measure of a referent's cognitive status, and therefore the thing that needs to be coordinated. This approach is consistent with past accounts of reference form that relied on the concepts salience or accessibility. In my proposal, highly activated referents are those deemed salient by the discourse participants, and hence more accessible than less activated referents.

At the same time, my proposal contrasts with previous accounts, in the following ways.

First, the activation account does not depend on "salience" as a primitive. The goal of previous accounts has generally been to identify factors that lead a particular referent to be salient or accessible (e.g., Ariel, 1990; Gordon et al., 1993; McDonald and MacWhinney, 1995; Stevenson et al., 1994). My results are wholly consistent with these
studies, because they show that the linguistic positions of subject and focus are associated with salient referents. However, I have gone further: The corpus analysis shows that subjects and foci are also associated with a tendency to refer more often to their referents, which I have argued is an index of how important they are to the discourse. This suggests that salience has its roots in the way people use language: the things people refer to more often are the things represented with greater activation, and are thus viewed as more salient.

By anchoring salience in patterns of languages use, my approach has a second advantage: it does not rely on a rule positing that subjects and foci are salient positions. Previous accounts have treated the salience of subjects and other positions as a characteristic of the positions themselves (e.g., Gordon et al., 1993; McDonald and MacWhinney, 1995; Stevenson et al., 1994). This has been used to explain why pronouns and other less-specified forms of reference can be used, through the stipulation that less-specified forms are used when the referent is more salient. This rule-based approach is also seen in Centering Theory (e.g., Gordon et al., 1993; Grosz et al., 1995), which uses subject position as a categorical marker that one entity is the "backward-looking center", or the most accessible referent. The same claim holds for the salience of sentence and discourse topics (e.g., Ariel, 1990; Gernsbacher, 1990). In contrast, I have suggested that the referents of subjects and foci are more salient than other referents because speakers favor these positions for referents that they are likely to refer to again later.

A third advantage of my account is that it looks to general properties of language use to suggest how subjects and foci mediate the mental representations of the speaker
and listener. My approach builds on two traditions in psycholinguistics. One is H. Clark's (1996) theory of language use as a joint activity, which focuses on the goal-driven, communicative nature of language. The other is the constraint-based models developed by MacDonald, Tanenhaus, and colleagues (e.g., MacDonald et al., 1994; Trueswell and Tanenhaus, 1994; Tanenhaus and Trueswell, 1995), which suggest that people keep track of how language is used, and use their knowledge of usage patterns during language processing. Both of these traditions consider linguistic competence to be the direct result of experience with language in the social and pragmatically situated uses of day-to-day life.

Finally, my account has the advantage of explaining the results of the experiment and the corpus analysis just presented. The rating experiment revealed that subjects and foci are viewed similarly in terms of reference form: readers preferred passages that used pronouns to refer to the referents of both subjects and foci, but preferred names to refer to other referents. The corpus analysis showed that subjects and foci share a second characteristic, a relatively high probability that their referents will be mentioned in the following sentence. The activation account has suggested how these patterns relate to one another. The association of Subjecthood and Focus with Reference Continuation is stored as a part of the categories subject and focus, and this allows discourse participants to use these positions as tools to coordinate the cognitive status of the discourse referents.
Chapter 4

The effects of thematic roles on discourse and referential patterns

In the preceding chapters, I presented information about four factors that influence choices in reference form: Recency, Subjecthood, Focus, and Parallelism. In this chapter, I turn to a fifth factor, the thematic role of referents. Past research has shown that pronoun resolution is influenced by the thematic role that potential referents have played (e.g., Garnham et al., 1996; McDonald and MacWhinney, 1995; Stevenson
et al., 1994). For example, the referent of the pronoun in 1 is more naturally interpreted as the stimulus-referent than the experiencer-referent.26

(1) John amazed Bill because he....

stimulus experiencer

The bias toward the stimulus-referent in sentences like this one has also been termed the "implicit causality" of a verb. For a description of the relevant literature, see §1.1.2.1.

There are two main points that I will develop in this chapter. First, I will discuss a new approach to studying the effects of implicit causality. Second, I will present additional evidence for the general theme of this dissertation. In past chapters, I showed that the factors Recency, Subjecthood, Focus, and Parallelism were doubly associated with both Reference Form and Reference Continuation. Here I will show the same double association for thematic role information, focusing on goal and source roles. The investigation of these roles is particularly important, because they represent the semantic role of referents in a given proposition. In contrast, Subjecthood, Focus, and Parallelism reflect aspects of the linguistic forms that had been used to refer to discourse entities, and Recency reflects information about the amount of time or information that has passed since the referent was last mentioned. (See §1.2.1. and §4.5.1. for further discussion of the nature of thematic role information).

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26 Following the system from preceding chapters, I will use terms like "stimulus-referent", "goal-referent" or "source-referent", to indicate a character that played a particular thematic role in the situation denoted by the preceding clause. I will also continue use the terms "subject-referent" or "object-of-PP-referent" to refer to the entities that were referred to with the subject or object of PP of the preceding clause. Note that a particular referent can be described in terms of both properties. For example, "John" in example 1 is both the subject-referent and the stimulus-referent.
4.1. A multiple-constraints approach to Implicit Causality

The literature on implicit causality suffers from two problems. The first problem, which I discussed in chapter 1, is the practical problem of characterizing the verb bias in a non-circular way. This problem has been partly solved by defining verb bias in terms of argument roles (Brown and Fish, 1983; McDonald and MacWhinney, 1995; Stevenson et al., 1994).

The second problem is that the notion of implicit causality does not explain any general processes of pronoun resolution. This is because most researchers have discussed verb biases in terms of the cause of a particular event (a notable exception is Stevenson et al., 1994). In a sentence like 1, it has been claimed that the interpretation of the pronoun is linked to the assumption that one character is a more likely cause of the event than another. This argument is perfectly logical in a case like this, where the two clauses are joined by "because". However, as many researchers have noted, the influence of the verb bias changes with other connectors, like "and", "but", or "so" (e.g., Ehrlich, 1980; Grober et al., 1978; Stevenson et al., 1994). In fact, the purported bias toward the cause of an event is often only observed after the connector "because".

Thus, implicit causality does not represent a general characterization of discourse processing or pronoun resolution. It does a good job of characterizing how people read sentences like 1, but most sentences are not like 1. In this chapter I will develop a more general approach to studying the effects of implicit causality and thematic roles.

My approach draws directly on the work of Stevenson et al. (1994), who discuss implicit causality effects in terms of event structure. Following Moens and Steedman (1988), they consider an event to have three basic components: the initiating conditions,
the event itself, and the consequences of the event. For any given event clause, the following clause may specify information about either the **cause** or the **consequences** of that event. Within this framework, Stevenson et al. asked whether comprehenders tend to focus on the cause or the consequences of a given event. Based on their results, they argued that the focus is different for different kinds of verbs. For event verbs like "send", as in "Al sent a letter to Tracy," the default is for comprehenders to focus on the consequences, so the goal-referent is more accessible. In contrast, for stative verbs like "admire", as in "Al admired Tracy," there is no event structure. Here comprehenders focus on the cause, so the stimulus referent is more accessible. Stevenson et al. also suggest that the presence of a connector like "because" or "so" will either strengthen or modify the default. This approach is consistent with the early work on implicit causality, which showed an interaction between verb bias and clause connector (e.g., Ehrlich, 1980; Grober et al., 1978).

There are two things that are important to note about Stevenson et al.'s (1994) approach. First, it moves away from characterizing verb bias in terms of implicit cause. This is an important step, because many clauses are not causally related to the previous one. Following Stevenson et al., I also assume that referent accessibility and pronoun resolution are influenced by the comprehender's focus on the cause, consequences, or other continuations of the discourse.

Second, Stevenson et al. characterize verb bias in terms of "defaults" for different types of verbs. This implies that pronoun resolution follows rules like "focus on the consequences of an event except in the presence of because." While this is a good descriptive generalization, I will propose a more general explanation, and also that
language use doesn't rely on "defaults". Instead, comprehenders focus on one referent or another as a result of several constraints. I will consider two constraints in detail here: a) the participant roles, as determined by the verb's semantics; and b) the way in which comprehenders interpret how a given clause relates to the previous clause and the discourse as a whole. Although I will discuss each constraint separately, it is important to note that they are not independent of each other. Both constraints are built out of smaller constraints, and the listener's representation of the role of a given clause is sensitive to the semantics of the preceding clause.

4.1.1 Participant roles

As shown by the literature on implicit causality (see §1.1.2.1), pronoun resolution is influenced by the event described in the previous clause. This has been characterized as either the effect of a bias inherent in the event (e.g., Garnham et al., 1996) or the effect of the thematic roles of participant entities (e.g., McDonald and MacWhinney, 1995; Stevenson et al., 1994). This means that the imputed cause of the event in sentences like 1 biases the comprehender toward one entity or another during the interpretation of subsequent pronouns.

In reporting my studies, I will continue to discuss participant roles in terms of thematic roles, for ease of presentation. However, it is important to note that these roles are interpreted with respect to many aspects of the verb's semantics. One such aspect, discussed above, is whether the verb describes an event or a state. Another aspect is the type of event the verb represents. For example, consider the verbs in 2 and 3.
Although some of the referents in 2 and 3 share the same thematic roles, the verbs in 2 are verbs of transfer, while those in 3 are verbs of motion. The comparison of different verb types is beyond the scope of this study, but it is important to realize that this difference may also influence the accessibility of referents during processing. To keep things to a manageable size, I will focus on only one verb type for this study.

4.1.2. Clause relationships

The tendency for comprehenders to focus on one referent over another is also a function of how they interpret the relationship between a given clause and the previous one. This interpretation must be represented at some level in the listener's discourse model. For simplicity, I will treat it here as a local representation. Figure 1 depicts how a listener might represent the various possible relationships between two particular
clauses. At first, several types of relation are activated. As the listener receives additional information over time, one relation will become fully activated, and the others will lose activation. Activation is represented here as lines emanating from a particular representation. The number and size of lines represents the degree of activation.

The activation of a given relationship is a process that occurs dynamically, over time, and is sensitive to several constraints.

One very important constraint, as many researchers have suggested, is the presence of connectors like "because", "so", "and", or "but". These discourse markers can strongly bias the interpretation of the following clause. This kind of information has often been treated as a categorical indicator of the contribution of the following clause. However, even connectors do not fully specify the role of the following clause. For
example, the conjunction "and" can have many interpretations (Schmerling, 1975), some of which are in 4.

(4) a. **Temporal:** I wrote my dissertation and filed it.

b. **Causal:** It was cold and she put on her jacket.

c. **Simultaneous:** Alice played her guitar and sang.\(^\text{27}\)

Other connectors, like "because", more strongly indicate the speaker's intentions. However, even "because" is ambiguous to the extent that it can signal cause in one of three domains, as in 5.

(5) from Sweetser (1990:77)

a. **Cause of real-world action:** John came back because he loved her.

b. **Cause of speaker's knowledge:** John loved her, because he came back.

c. **Cause of speech act:** What are you doing tonight, because there's a good movie on.

Clause connectors can therefore be best understood as partial, probabilistic constraints. That is, a connector like "because" might signal a high probability that the following clause will contain causal information, and would therefore highly activate a causal interpretation. A connector like "and", on the other hand, weakly activates several

\(^{27}\) This example comes from Schwenter (1998:25).
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different relations. "And" provides less constraining information, leaving the listener to interpret the relationship on the basis of other factors.

Other constraints that may play a role include discourse genre, tense, or aspect. For example, 6a may be more likely to be followed by another event than 6b.

(6)   a. John raked the lawn. (Then he went inside).
   b. John rakes the lawn. (But I never do).

Even though both 6a and 6b use the same verb, listeners are more likely to think of 6a as part of a narrative, in which case it is more likely that the speaker will follow up with a description of a subsequent event. In contrast, the simple present tense in 6b turns it into a proposition about John's habits, which may be less likely to be followed by a description of a subsequent event.

My approach is one where comprehenders understand language based on multiple sources of information. It suggests why, for example, Stevenson et al. (1994) found thematic role biases even for sentences with no connector. In these sentences, readers were influenced by other aspects of each sentence, such as the tense, aspect, genre, or type of verb. This approach also offers a more general explanation for their finding that different biases exist for different combinations of verb types and connectors. Stevenson et al. explained these results in terms of different default biases for different verbs, with the added proviso that connectors can change the default. This type of explanation is essentially a re-description of the results.

The goal of the present study is not to develop a precise characterization of the constraints that influence how a comprehender interprets the contribution of a given
clause to the discourse. I have suggested some constraints here; these are predictions to be tested in future work. This proposal instead serves as the basis for the studies that I will present in this chapter.

One of the core aspects of my proposal is that language processing involves unconscious hypotheses about where the discourse is going, and that they influence the activation of discourse referents. The listener's predictions about the discourse flow are neither conscious nor categorical. Rather, certain referents are activated probabilistically, for a short period of time, as various kinds of information become available. Activation is influenced by the thematic roles of referents in the preceding clause, but also by other information.

Importantly, my proposal for studying thematic role information parallels the proposal I have been developing in this dissertation. I have claimed that during language comprehension referent representations become activated when there is a strong likelihood that they will be referred to again, especially during anaphor resolution. Listeners know that speakers are more likely to refer to recently mentioned entities, subjects, foci, and parallel NPs. Similarly, the thematic role of a referent may indicate the likelihood it will be mentioned again, depending on how the listener interprets the relation between that clause and the following one.

### 4.2 Goal and Source roles

For the studies in this chapter I have chosen to focus on two thematic roles: goal and source. These roles provide a good testing ground for my ideas because they often appear together, but the subject is the source in some verbs (e.g., *send*) and the goal in others (e.g., *receive*). This feature is important because, as the data in §2.3.2.1 and §3.2
showed, reference form is highly sensitive to the grammatical role of the antecedent. Therefore, the effect of other characteristics such as thematic roles may only be observable while controlling for grammatical role.

Past research suggests that goal-referents are more accessible than source-referents (Stevenson et al., 1994). The participants in Stevenson et al.'s study interpreted ambiguous pronouns as referring to goal-referents more often than to source-referents, and in the condition where the pronoun was not supplied (see §1.1.2.1), participants referred to the goal more than to the source. Further support comes from Stevenson and Urbanowicz's (1995) self-paced reading experiment, in which they recorded the time it took participants to read anaphors with goal- or source-referents. Although they did not specifically comment on the difference between pronouns and names, their data did include a manipulation of reference form (pronoun vs. name). Using their data, I calculated the difference between the reading times for pronouns and names (\(= (\text{average RT for pronouns}) - (\text{average RT for names})\)). Figure 2 presents the average reading times separately for NP1 antecedents (i.e., subject antecedents) and NP2 antecedents.
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Figure 2: Results from Stevenson and Urbanowicz (1995)

The difference between pronoun and name reading times (in msec), calculated from data in tables (2) and (4) (Stevenson and Urbanowicz, 1995).

These data show that participants read names faster than pronouns in all conditions, which could be termed a "name advantage". However, there was a greater name advantage for source-referents than goal-referents, for both NP1 and NP2 antecedents. Put another way, pronouns were read relatively faster for goal-referents than source-referents, suggesting that the goal-referent was more accessible.

I performed the experiment described below to investigate choice of referring forms for goal- and source-referents. At the same time, I looked at whether participants would refer to goal- or source-referents more overall. I hypothesized that the goal bias found by Stevenson and Urbanowicz for reference comprehension would also influence choices of reference form in production, for two reasons. First, Stevenson et al.’s (1994) off-line sentence completion task yielded similar results, and second, other factors that
influence reference comprehension (e.g., Subjecthood) have also been shown to influence production choices (see chapters 2 and 3).

4.3 Experiment: Goals and Sources

The first step in this study was to establish that choices in reference form are sensitive to the thematic role of the antecedent. The methodology used in this experiment was an oral story-completion. Participants were presented with written stimuli consisting of three-sentence stories, such as 7 and 8. The last sentence in each item contained a verb with goal and source arguments.

(7) There was so much food for Thanksgiving, we didn't even eat half of it. Everyone got to take some food home. Lisa gave the leftover pie to Brendan.

(8) I hate getting sick. It always seems like everyone gets sick as soon as it's vacation. Marguerite caught a cold from Eduardo two days before Christmas.

Participants were asked to read these stories aloud into a tape recorder and add a natural continuation sentence to the story at the end.

This methodology combines comprehension and production processes. Although the task was to produce an utterance, it required participants to comprehend the stories before providing a continuation. Of particular importance is that their responses were made on the basis of the mental representations they developed while reading the story.
In that sense, their responses reflect the cognitive outcome of their comprehension of the story.

This methodology offered several advantages. First, participants were not restricted in the type of continuation they added, except that it had to be a new sentence, rather than a continuation of the last one. This freedom meant that their responses provided information about how they would tend to continue the story, and allowed me to investigate which character they would mention first. Second, I could analyze whether participants used pronouns more often for goal or source characters.

A third question that I asked in this study was how the participants' continuations would be influenced by the relationship between their continuation sentence and the stimulus story. That is, did participants produce continuations that expressed the cause of the preceding event, a subsequent event, or something else? I considered the participants' continuation to be an indicator of their mental representation as it was at the end of the stimulus story. Therefore, if a participant provided a causal continuation, it signaled that the causal relationship was most activated at the end of the stimulus story.

Unlike other implicit causality studies, I did not include any conditions with overt connectors like "because" or "so". Their absence meant that the relation of the continuation sentences was driven by other factors. The purpose of this study was not to discover exactly what those were. Instead, I just wanted to know whether participants would choose to refer to source- or goal-referents more often, depending on the role of the continuation sentence.

The methodology I used had other advantages as well. Since the task was oral, rather than written, it reflected on-line processes. In contrast, a written story-completion
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methodology would have allowed participants to reflect upon the story and their continuations. Also, in contrast with the rating methodology, it was possible to exclude an item when it was clear that the participant had not understood the story as intended (for example, when a name was interpreted with a different gender than the one intended).

4.3.1. Methods

The experiment was conducted in the language laboratory at Stanford University. Each participant sat in a cubicle outfitted with a tape recorder and headset with a microphone and earphones. The stimuli were provided in written form, with several spaces between each item to prevent participants from reading the following item while completing the current one.

Each stimulus item consisted of a three-sentence story like 8 and 9 above. The first two sentences provided the context, and did not contain references to either of the characters introduced in the third sentence. The third sentence included either a goal-source verb or a source-goal verb; all the verbs used are provided in Table 1.

Table 1. Verbs used in Experiment 2

<table>
<thead>
<tr>
<th>Source-Goal Verbs</th>
<th>Goal-Source Verbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>bring</td>
<td>accept</td>
</tr>
<tr>
<td>give</td>
<td>borrow</td>
</tr>
<tr>
<td>hand</td>
<td>bought</td>
</tr>
<tr>
<td>loan</td>
<td>catch (used twice)</td>
</tr>
<tr>
<td>offer</td>
<td>get (used twice)</td>
</tr>
</tbody>
</table>

Three verbs were used in two different stimulus items each, because these verbs yielded more natural stories than other less common verbs would. One verb, "rent", was used as both a source-goal verb and a goal-source verb, because it commonly occurs in both frames.
All verbs were used in a prepositional frame. Source-goal verbs are commonly used in both prepositional and double-object constructions ("Cynthia taught the lambada to Sean" / "Cynthia taught Sean the lambada"). For these verbs I only included prepositional constructions. This was to maintain consistency with the goal-source verbs, where the source argument must appear as an object of preposition, as in "Annette caught a ride from Scott". This consistency was particularly important because the choice between the double object and prepositional constructions is partly driven by the discourse status of the referents (Arnold et al., 1998).

In the third sentence of each story, two human characters were introduced by first names. These two characters filled the source and goal roles in the event. The names I used were ones that are almost always associated with only one gender. In all cases, the two characters were of opposite gender. The theme argument was always inanimate. In half the items, the theme argument occurred as a definite NP, in half as an indefinite NP.

A total of 16 sentences were constructed with each type of verb. Each participant saw all 32 items (Appendix A). They were combined with 24 items belonging to another experiment (Experiment 2 in Arnold, 1998), such that items for each experiment served as distracters for the other. The items from the other experiment also had three sentences and used proper names, but followed a different structure from the present one.
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4.3.2. Participants

Sixteen native speakers of English from the Stanford community participated in this and another experiment in exchange for $7. The approximate time needed to complete both experiments was forty-five minutes. "Native speaker" was defined as having started learning English by 5 years of age.

4.3.3. Results

The continuations for each item were tape-recorded and transcribed. Thirty-five completions were excluded from the analysis. Reasons for exclusion included continuing the last sentence rather than beginning a new one (n=13), adding a nonsensical or ambiguous continuation (n=6), saying nothing at all (n=3), experimenter error (n=8), or interpreting the name of one of the characters with the unintended gender (n=5). For example, the name "Ali" was intended as a female name, but some participants read the name "Ali" as a male name, with an accent on the second syllable. Examples of scorable participant completions are shown in Table 2.
Table 2. Example responses in Experiment 2.

Stimulus: There was so much food for Thanksgiving, we didn't even eat half of it. Everyone got to take some food home. Lisa gave the leftover pie to Brendan. . . .

- Brendan loved pie and cakes and all manner of sweet things but didn't know how to bake.
- He needed it the most since he was living off campus and didn't have access to food.
- I got the turkey and the stuffing, yum!
- She gave all the leftover turkey to me, and I asked if I could have the stuffings too, but she said don't be greedy, she gave the stuffings to her sister.

Stimulus: I hate getting sick. It always seems like everyone gets sick as soon as it's vacation. Marguerite caught a cold from Eduardo two days before Christmas. . . .

- Unfortunately, Marguerite was sick on Christmas day.
- She was headed for the Bahamas, and it was tough.
- Eduardo gave it to me . . and so I was sick over the entire holiday.
- And they were both in bed for the holiday.

I was only interested in the frequency of referring to the goal and theme characters, so references to other people or things were not included in the analysis. This left 346 completions that could be analyzed.

For each item, I only considered the first continuation sentence, using a coding procedure similar to the one used for the corpus analysis in Chapter 3. First, I coded which character or object from the previous utterance was referred to first, if any. Second, I looked at how this character was referred to -- with a pronoun or with a name. The rationale behind this procedure was to determine which of the two characters was
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considered more relevant to the following discourse, and to see how that character was referred to.

In a departure from the coding system for the corpus analysis, I also looked at a third factor: type of continuation sentence. I coded each response in terms of four categories: a) specifying the cause, b) specifying the consequence, c) elaborating or developing the idea of the last sentence further, or d) describing a related yet independent fact or event. Table 3 shows examples of each type.
Table 3. Examples for each category of relation between the continuation sentence and previous one.

<table>
<thead>
<tr>
<th>RELATION</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>cause</td>
<td>The U2 concert was sold out a week before the show. Scalpers were selling tickets for ridiculous prices. Fortunately Rafael got a ticket from Gabrielle. Gabrielle's friend Phil couldn't make the concert.</td>
</tr>
<tr>
<td>consequence</td>
<td>I hate getting sick. It always seems like everyone gets sick as soon as it's vacation. Marguerite caught a cold from Eduardo two days before Christmas. It kind of put a damper on the Christmas festivities.</td>
</tr>
<tr>
<td>elaboration</td>
<td>The professors in the music department were all in a good mood. The first day of music lessons had gone unexpectedly well. Melora taught a sonata to Mike in an hour and a half. That is really fast.</td>
</tr>
<tr>
<td>related</td>
<td>My physics class gets out at 7 pm and it's already dark then. A lot of people have trouble getting home. Annette usually catches a ride from Scott. I was wondering if I should ask Scott to give me a ride also.</td>
</tr>
</tbody>
</table>

The results were tabulated in terms of each question. First, in what percentage of cases did people refer to the source-referent, and in what percentage to the goal-referent? Second, what was the rate of pronoun use for each type of referent? Third, how was the choice to talk about the goal or the source influenced by the choice of how the continuation sentence would relate to the rest of the story?

To test the statistical significance of the results, I conducted stepwise logistic regression analyses, using SPSS 6.1. Logistic regressions are commonly used for two purposes: 1) model building and 2) model testing. In this case, I used it for model testing. That is, I wanted to know which independent variables and interactions were
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significantly correlated with the dependent variable. These are the same questions that can be investigated with analyses of variance (ANOVA), as I did in chapter 3. However, while ANOVA requires a scalar dependent variable, logistic regression can be used with categorical dependent variables, such as the ones investigated in this experiment. This analysis is also similar to VARBRUL, which is commonly used in studies of sociolinguistic variation; the difference is that the SPSS version of logistic regression permits the investigation of interactions between independent variables, while VARBRUL assumes that no interactions exist.

To use logistic regression for model testing, SPSS first builds a model of the data, using all the variables that significantly contribute to a characterization of the dependent variable. To assess the contribution of a given variable, x, the program compares the model with x to a model without x. The contribution of x is measured in terms of the ratio of the log likelihood in each model. The models can be built using either a step-up or step-down procedure; in each case I performed both analyses and found the same results.

4.3.3.1. Did participants begin more often with goal or source-referents?

The first question I asked was "Who was referred to first?" The data in chapters 2 and 3 showed that Subjecthood was highly correlated with Reference Continuation. That is, the entities that speakers talk about are often those that were mentioned in subject position of the preceding clause. Here I was interested in whether continuation patterns would differ for goal and source-referents, but I expected that the Subjecthood factor would interact with any effect of thematic roles. Therefore, I looked at the difference between goal and source-referents separately for subject and object-of-PP referents,
calculating the percentage of references to goal- and source-referents for each category. The results are in Figure 3.

![Figure 3: Distribution of choice of referent by grammatical function and thematic role](image)

The results revealed a goal bias for both subject referents and object-of-PP referents, in that the rate of reference to subject-referents was sensitive to verb type (goal-source vs. source-goal) (-2\*Log LR = 14.513, df=1, p<.0001).\(^{29}\) For both subject- and object-of-PP-referents, they were more likely to be the first referent of the continuation sentence if they were also the goal.\(^{30}\)

\(^{29}\) These statistics represent an analysis that included an additional independent variable, whether there was material after the object of preposition or not. The motivation for investigating this variable will be discussed below.

\(^{30}\) For comparison I also performed an analysis that included all references to the goal or source arguments, and not just the first one. This procedure yielded more data points, because in many cases a particular
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The primary reason for considering who was referred to more often was to compare goal continuations with source continuations. In this regard, the experiment produced the expected results. However, a secondary, unexpected result was also observed: participants continued the discourses more often with the prepositional object NP (n=260) than the subject NP (n=86). This result was surprising, because it contradicted the findings of the corpus analysis in §3.3, which suggested that the subject referent is a more likely continuation of a discourse than any other referent.

There are two possible explanations for this result. On one hand, it may be that this particular story-completion task led participants to prefer a continuation that would provide some closure to the story -- a concluding sentence, in effect. The instructions only requested that subject add "a natural continuation", and not that they finish the story. However, it was very likely that they were thinking of this as the last sentence in the story. If this is the case, the structure of the stimuli may have been biased toward object continuations, in that they introduced a new object character at the end of the stimulus item, so that participants may have expected that the narrative would then justify the introduction of that character. This hypothesis could be tested by repeating the experiment, but asking participants to add a longer continuation, thus investigating continuations that are not narrative-final.

continuation referred to both the source and the goal referents. These results followed the same pattern as the results using only the first references.

<table>
<thead>
<tr>
<th>% References to goal or source referents in each position</th>
<th>goal-referents</th>
<th>source-referents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject-referents (n=126)</td>
<td>68%</td>
<td>32%</td>
</tr>
<tr>
<td>Object-of-PP-referents (n=286)</td>
<td>56%</td>
<td>44%</td>
</tr>
</tbody>
</table>
A second possibility is that the tendency to refer to objects reflects a general Recency effect, which also surfaced in chapter 3. Under normal conditions, Recency effects are modulated by the subject bias. That is, subject referents are mentioned more often that object-of-PP referents, even though object-of-PP referents are usually more recent. However, in this task, the object-of-PP character almost always appeared as the final element in the stimuli items, which may have caused it to be more activated at the point when participants were constructing their next utterance.

The stimulus design offers a way to test this hypothesis, because in 5 of the stimuli from this experiment, the object of PP did not appear as the last element in the utterance. These stimuli are shown in (9).

(9) Stimulus-final sentences that contained material after the object NP.

- Marguerite caught a cold from Eduardo two days before Christmas.
- Juan received a telegram from Claire when their mother died.
- Phil paid $200 to Emily for a full weekend.
- Melora taught a sonata to Mike in an hour and a half.
- Sam brought flowers to Ali in the hospital.

I compared the results for these items with the other items, to see if the tendency to continue with the object would disappear.
Figure 4 shows that participants referred to the object of preposition more often when there was no intervening material. This effect of end material (present vs. absent) was significant (-2*Log LR = 3.962, df=1, p<.05). However, the presence of end material did not entirely remove the bias toward referring to the object-of-PP-referent. Therefore, the corpus analysis, described below, provides an important test of whether the object-of-PP bias is a true effect, or a side-effect of the experimental methodology.

4.3.3.2. Were pronouns used more for goal or source-referents?

I now turn to the second question, which concerns how goals and sources were referred to. I looked at four different categories of referent: subject/goal-referents, subject/source-referents, object-of-PP/goal-referents, and object-of-PP/source-referents. For each category, I counted the proportion of cases that pronouns were used, out of the total number of references to a referent of that type. The results, presented in Figure 5,
showed that pronouns were used more for goals than sources, for both subject referents and object referents.  

These data reveal two patterns. First, the use of pronouns was far greater for subject referents \(-2^* \text{Log LR}=131.640, \text{df}=1, p<.0001\). This finding supports the general subject bias observed in the data from chapter 3. Second, pronouns were used more for goal-referents than for source-referents \(-2^* \text{Log LR}=4.076, \text{df}=1, p<.05\). In Figure 4 it appears that the goal bias is stronger for object of preposition referents, but the interaction between grammatical function and thematic role was not significant \((p>.3)\). This suggests that the goal bias, though small, is robust across all grammatical positions.

As with the previous results, I performed an additional analysis, including all forms of reference, and not just the first one in each continuation. This analysis produced a similar pattern of results.

### Percentage Pronominalization, including all references to the Goal or Source referents

<table>
<thead>
<tr>
<th>Reference Type</th>
<th>Goal ((n=245))</th>
<th>Source ((n=167))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject referent</td>
<td>71%</td>
<td>70%</td>
</tr>
<tr>
<td>Object of PP referent</td>
<td>21%</td>
<td>11%</td>
</tr>
</tbody>
</table>

---

\[^{31}\] As with the previous results, I performed an additional analysis, including all forms of reference, and not just the first one in each continuation. This analysis produced a similar pattern of results.
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4.3.3.3. The relationship of continuation sentences to the story

As I mentioned above, the stimuli contained no overt connectors to bias the relationship of the continuation sentence to the rest of the story. Instead, the types of continuations that people produced were the result of their reaction to other aspects of the stimuli. As participants read the stimulus story, they had to form a mental model of the characters and actions, and these mental models were influenced by the form and meaning of the three stimulus sentences.

Because this was an oral task, it was also at a rate that is close to normal speaking. Participants' responses therefore to some extent reflect the on-line processes occurring at the moment they add a continuation sentence. In particular, they reflect the cognitive status of the discourse referents, and the participants' assumptions about where the discourse is going. For example, participants may focus on a causal continuation for the story, a specification of a subsequent event, or some other type of continuation. Although the data do not reveal why they focus on one type of continuation rather than another, their responses do indicate what the type of continuation was.

Therefore, as I mentioned above, I coded each continuation sentence in terms of whether it specified a) the consequences of the preceding event, b) an elaboration or further development of the previous clause, c) a related event, or d) the cause of the preceding event. The participants' estimation of where the discourse is going has consequences for whether they focus more on the goal- or source-referent. Figure 6 shows the proportion of references to the goal and source-referents for each of the four types of continuation sentence.
The first thing these results show is that over half of the total responses provided information about the consequences (N=179), rather than something else (N=167).

Furthermore, the highest rate of reference to the goal argument occurred for consequence continuations and the next highest occurred for elaboration continuations. In contrast, the opposite bias occurred for sentences that specified the cause of the preceding event or a related proposition. A logistic regression showed that the choice of referent (goal-referent vs. source-referent) was sensitive to the type of connection the participant used (-2*Log LR=34.264, df=3, p<.0001), the grammatical function of the last reference to the entity (-2*Log LR=8.234, df=1, p<.05), and an interaction between the two (-2*Log LR=29.993, df=3, p<.0001).
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4.3.4. Discussion

The results from the thematic roles experiment showed that participants tended to continue stories with goal-referents more often than source-referents, and also that they tended to use pronouns more often for goals than sources. The primacy of the goal-referent, in comparison with the source-referent, is consistent with the findings of Stevenson et al.'s (1994) written sentence completion task and Stevenson and Urbanowicz's (1995) reading time experiment. These results are also consistent with the double association that I demonstrated in earlier chapters. That is, Goal Status joins Recency, Subjecthood, Focus, and Parallelism in a double association with Reference Form and Reference Continuation.

At the same time, the results showed that the goal bias was stronger for some conditions than others. Specifically, when participants chose to explain something about the consequences of the event, they tended to talk about goal-referents more than source-referents. However, they did not always focus on the consequences, and when they didn't, the rate of reference to the goal-referent declined.

Thus, the goal bias for continuations about the consequences matched the goal bias in the full sample of continuations. The continuations about consequences also represented the most frequent type of continuation. Therefore, the goal bias observed in the full sample may have occurred because of a bias toward focusing on the consequences of the stimulus event. In this sense, the results are consistent with Stevenson et al.'s claim that comprehenders tend to focus on the consequences of an event.
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However, my results are not consistent with Stevenson et al.’s suggestion that focusing on the consequences is the default, which can be modified by connectors like "because". In a task like this one, where there were no connectors, their account would predict that the large majority of responses should focus on the consequences. Contrary to this prediction, 48% of the responses did not. This suggests that these data are not best explained in terms of a default rule.

In sum, the data from the experiment showed two general patterns. People referred more to goal- than to source-referents, especially when they focused on the consequences of an event. They also used pronouns more often for goal- than source-referents. However, the results were also perplexing in one aspect: participants continued the stories with the non-subject referent more often than the subject referent. This contradicts the findings from chapters 2 and 3 that subject referents are more likely to be referred to again than non-subject referents. This issue was further investigated in a corpus analysis, described below.

4.4. Corpus Analysis: Thematic Roles

The purpose of this corpus analysis, like the one in §3.3, was to investigate patterns of discourse with respect to goal- and source-referents. Do people refer more often to referents that have played certain thematic roles?

4.4.1. Methods

This study followed a similar methodology as the topic/ focus corpus analysis in §3.3, using excerpts from the Aligned-Hansard corpus. The difference was that for this analysis, I extracted samples of sentences containing the verbs listed in 10.
(10) Verbs used in Corpus Analysis 2

<table>
<thead>
<tr>
<th>SOURCE-GOAL VERBS</th>
<th># examples</th>
<th>GOAL-SOURCE VERBS</th>
<th># examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>give</td>
<td>22</td>
<td>get</td>
<td>19</td>
</tr>
<tr>
<td>send</td>
<td>19</td>
<td>accept</td>
<td>18</td>
</tr>
<tr>
<td>teach</td>
<td>1</td>
<td>receive</td>
<td>25</td>
</tr>
<tr>
<td>offer</td>
<td>20</td>
<td>buy</td>
<td>2</td>
</tr>
<tr>
<td>pay</td>
<td>20</td>
<td>take</td>
<td>20</td>
</tr>
<tr>
<td>TOTAL</td>
<td>82</td>
<td>learn</td>
<td>5</td>
</tr>
</tbody>
</table>

I only included instances where the verbs were used with both a source and a goal argument. As in the experiment, I limited the study to verbs used in the prepositional frame. I did this so that my sample of goal-source verbs would be comparable with my sample of source-goal verbs, which only occur in the prepositional frame.

I analyzed each of these utterances, following the same procedure as in the corpus analysis in chapter 3. That is, the clause with source and goal-referents was labeled sentence 1 (S1). I then identified the next independent clause as S2 (see §3.3 for definition). I found the first expression in S2 that referred to something from S1, if there was one, and coded whether this expression referred to the goal-referent, source-referent, or other referent from S1. Examples are shown in 11.
(11) Examples from the thematic roles corpus analysis.

<table>
<thead>
<tr>
<th>first ref.</th>
<th>example</th>
</tr>
</thead>
</table>
| goal (subj) S1: **We** will **buy** what we want offshore **from** the United States or elsewhere.  
S2: **We** do not have to care whether . . . |
| source (subj) S1: Individuals write, phone and visit us and all ask if **we** can **give** any assistance **to** them, their relatives or friends who are seeking gainful employment.  
S2: **We** know their frustration . . . |
| goal (obj of PP) S1: Mr. Speaker, I rise today to **pay** special homage **to** a truly vibrant and magnificent lady on her sixtieth birthday.  
S2: She has always had a reputation for congeniality and fairness toward all mankind. |
| other S1: I will hasten to **send** this good message **to** the Quebec Minister of Finance.  
S2: It’s a comment which, I think, he will appreciate tremendously. |

4.4.2. Results and Discussion

The results of this corpus analysis were tabulated separately for goal-source verbs and source-goal verbs. For each verb type, I counted the number of references to subject referents, object-of-PP referents, other referents from S1, and no referents from S1. Note that for goal-source verbs, the subject referent was also the goal-referent, and for source-goal verbs, the object-of-PP referent was also the goal-referent.

The results show that the goal-referent was mentioned more often than the source-referent ($\chi^2(1) = 6.091, p<.02$). Figure 7 shows the percentage of references to goal- and source-referents separately for subject- and object-of-PP-referents. The bars in Figure 7 do not add up to 100%, because the percentages are calculated out of all utterances in
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each sample, but Figure 7 does not include the cases when S2 did not contain a reference
to either the goal- or source-referent.

![Figure 7: Corpus Analysis results: distribution of choice of referent by grammatical function and thematic role](image)

These data show three patterns. First, there was a large effect of Subjecthood. That is, speakers referred to subject referents more often than other referents. This corroborated the results of the corpus analysis on Subjecthood and Focus in chapter 3. It also suggested that the Obj-of-PP bias in the thematic roles experiment was the result of the particular experimental task, and was not indicative of a tendency to focus on objects of prepositions with this type of verb.

Second, there was an effect of Goal Status. This effect is largest for the object-of-PP category, where there were more references to the goal-referent than the source-
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This supports the hypothesis that Goal Status is associated with Reference Continuation. That is, the referents that play the role of goal were somewhat more likely to be referred to in the following utterance. However, this was a smaller effect than that of Subjecthood.

Third, there was an interaction between Subjecthood and Goal status. That is, for subject referents, it did not matter much whether the referent was also a goal or not. But for object-of-PP referents, it mattered a great deal: goal-object-referents were referred to far more than source-object-referents. To test the reliability of this interaction, I considered the items with subject-referents and object-of-PP referents as separate samples, and asked whether the proportion of goal-referents was different in each of these two groups. I computed the z-statistic for comparing two proportions, and found that Goal Status indeed had more of an effect when the referent was also a prepositional object than when it was a subject ($z=-2.09, p=0.0183$). This interaction is consistent with Stevenson and Urbanowicz's (1995) reading time data for names and pronouns, presented in Figure 1, where the goal advantage was stronger when the antecedent was the second NP (i.e., the object of preposition).

4.5. General discussion

The results of the experiment and corpus analysis show that two generalizations can be made about verbs of transfer. First, speakers tend to talk about the goal- more often than the source-referent. Second, speakers tend to use pronouns more often to refer to the goal- than the source-referent. Thus, these data exhibit a pattern that parallels my other results: where the comprehender finds reference to a particular entity is more probable, speakers tend to use pronouns. This parallelism is depicted in Figure 8 in terms
of the double association of the factor Goal Status with (a) Reference Form and (b) Reference Continuation.

**Figure 8: The double association for Goal Status**

These data provide the last piece of evidence for the overall hypothesis, that all five linguistic factors show this double association. This supports my general claim that discourse processing parallels patterns in discourse structure.

In the remainder of this chapter, I will discuss two questions. First, where does this discourse pattern come from? Why do people tend to refer more to goals than sources? I will argue that this pattern, like others, derives from the fact that language is a joint activity (H. Clark, 1996). Second, how does thematic role information influence discourse processing and production? As before, I will appeal to listener accommodation.

### 4.5.1. Where does the Goal Status factor come from?

Language use is amazingly regular. This is because people use language for specific purposes (H. Clark, 1996), and language use therefore reflects generalizations about human interests and desires.

The Goal Status factor differs from the factors discussed in chapters 2 and 3. In chapter 3, I argued that Subj ecthood and Focus are associated with Reference Continuation because these positions have become specialized for cognitively salient referents. That is, the speaker uses these positions for activated referents in order to communicate something to the listener. In contrast, the effect of thematic roles has to do
with the semantic roles of the referents, and so is driven by what speakers want to say, not how they want to say it.\textsuperscript{32} Since the results from this chapter suggest that people choose to talk about goals more often than sources, the question that needs to be answered is: Why do people tend to talk about goals?

Consider an individual, Jane. On any given occasion, the reason Jane talks about the goal depends on the things she is interested in, and her reasons for describing the event in the first place. What purpose did this utterance serve within Jane's intentions for the conversation? She might have been reporting a sequence of events, describing the cause of some other event or state, or providing evidence for some other claim. For example, imagine that Jane witnesses a Stanford basketball game in which Flores passes the ball to Nygaard, who makes the winning basket in the last 5 seconds of the game.\textsuperscript{33} The next day Jane mentions this event to a friend. Her reason for doing so might be to recount the sequence of events leading to Stanford's victory, as in 12. Or she might wish to argue for the incompetence of the other team, as in 13. Or she might want to speculate on Flores's motivations for passing the ball to Nygaard, as in 14.

\textsuperscript{32} As noted in chapter 1, some choices in linguistic form, e.g., between "chase" and "flee", can change the thematic roles of characters in an event. However, the verbs I investigated do not have this property.

\textsuperscript{33} The names of the players are real, but to my knowledge the event is completely fictitious.
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(12) With five seconds to go, Flores managed to get the ball to Nygaard. Then Nygaard shot a beautiful three-pointer and they won the game.

(13) With five seconds to go, Flores managed to get the ball to Nygaard. It only happened because Nygaard's defender wasn't paying attention and left her wide open.

(14) With five seconds to go, Flores managed to get the ball to Nygaard. Normally Flores takes it in herself, but this time there were two defenders guarding her.

Examples 12-14 show three contexts in which she could say "Flores managed to get the ball to Nygaard." In each variant, one referent is more central to Jane's intentions than the other. However, her decision about how to continue the discourse has nothing to do with the fact that Nygaard was the goal-referent, and everything to do with her desire to communicate a specific message.

My data do not provide evidence about why people say the things they do, but they do show that on average, people refer to goal-referents more often than source-referents with this type of verb. This suggests that there is something about goal-referents and the events they occur in that leads people to talk about them often.

This pattern, I suggest, is driven by generalizations of human interest. Jane talks about a basketball player because she has focused on that player as interesting or important, and because she wishes to communicate a message about her. Speculatively,
there are several reasons to believe that this kind of discourse pattern is natural. First, the
kind of event I investigated had three participants: a source-referent, a theme-referent, and a goal-referent. In all cases the theme moved from the source to the goal, either literally or metaphorically. At the end of the event, the goal and the theme ended up together. One possibility is that observers of such an event simply follow the motion of the theme, so that their focus of attention tracks the location of the theme. If this is the case, they will end up focusing on the goal. A second possibility is that observers are interested in the consequences of the event, or a subsequent related event. In this case, too, they will focus on the goal.

Generally speaking, the goal bias may also reflect the fact that people are interested in the goals and intentions of other people. In this example, Jane knows that Flores's ulterior motive for passing to Nygaard was to win the game, which requires making a basket. In cases like this, it is more likely that Jane would choose to report on the successful basket (as in 12), rather than any other aspect of the event.

In sum, regularities in human interest lead to regular discourse patterns. One of these is that transfer verbs are used for events in which speakers are interested in the goal character more often than the source character. Thus, goal-referents get referred to more often than source-referents. In the following section, I will discuss how these patterns might influence choices in reference form.

4.5.2. How thematic role information is used

Language use typically takes place between two or more people. The listener tries to understand what is being said, and the speaker tries to make the listener
CHAPTER 4: THE EFFECTS OF THEMATIC ROLES

understand (Clark, 1996). The speaker attempts to use referring forms that will be interpretable for the listener. Therefore, to understand the speaker's choices it is important to understand the factors that facilitate comprehension.

One of these factors is the activation of referents in the mental representation of the listener. How do referents become activated? One way is when there is a high probability that the speaker will refer to them again. Constraint-based models of language processing have suggested that experience with a language results in implicit knowledge of which patterns are more frequent than others (e.g., MacDonald et al., 1994; Tanenhaus and Trueswell, 1995). The data in this chapter suggest that speakers refer to goal-referents more than source-referents, particularly when they talk about chains of events. This knowledge is stored in the cognitive system. Although it is not linguistic itself, it is available to the language processing system. In a novel processing situation, goal-referents have a relatively high probability of receiving subsequent reference.

There are two ways that this probability may influence the subsequent interpretation of pronouns. Some researchers have presented thematic role effects in terms of focusing: as comprehenders determine the role of a referent in a particular event, that information influences the cognitive status of the referent, making it more, or less, accessible (e.g., Stevenson et al., 1994). During the comprehension of the next clause, referent accessibility influences the interpretation of referring forms. Other researchers have claimed that thematic role effects only come into play during anaphor resolution itself, and do not influence the representation of discourse entities beforehand

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34 Clark claims that "All language use requires a minimum of two agents. These agents may be real or imaginary, either individual people or institutions viewed as individuals," (1996:23). Even in cases where
(Garnham et al., 1996; McDonald and MacWhinney, 1995). Under either account, the discourse patterns observed in the corpus analysis could play a role.

Recall that I am assuming that referent representations can be activated to varying degrees. This activation reflects the degree to which a referent is interpreted as important to the speaker's intentions, and the probability that a given referent will be mentioned again. For example, if John hears the sentence "Mark received the manuscript from Mary," he instantiates a representation of Mark in his mental representation, along with representations of the manuscript and Mary. Since the NP "Mark" was the goal argument of the proposition, John may add more activation to the representation of Mark than he would if the sentence had been "Mark sent the manuscript to Mary." This increased activation would make it easier for John to interpret a subsequent reference to Mark than if "Mark" had not been the goal.

Alternatively, it may be that the effect of thematic roles is not strong enough to influence the activation of referent representations from the start. However, the probability of subsequent reference for each discourse entity becomes relevant when John encounters a subsequent anaphor. At this point, the relative probability that Mark is the referent will cause the representation for Mark to become partially activated, if it wasn't already. This also would facilitate anaphor resolution.

The partial activation of representations in John's mental model has direct implications for the speaker's choice of referring form. When comprehension is facilitated, the speaker can use less-specified forms, like pronouns. The data in Figure 4 showed that speakers did indeed use pronouns more often for goal-referents.

an individual appears to be speaking and writing without an addressee, Clark argues that the addressee is implicit.
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At the same time, it must be acknowledged that the effect of Goal Status is small. The contrast between source and goal roles alone ignores many other relevant constraints. Two I have focused on here are: 1) Subjecthood, and 2) other semantic information.

4.5.2.1. Subjecthood

The data from both the experiment and the corpus analysis suggested that Goal Status competes with the much stronger Subjecthood constraint. In the experimental data in Figure 4, pronouns were used more often with subject-antecedents than object-of-PP-antecedents. The corpus analysis data in Figure 7 also indicated that speakers referred more often to subject referents than object of PP referents.

4.5.2.2. Other semantic information

Although it is very useful to employ thematic role labels like "source" and "goal", they are actually impoverished labels for representing semantic roles. Some linguists have suggested more detailed ways of talking about thematic roles (e.g., Dowty, 1991; Jackendoff, 1987) and verb classes (Levin, 1993).

Under Jackendoff's scheme, there are three tiers: the thematic tier, the action tier, and the temporal tier. The thematic tier represents information dealing with motion and location, the action tier contains Agent-Patient relations, and the temporal tier represents the temporal framework. Each participant may thus be associated with roles on more than one tier, although all tiers need not be represented for every participant or every role. In the studies in this chapter, I only contrasted verbs in terms of their thematic tier. However, all of the verbs except "hear", "inherit", and "receive" have an action tier as well. Differences in the action tier may have influenced how the referents were represented. For all of the source-goal verbs, the subject was both the source and the
agent. However, the action tiers for the goal-source verbs are not homogeneous. In some cases, the source can be seen as the agent (Clark and Carpenter, 1989), as in "Jennifer heard the news from Pablo," or "Juan received a telegram from Claire when their mother died." In other cases, the goal-referent is more agent-like, as in "Sonia quickly learned the steps from Allen," or "Elizabeth had to borrow the notes from Art." Other examples have no agent, like "Nick inherited big feet from Christine," and in some items the assignment of action-tier roles is ambiguous, as in "Fortunately Rafael got a ticket from Gabrielle." Therefore, while this tier may have played a some role, it is currently unclear what role it might have had.

But even if a complete and precise characterization of participant roles were possible, it would not be sufficient to explain the data in this chapter. The data show that the likelihood of reference to a goal-referent also depends on the way in which an utterance relates to its immediate predecessor. That is, the goal bias shows up mostly in contexts where the following utterance focuses on the consequences of an event. To understand the speaker's choices in referring forms, it is important to consider how the listener interprets relations among clauses, and how that in turn influences the activation of referents in the listener's mental representation.

4.5.2.3. An example

Let me illustrate how thematic roles and clause-relationships influence the mental representation of the listener and the processes of anaphor resolution. The following scenario would account for the data in §4.3 and §4.4, and follows from constraint-based models of language processing (e.g., MacDonald, 1994; Tanenhaus and Trueswell, 1995). It is, nevertheless, speculative, and does not include all the relevant information.
Imagine that Mary says to John "I sent the manuscript to Mark, and..." At this point in the discourse, John knows that Mary is probably in the process of producing another clause. But he doesn't know what Mary wants to say. He doesn't know who or what she will refer to, nor how her next clause will relate to the one he has just heard.

John's experience with linguistic patterns in English influences how he represents the discourse situation. He instantiates representations of Mary, the manuscript, and Mark. His representation for Mary is relatively active, because she was mentioned using a grammatical subject. He also may begin to activate possible relationships that the next clause could have to the previous one. For example, if event clauses are often followed by descriptions of the next event in sequence, this type of connection would be partially active. Also, hearing the connector "and" would provide partial information about the type of clause that will follow. Minimally, the listener knows that the following clause won't start with "because" or "but". Figure 9 depicts John's mental model, using the same representation of activation as Figure 1.

At the next moment, John hears Mary continue "...and the next day...". He still has not heard the bulk of her second clause, but now he has strongly constraining information about the type of utterance she is producing. It is very likely that the upcoming clause will provide information about a subsequent and related event. At this point, his representation for this type of connection becomes highly activated. This may also increase the partial activation of his representation for the goal-referent (Figure 10).
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Figure 9: A partial representation of John's mental representation after he hears "I sent the manuscript to Mark and ..."

Possible type of following clauses:
- following event
- cause
- related event
- elaboration

Figure 10: A partial representation of John's mental representation after he hears "I sent the manuscript to Mark and the next day..."

Possible type of following clauses:
- following event
- cause
- related event
- elaboration
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If Mary continues the sentence by saying "...and the next day he...", the representation for Mark will become increasingly activated, as John interprets Mark as the referent of the pronoun, and accesses his representation of Mark.

Thus, Goal Status influences discourse processing by partially activating goal-referents more than source-referents. This differential activation may occur before an anaphor is encountered, in essence making one referent more prominent than the other. Or, it may not occur until it becomes relevant for anaphor resolution processes. In either case, the partial activation from thematic role information facilitates comprehension.

Speakers have access to the same information as listeners, both in terms of the discourse record and the distributional patterns in English. The speaker therefore has a basis for constructing a model of the listener's model, which enables the speaker to choose pronouns whenever a referent is sufficiently accessible to the listener.

4.5.3. Future work

In this chapter I have suggested a new way of looking at implicit causality effects on pronoun resolution and reference form. I have suggested that thematic roles and connectors like "because" are part of a larger system, in which listeners try to build a model of how one clause relates to the previous one. However, this framework needs much work.

I have suggested that listeners relate one clause to the previous one on the basis of multiple constraints, and not just overt connectors or default biases. I suggested some possible constraints, like tense, aspect, and discourse genre, but these need to be investigated systematically. Furthermore, it is important to understand how these
constraints become integrated over time. When the listener is biased to expect one type of continuation, does this interfere with the interpretation of the next clause?

Furthermore, I have suggested that this framework is preferable to one that proceeds by "default" rules. However, this claim needs to be supported with systematic comparison of opposing models.

4.5.4. Conclusion

In the last four chapters I have presented evidence that choices in reference form parallel regularities in discourse structure. Roughly speaking, speakers use pronouns for the things they like to talk about. In this chapter, I extended this generalization to account for the influence of thematic roles. Unlike the other factors, thematic roles have more to do with meaning than form. This suggests that language processing is sensitive to knowledge about the world, and not only linguistic knowledge. This perspective is consistent with the view that linguistic behavior has access to other aspects of cognition, and isn't an encapsulated system (MacDonald et al., 1994:700; Tanenhaus et al., 1996).
Chapter 5

Conclusions

In this chapter I will summarize my findings, sketch a preliminary processing model for the comprehension of reference, and suggest directions for future work.

5.1 The findings

The goal of this dissertation was to understand why diverse linguistic factors influence choices in reference form. I considered five factors: Recency, Subjecthood, Focus, Parallelism, and Goal Status. All five had previously been shown to influence reference processing, yet there is otherwise nothing obvious that binds them together.

Through text analyses, corpus analyses, and experimentation, I demonstrated that all five factors share another property: each is associated with referents that have a higher probability of being continued in the following discourse than other comparable
CHAPTER 5: CONCLUSIONS

Recently mentioned referents are more likely to be referred to than referents that have not been mentioned for awhile; subject-referents are more likely to be subsequently mentioned than object-referents; focused referents more likely than nonfocused referents; parallel referents more likely than nonparallel referents; and goal-referents more likely than source-referents. A summary of these findings is depicted in Figure 2 from chapter 1, repeated here as Figure 1.

**Figure 1: A summary of the findings in this dissertation:**
All five factors are associated with both Reference Form and Reference Continuation

These data lead to the generalization that people use attenuated forms, like pronouns, to refer to the types of things they usually talk about.

There are two main questions that arise from these data. First, why do speakers tend to refer to referents associated with these five factors? I have suggested that for each factor, patterns of reference are best understood under the "language-as-action" approach to studying language use (H. Clark, 1996). This approach focuses on the fact that people use language for a purpose, whether that purpose is to coordinate a business transaction, relate a narrative, give a lecture, or something else. This means that discourses are driven by the goals and intentions of the discourse participants, at multiple levels. I have argued
APPENDICES

that the goal-driven nature of language underlies the association of Reference Continuation with each of the factors in Figure 1.

The second question that arises is why speakers use less-specified forms for referents with these properties. The language-as-action approach again offers an answer: people speak with the intention of communicating with their addressees (H. Clark, 1996). This means that on any given occasion, they design their utterances for their addressees, given particular local and global aims. From this generalization it is plausible to assume that speakers choose referential forms that will facilitate comprehension. Less-specified forms of reference are more efficient for all discourse participants, but in some cases comprehenders need more information to correctly identify the referent. This type of "listener accommodation" explanation also appears in other accounts of reference form and reference processing (e.g., Ariel, 1990:16; Clark and Marshall, 1981).

Because my account is one of listener accommodation, it is important to understand how each factor relates to processes of comprehension. In the preceding chapters, I suggested that the association of each factor with Reference Continuation has implications for how they are used during language processing. In the following section, I will offer some further speculations about how this information might be stored and used.

5.2. A constraint-based account of activation

Recent models of psycholinguistic processing have suggested that learning a language involves learning the correlations between forms and functions, and the degree to which they correlate, at multiple levels (e.g., Bates and MacWhinney, 1989;
MacDonald et al., 1994; Tanenhaus and Trueswell, 1995; Trueswell et al., 1994). Once learned, this information is used during language comprehension.\(^{35}\)

In this section, I will review two such approaches to language comprehension. Then I will propose a similar model for reference processing.

5.2.1. Competitive, constraint-based models

The Competition Model is one example of a competitive, constraint-based model that involves the use of probabilistic, correlational information (Bates and MacWhinney, 1989). Bates and MacWhinney argued that, during language comprehension, people interpret the input on the basis of competing "cues", which differ from one language to another. For example, understanding any sentence requires identifying which NP is the grammatical subject. In English, word order is a fairly reliable indicator of grammatical functions, so English speakers generally take the pre-verbal NP to be the grammatical subject. In contrast, word order in Italian is more flexible than in English, so it is less informative. (Bates, MacWhinney, and Smith 1983; Bates 1976). Instead, Italians rely more on pragmatic and morphological cues in identifying subject NPs. Bates and MacWhinney measured the relative strength of cues in different languages by presenting people with unusual or ungrammatical sentences and forcing them to decide on an interpretation. For example, when English speakers were presented with a sentence like "The pencil hits the cow", they tended to choose "the pencil" as the agent/subject. In contrast, when Italian speakers were presented with the Italian analogue "la mattia colpisce la vacca", they tended to choose the cow ("la vacca"). They claimed that Italians do not "trust" word order to the degree that English speakers do, and rely instead on

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\(^{35}\) Theoretically, this information should be used in production as well. However, most studies in these
pragmatic cues during the assignment of grammatical functions (Bates and MacWhinney, 1989:11).

Bates and MacWhinney argued that cross-linguistic variation in language comprehension can be studied in terms of the cues that are relevant for each language. The strength of a cue for a particular language can be measured in terms of its "cue validity", or the reliability of cues in a particular language (1989:41). While cue validity is a characteristic of the language itself, its psycholinguistic corollary is "cue strength":

This is a quintessentially connectionist notion, referring to the probability or weight that the organism attaches to a given piece of information relative to some goal or meaning with which it is associated. In other words, cue strength is the weight on the connection between two units.

In our psycholinguistic instantiation of this idea, each link between a given surface form and an underlying function is given a weight or strength. With this kind of mechanism, no sharp line is drawn between probabolistic tendencies and deterministic rules. An obligatory relationship between form and function is nothing other than a connection whose strength approaches unity. This permits us to capture statistical differences between adult speakers of different languages, and it permits us to describe facts about language change (in language history and/or in language learning) in gradual and probabilistic terms; we are not forced to postulate a series of all-or-none decisions in which parameters are

traditions so far have focused on comprehension processes.
definitively set and rules are added or dropped.

(Bates and MacWhinney, 1989:42)

Thus, cue strength is the weight of a given piece of linguistic information. For example, word order has a higher cue strength for English speakers than for Italian speakers for decisions about grammatical functions. According to this model, language acquisition is essentially learning the relative strengths of cues for a target language.

A similar approach has been developed in constraint-based models for the processing of lexical and syntactic ambiguities (e.g., MacDonald, 1993, 1994, 1996; MacDonald et al., 1994; Tabor et al., 1998; Spivey-Knowlton and Sedivy, 1995; Trueswell, Tanenhaus, and Kello, 1993; Trueswell, Tanenhaus, and Garnsey, 1994). These models propose that readers or listeners interpret ambiguous input on the basis of all available constraints. Constraints, like Bates and MacWhinney's cues, are features of the input (linguistic or otherwise) that support one interpretation over another. When all constraints point to the same interpretation, comprehension is easy, but when they conflict, comprehension is hard. Furthermore, these models suggest that syntactic and lexical ambiguities are processed with the same general mechanisms.

For example, a much-studied syntactic ambiguity is the main verb/reduced relative ambiguity, as in 1.
(1)  a. The horse raced past the barn.
    b. The horse raced past the barn fell. (Bever, 1970)

MacDonald et al. (1994) and others have argued that syntactic ambiguities like this one derive from the lexical ambiguity of "raced". In 1a, "raced" is a past tense main verb, while in 1b it is a past participle verb in a reduced relative clause. However, the two sentences appear identical until the very end, creating a temporary structural ambiguity. MacDonald et al. propose that ambiguous words like "raced" have ambiguities at multiple levels of representation, and that biases at each level can support one interpretation or another. For the main verb/ reduced relative ambiguity, they discuss five levels of ambiguity, listed in Table 1 (MacDonald et al., 1994:689)

<table>
<thead>
<tr>
<th>Table 1. Levels of ambiguity for the Main Verb/ Reduced Relative ambiguity</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. syntactic structure (main verb vs. reduced relative)</td>
</tr>
<tr>
<td>b. tense morphology (&quot;ed&quot; as past tense vs. &quot;ed&quot; as participle)</td>
</tr>
<tr>
<td>c. voice (active vs. passive)</td>
</tr>
<tr>
<td>d. argument structure (transitive vs. intransitive)</td>
</tr>
<tr>
<td>e. assignments of thematic roles to nouns in the sentence (e.g., subject as agent vs. subject as theme)</td>
</tr>
</tbody>
</table>

For example, consider the fragment "The evidence examined...." To arrive at a reduced-relative interpretation of "examined", it is also necessary to assign the role of theme to
"the evidence". The process of assignment is facilitated here, because "the evidence" makes a good theme, of "examine" but not a good agent. The reduced relative interpretation also requires the comprehender to interpret "examined" in the transitive frame. This process is also facilitated, because "examine" is an obligatorily transitive verb. Thus, MacDonald et al. argued that the reduced relative reading should be easier for fragments like this one than fragments without these properties.

Their claims have been supported by several studies. For example, Trueswell (1996) showed that the processing of this ambiguity is influenced by biases at two of these levels. First, it is influenced by the degree to which the initial noun is a plausible theme or agent for the following verb ("e" in Table 1). For example, it's plausible to think that a room would be searched, but not that it would search something, so "the room" is a good theme, but a bad agent. Therefore "the room searched" promotes the reduced relative interpretation, where the initial noun would have to be the theme. In contrast, "the thief" is a bad theme, but a good agent, so it would promote the main verb interpretation. Second, it is easier to arrive at a relative-clause interpretation if the "ed" verb form is often used as a participle, relative to the overall usage of the verb ("b" in Table 1).

In a word-by-word self-paced reading task, Trueswell had participants read sentences like those in 2 and 3.
(2) Exp. 1 (Trueswell, 1996): Initial noun is good theme, bad agent
   a. The room searched by the police contained the missing weapon.
   b. The room that was searched by the police contained the missing weapon.

(3) Exp. 2 (Trueswell, 1996): Initial noun is good agent, bad theme
   a. The thief searched by the police had the missing weapon.
   b. The thief that was searched by the police had the missing weapon.

The stimuli compared ambiguous reduced relative sentences (2a and 3a) with their unambiguous counterparts (2b and 3b). Half the items used verbs like "search" that had a low participle frequency (Low-PP items), half used verbs with a high participle frequency (High-PP items).

The results were reported in terms of the difference between the ambiguous sentences and the unambiguous sentence, in different regions of the sentence. The crucial region is at "by the police", which provides unambiguous support for the reduced relative reading. In Experiment 1, where plausibility supported the relative clause interpretation, the results showed processing difficulty only for the Low-PP items. That is, when the "ed" verb form was frequently used as a past participle, it biased the interpretation towards the reduced relative sufficiently that no processing difficulty occurred. In Experiment 2, by contrast, plausibility supported the main clause interpretation, and reading was slowed for both Low-PP and High-PP items. But the verb bias played a role in this experiment as well, in that it took longer for readers to "recover"
from the difficulty in the Low-PP condition than the High-PP condition. So, in the High-PP condition for Experiment 1, the reduced relative interpretation was supported by the plausibility information, the frequency information, as well as the disambiguating by-phrase. Since all constraints agreed with each other, no processing difficulty occurred. In other conditions, where the constraints did not support the same structure, processing was relatively slower. Thus, Trueswell's study demonstrated that syntactic ambiguity resolution is sensitive to contextual semantic constraints, as well as to the frequency with which a given form is used for a particular function.

Although the term "constraint-based" suggests that these models are principally about the use of multiple constraints, their most important feature is that the constraints are probabilistic and graded (Spivey-Knowlton and Tanenhaus, 1994:436). Trueswell et al. (1994) described their model of parsing as follows:

> The principles that underlie the approach are simple. Structures are partially activated with the strength of activation dependent upon their likelihood given the input. The effects of a contextual constraint will depend upon its strength and the availability of the alternative structures.

>(Trueswell, Tanenhaus, and Garnsey, 1994:304)

Thus, syntactic ambiguity resolution is influenced by essentially two things: the strength of the available constraints and the competition among alternative interpretations. Structures compete with each other in parallel, and are activated by constraints like lexical frequency and semantic plausibility.
For the purposes of my proposal, it is important to highlight the role that frequency plays in these models. Like the Competition model, constraint-based models assume that part of learning a language is learning the constraints of that language, and that constraints are built from a person's experience. One type of constraint is characterized in terms of lexical frequency information. In the example above, individual verbs differed in terms of the frequency with which they occurred in the form of a past participle relative to their overall frequency. The relative frequency of transitive and intransitive verb uses also influences the resolution of main verb/reduced relative ambiguities (MacDonald, 1994). The relative frequency of uses for a lexical item is hypothesized to be stored with that lexical item, available for use during language comprehension.

A particularly important aspect of these models is their emphasis on the role of the individual's experience in learning generalizations about the world, and thus the degree of constraint associated with different types of information. In some cases, constraints are associated with purely linguistic information, like the relative frequency of participial uses for a given verb. In other cases, however, constraints come from experience with the real world and the plausibility of certain events. Therefore it is possible for non-linguistic information to influence linguistic processing.

5.2.2. Reference processing

My proposal here is to approach reference processing in terms of constraint-based models. These models have been developed to deal with ambiguities at the lexical and syntactic levels; here I will consider referent identification as a type of ambiguity resolution in the referential domain. From these models I will adopt the features
described above: representations can be partially activated, based on probabilistic information that supports one interpretation over another. Activation changes dynamically as linguistic input is processed, and as different sources of information become available.

There are numerous other assumptions that my proposal makes, based on other work in discourse processing. These assumptions were detailed in §1.2.2.2; I will briefly review them here.

First, I assume that discourse processing involves a representation of the information shared between interlocutors, or the "common ground" (H. Clark, 1996). One part of the common ground is the discourse representation, which contains both the text model and the situation model. The text model is where linguistic input is briefly represented and parsed before it is used to update the situation model. The situation model contains information about the linguistic and nonlinguistic aspects of the discourse. In a face-to-face conversation, for example, it would contain information about the physical surroundings, the identity of the interlocutors, and also the linguistic component of the discourse. In a written text, by comparison, the reader's model would contain primarily the information from the text. The situation model includes representations of the discourse entities, the events, and the relationships among them. The representation of a particular entity might best be considered as a distributed representation, consisting of the conglomeration of features for that entity (Kawamoto, 1988; Seidenberg and McClelland, 1989). For ease of presentation, however, I will use local representations for discourse entities and other information in the situation model.
Thus, the sentence "John baked a cake" might have a situation model like that in Figure 2. An important feature of the representations of entities is that they can be activated to a greater or lesser degree. Activation, as before, is represented as the number and size of lines emanating from a particular representation.

Figure 2: Partial situation model for "John baked a cake"

When comprehenders construct text and situation models, they also need to access information stored in long-term memory. Grammatical knowledge is needed to parse the linguistic input. For example, "John ate the cake", results in a different (and more plausible) model than "John was eaten by the cake". World knowledge also plays a role in constructing the situation model. For example, if Alfred hears Sharon say "I bought a chair", she might envision a prototypical chair, with four legs, a straight back, and no arms. But Sharon's mental model might be different if she knows that Alfred was in the market for a big, comfy armchair. World knowledge also serves as the basis for making inferences, which also influence the situation model. For example, the sequence in 4 would lead to the inference that the picnic supplies contained beer, which would then be represented in the situation model.
(4) We checked the picnic supplies. The beer was warm.

(Haviland and Clark, 1974)

The comprehender's knowledge in long-term memory is also important for determining the activation of entities in the situation model. I have shown that five factors are associated with an increased probability that their referents will be referred to in the following utterance. I propose that this information is stored in long term memory, along with other information about those structures. For example, Jane's experience with the English language has endowed her with a concept of grammatical categories. She knows that subjects and objects map in systematic ways onto the thematic roles of a verb. I propose that her representation of the subject category also represents her experience with the discourse role of subjects, and her experience that subject-referents have a high probability of being referred to in the subsequent discourse. This knowledge might be represented in one of several ways. It may be represented directly in terms of the probability of subsequent reference. Or it may be represented in terms of an index of the speaker's attention -- that is, Jane's experience is that speakers tend to talk about subject-referents; this tells her that subject-referents are usually important to speakers, so they have a high probability of subsequent reference. Regardless of how it is represented, Jane's knowledge of the discourse role of subjects results in higher activation for subject-referents in her situation model. Her representation of the focus category in cleft constructions has a similar property, since through experience she knows that the focus-
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For both subject and focus categories, the information associated with them can be said to form part of Jane's linguistic competence. Similarly, her experience with parallel structures is also part of her linguistic knowledge. Jane's experience with discourse processing has shown her that parallel structures often have parallel referents. There are several possibilities for how information about parallelism may be represented. It may be stored in terms of syntactic structures, as in Figure 3.

**Figure 3: A possible partial representation of parallelism information**

Given two subsequent clauses with this structure:

- \( \text{NP}_1 \ [\text{VP} \ \text{NP}_2] \)
- \( \text{NP}_1 \ [\text{VP} \ \text{NP}_j] \)

There is a high probability that \( i=1 \) and \( j=2 \).

Parallelism may also have a more complex representation, such that the more features shared by two verbs, the higher the likelihood that the referents are parallel (Arnold, 1995, Smyth and Chambers, 1994).

In addition to linguistic knowledge, Jane also has world knowledge that influences her situation model and discourse processing. One relevant aspect is her knowledge that recency of mention is correlated with probability of subsequent reference. This might be represented in terms of the amount of time that has passed since a referent...
was mentioned, or the amount of new material that has been introduced to the discourse. On the other hand, this knowledge might be represented more generally in terms of focus of attention: the more recently something was mentioned, the more likely it is to be in the focus of attention of Jane's interlocutors. Finally, Jane's experience with the world has also taught her that people tend to be interested in goals and consequences. This information is also available to Jane when she constructs a situation model of a goal referent.

In sum, people's experience with a specific language and the world around them is recorded in long-term memory. I propose that part of their knowledge includes their experience of discourse patterns. Thus, for each of the five factors I have discussed, people represent their association with Reference Continuation.

How does this knowledge influence discourse comprehension? In the following section I will make some suggestions.

5.2.3. Referent activation during discourse comprehension

The following is a preliminary sketch of how referent activation may work during discourse comprehension. For presentational purposes, I will adopt a variant of the Interactive Activation model to describe my suggestions for referent activation (McClelland and Rumelhart, 1981). This and similar models were originally proposed to account for word recognition. MacDonald et al. (1994) used this architecture to describe a unified model of lexical and syntactic ambiguity resolution, in which they proposed to include syntactic information in the lexicon. So previous uses of the model have restricted themselves to processes relevant to the text model. Here I am proposing to extend the model one step further, to account for representations of entities in the
situation model. This step is a reasonable one to make, considering the evidence that parsing is influenced by the referential context of an utterance (e.g., Tanenhaus et al., 1996).

The interactive activation model has several properties helpful for describing my data. First, it works in terms of an activation metaphor. It consists of representations at several levels, each of which is called a "node". Nodes are local representations at each level, which means that each node represents the whole of a particular representation. For example, McClelland and Rumelhart (1981) posit a node for the word "cart", as well as nodes for the letters "c", "a", "r", and "t", and nodes for each letter feature (e.g., a horizontal line). There are advantages to using distributed representations instead, as some later connectionist models do (e.g., Kawamoto, 1988; Seidenberg and McClelland, 1989). However, I will stick with local representations for simplicity.

Nodes are connected to other nodes both within the same level and at adjacent levels, such that the activation of one node influences the activation of connected nodes. Nodes can be connected with either an excitatory or an inhibitory connection: excitatory connections increase the activation of connected nodes, inhibitory connections decrease it. In addition, the connections between nodes vary in their strength, which is specified as the "weight" between two nodes. The weight between two particular nodes reflects the degree to which one node supports the activation of another. In the case of an ambiguous word like "bat", the word node would be connected to semantic representations for both "bat-as-flying-mammal" and "baseball bat". The use of "bat" for the "baseball bat" meaning is more common than the "flying mammal" meaning (at least for some speakers
of American English), so the weight connecting the word "bat" to the meaning "baseball bat" would be relatively stronger.

At each stage of processing, each node can be activated to varying degrees, depending on the input. When an activated node stops receiving activation, it decays until it reverts to its initial state. This initial state, or "resting activation", may be different for different nodes. An important feature of the interactive activation model is that activation on a given node builds up over time. Thus, it contrasts with other models of language processing that assume that accessing information is essentially instantaneous (McClelland and Rumelhart, 1981:379).

For example, consider a situation in which Jane hears the sequence in 5. Assume that the characters in this sequence are known to both Jane and the speaker.

(5) a. John baked a cake for Mary.
    b. The next day he gave it to her.

When Jane hears 5a, she parses it and instantiates representations of "John", "cake", and "Mary" as nodes in her situation model. These nodes are associated with two kinds of nodes in long-term memory. First, they are associated with her conceptual knowledge of the referents. For individuals like "John" and "Mary", she accesses representations of those people; for indefinite referents like "cake", she accesses a representation of that type of object, which is influenced by her experience with prototypical instances of that category, and the most plausible instance for that given situation. Second, the entity nodes are linked with properties of the linguistic phrases used to introduce them to the discourse. Note that these properties are not a part of the situation model per se; rather,
the discourse entities are linked with the comprehender's stored knowledge about linguistic categories and their pragmatic uses. A partial picture of these representations is shown in Figure 4. In this picture, the only aspect of the linguistic phrase I am including is the information about grammatical function. Following McClelland and Rumelhart (1981) I am representing excitatory connections with arrows, and inhibitory connections with circles.

At the next time step, Jane parses 5b, which contains the pronoun "he". At this point, Jane is faced with the task of identifying the referent of the pronoun. Since pronouns are almost always used for referents that are already in the situation model of the listener, Jane knows to look for the referent there.
I propose that anaphor resolution proceeds in the following way: First, the referent-seeking anaphor becomes connected to properties in long-term memory. These connections are weighted to the degree that the listener knows that the referent for the anaphor has those properties. For example, given the anaphor "he", Jane knows that the referent is probably male and human. Therefore, the weight of the connection between "he" and the nodes for "male" and "human" is relatively high. At the same time, the anaphor develops inhibitory connections to the properties "female" and "nonhuman". Note that these connections represent the process of searching for a referent, and not the process of identifying the anaphoric expression itself.

In addition to properties like "male" and "human", the anaphor becomes connected to properties of the referents in the discourse model. These properties include information from each of the five factors I have discussed. In the preceding chapters I showed that each factor is associated with "Reference Continuation". I proposed that this information is stored as a part of an individual's linguistic knowledge, such that each factor carries information about the probability of subsequent reference. Here, I propose that this information is encoded in terms of the weights of the connections. In this example, Jane has the knowledge that the referents of anaphors are more likely to be subject-referents than object-referents or oblique-referents. Therefore, the weight for the connection with the node for "subject-referent" is higher than that for "object-referent", which is higher than that for "oblique-referent". In an actual implementation of this model, the weights would be specified as real numbers between 0 and 1. Here, however, I have merely indicated the relative weights of the connections, with the labels "high", "medium", or "low".
A portion of the referent resolution process is depicted in Figure 5. This picture is necessarily only a partial one, and makes one particularly dangerous oversimplification. In past chapters I have talked about referent activation partly in terms of how the referent is instantiated into the situation model. That is, subject-referents are instantiated with higher activation than object-referents. This view is consistent with the idea of "salience", that some referents have inherent properties that make them more activated. In this figure, however, I am focusing on the point in time where the anaphor is encountered. At this point, the relative probability of each referent is especially relevant, because the processing system is engaged in the task of identifying a referent for the anaphor. By placing the weights on the connections between the anaphor and the properties "subject-referent", "object-referent", etc., I am representing the fact that this information is relevant to the process of anaphor resolution. However, entities in the situation model do not start out with the same levels of activation, and factors like Subjecthood can influence the activation of referents from the moment they are entered into the situation model. This kind of activation is discussed further in §5.2.4, below.
Consider what happens as Jane tries to identify a referent for "he". The node for the anaphor partially activates the nodes for the properties of "subject-referent", "object-referent", and "oblique-referent". The only one that is connected with "John" is the node for subject-referent, so the partial activation associated with the subject-referent accrues to "John". Note that if "John" had been the object-referent, the same process would have occurred, except that the weight for the object-referent node is lower, so "John" would have received less activation. At the same time, the node for "he" sends activation to the
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nodes for "male" and "human". These connections are weighted relatively high, because the referents of "he" are usually male and human. Since "John" is also connected with these nodes, activation flows along these path to the node for "John".

While activation for "John" rises, the other referents also momentarily experience low levels of activation. "Mary" and "cake" receive low levels of activation from their association with the properties "object-referent" and "oblique-referent". The node for "Mary" is also associated with the "human" node, so it receives some activation from this route. However, the "female" and "male" nodes are mutually exclusive, so they inhibit each other. Therefore, as "male" rises in activation, "female" falls, thus decreasing the activation for "Mary". Similarly, the nodes for "John", "Mary", and "cake" are mutually inhibited, so as one node rises in activation, the other two will fall. This ensures that only one referent will "win out" as the correct choice. In this example, the unique match between "he" and "John" is sufficient for John to be chosen as the referent, but this kind of categorical cue is not necessary for successful referent activation, since information from the linguistic expression and inferential processes are hypothesized to also affect referent activation. An important feature of the interactive-activation model is that it allows the "wrong" choices to become partially activated. However, low levels of activation are not noticeable to the individual.

Thus, this example illustrates how Subjecthood affects the comprehension of an anaphoric reference. The support for "John" as the referent of "he" comes from three sources: 1) his association with the feature "male", 2) his association with the feature "human", and 3) his identification as subject-referent at the current moment in the discourse. It is important to note that the activation from his identification with the
feature "subject-referent" is only partial. By itself, it would not be enough to fully activate the node for "John". In combination with other information, however, it increases the rate at which the "John" node becomes activated, thus facilitating the interpretation of the anaphor.

The role of the Subjecthood constraint becomes clearer if we compare the previous example with the variant in 6.

(6)  a. John baked a cake for Mary.
    b. The next day she thanked him for it with a bottle of wine.

As with the previous case, the anaphor node ("she") is connected with the nodes for subject-referent, object-referent, and oblique-referent. These routes send partial activation to both "John" and "Mary", but relatively more activation to "John" as the subject-referent. At the same time, the anaphor "she" has excitatory connections with the properties "female" and "human". This ultimately results in the selection of "Mary" as the referent, but full activation occurs somewhat more slowly than in the previous example.

Just as this model can account for the influences of the Subjecthood constraint, it can also account for the other four factors discussed here. In each case, the bias toward one anaphor type over another is encoded in the weights of the connections. As an illustration of the remaining factors, consider the processing of the sequence in 7.
(7)  

a. What John gave to Mary was a cake.

b. She was really surprised.

Figure 6 shows a partial representation of the factors relevant for processing the anaphor "she" in 7b. The bold lines indicate the routes of activation for the connections with "high" weights, so the reader can better appreciate the effect of each factor on the activation of referents.
Figure 6: A partial model of referent resolution for the segment "What John gave Mary was a cake. She..."
In sum, this model encodes the effect of each factor in terms of the weights on the connections between the anaphor and each value for a given factor. The weights themselves can be thought of as the probability of output y given input x. That is, speakers of English learn over time that subject-referents have a high probability of being referred to in the following clause. Therefore, given an actual anaphoric form, there is a relatively high probability that the referent is the subject-referent of the previous clause. The competing values for a particular factor (e.g., subject-referent vs. object-referent) are also mutually inhibitory. This means that the actual activation of a given node is the combination of the excitatory activation and inhibitory activation from other nodes.

5.2.4. The dynamic nature of activation: pre- and post-ambiguity constraints

Language comprehension is an inherently dynamic process. It is not always possible to build a fully-specified interpretation of the input immediately, but evidence shows that processing is immediate and incremental for processing at lexical (Marslen-Wilson, 1990), syntactic (Frazier, 1987), and referential levels (Tanenhaus et al., 1996). This also means that the listener's model at any given point is a function of the information that is available at that point. During the interpretation of lexical and syntactic ambiguities, it has been noted that comprehension can be influenced by information that comes before the ambiguity itself (pre-ambiguity constraints), as well as information that becomes available after the ambiguity (post-ambiguity constraints) (MacDonald, 1994, 1996).

Recall that I am treating reference resolution as a type of ambiguity resolution. Therefore, information that is available before the referring form itself can be considered
a type of "pre-ambiguity" constraint. Consider the case where Jane hears "John baked a cake for Mary...." The subject-referent, John, has a higher probability of being subsequently referred to than either "cake" or "Mary". At the same time, there is a high probability that the discourse will continue after this clause, and furthermore that the following discourse will relate to the current utterance in some way, perhaps with an anaphoric reference. In essence, Jane can expect her interlocutors to be coherent.

Therefore, Jane can anticipate the occurrence of an anaphoric reference or inferentially related information to some degree. In anticipation of some unknown anaphoric reference, and based on the information that is available at this point, her representations for each discourse entity become partially activated. That is, the discourse referents receive partial activation before the anaphor itself is encountered. This can be considered "predictive" activation: subject-referents are more predictable than object-referents, so they become relatively more activated. Another way of saying this is that subject-referents have a high probability of being related to the speaker's local goals and intentions, and thus are relatively topical. However, it is important to realize that this level of predictability is partial, and it occurs as a side-effect of the aim of trying to process the input with efficiency.

It is also important to note that predictive activation will not have a noticeable effect in all cases. The information from the anaphor itself is far more important to its interpretation, so that no amount of predictive activation can override it. For example, even if you thoroughly expect a reference to "Mary", you won't mistake the word "John" as a reference to her. This reflects what Marslen-Wilson termed "bottom-up priority" (1987, cited by MacDonald et al., 1994).
Activation from pre-ambiguity constraints is only noticeable under two conditions. One is when an extremely strong pre-ambiguity constraint provides enough activation to facilitate or inhibit the processing of a subsequent anaphor. Two candidates for this kind of constraint are Recency and Subjecthood, which are both large, robust effects. Therefore, recent-referents and subject-referents have higher activation from the point they are instantiated in the situation model, and not just when an anaphor is encountered.

In chapter 3 I suggested that subjects and foci are tools for negotiating the salience of referents in common ground. Under the view of Subjecthood and Focus as pre-ambiguity constraints, "salience" can be considered to be the activation of referents in anticipation of a possible future reference to them. From the listener's point of view, this is the same thing as building a situation model that closely matches that of the speaker: some referents are more activated for the speaker; these are the referents that the speaker intends to talk about or interact with non-linguistically (see §5.3.2.3, below). The listener uses cues like these to infer which referents have a high probability of being important in the following discourse. Put another way, listeners infer which referents are important for the speaker.

A second condition where pre-ambiguity constraints would be noticeable is when two or more weak constraints combine with each other. An example of this type is Parallelism. As I suggested in chapter 2, parallelism information may be useful in conjunction with other constraints that herald the coming of an anaphor. If a subject anaphor is imminent, subject-referents may receive partial activation. If an object anaphor is imminent (signaled by a transitive-biased verb), object-referents may receive
partial activation. If there is not enough information to signal the coming of an anaphor, parallelism effects will not come into play until the anaphor itself is encountered.

Another example of this type is Goal Status, which interacts with other constraints that signal the type of continuation. When other constraints suggest that the incoming clause specifies the consequences of the preceding event, the goal-referent receives partial activation.

At the other end of the scale, referent processing is also influenced by information that follows the anaphor. In many cases, this information results from inferential processes, based on knowledge of the world and the situation. Consider the example in 8.

(8) a. Steve tried calling Tom. But he couldn't get through.

b. Steve tried calling Tom. But he wasn't at home.

In both 8a and 8b, the underlined pronouns are ambiguous at the point they are encountered. There are two discourse entities that match the features of the pronoun, so neither one is immediately selected. At this point the nodes for "Steve" and "Tom" are partially activated on the basis of their associations with other constraints, and "Steve" as subject-referent would be slightly more activated than "Tom". It isn't until the following context is processed that the referent becomes clear. In 8a, the bias toward "Steve" would be confirmed by the following context, and processing would be facilitated, but in 8b the bias toward "Steve" would slightly inhibit the selection of "Tom" as the referent of the anaphor.

In sum, I have suggested that referent resolution is a dynamic process, where referent representations become probabilistically activated by means of supporting
constraints. Referent representations also compete with each other, such that in most cases a given anaphor selects one and only one referent.

5.3. Future Work

The model I sketched in the preceding section is preliminary and somewhat speculative, and leaves many questions open. In this section, I will suggest a number of directions for future work. First, I will discuss how these data might be considered in an alternate model, Discourse Representation Theory. Second, I will discuss some specific questions raised by the approach I have taken.

5.3.1. Discourse Representation Theory

A useful direction for future work is to consider how my data might be treated with different theoretical architectures. The framework I chose for my discussion was that of constraint-based models. However, it is notable that these models have been developed to account for the processing of lexical and syntactic ambiguities. My extension of these models has the advantage that it uses the same mechanisms for discourse processing, and thus moves toward a unified account of language processing at all levels. However, it is worth considering how existing theories of discourse might account for the same data, and whether it would be profitable to adopt characteristics of other models. Although I must leave this topic for future research, I will briefly consider one such model here: Discourse Representation Theory (DRT).

DRT, (Kamp, 1981; Kamp and Reyle, 1993), is one example of a semantically-oriented discourse theory. It was originally developed to account for different kinds of anaphoric and scope relations, most notably the "donkey sentences", as in 9.
(9) If Pedro owns a donkey he beats it.

Every farmer who owns a donkey beats it. (Geach, 1962)

DRT is similar to other semantic theories in that it discusses information in terms of truth conditions, but one difference is that it looks at truth conditions over the domain of the discourse, rather than a sentence.³⁶

Under DRT, the representation of a discourse proceeds in terms of a Discourse Representation Structure (DRS). These structures contain representations of the discourse entities and their relations. Consider the example sentence "Fred likes Mary". First, the input is parsed into its syntactic structure. On the basis of this parse, the discourse entities are entered into the DRS. In this example, there are two discourse entities corresponding to "Fred" and "Mary". The discourse markers themselves are essentially variables, but they are given content by association with the referents denoted by each NP. Propositions are also specified in terms of discourse markers (DMs), as in 10.

³⁶ This review of DRT comes mostly from a summary presented by Stirling (1993:156-170)
(10) The DRS from the sentence "Fred likes Mary" (Stirling, 1993:161)

\[
\begin{array}{cc}
x_1 & x_2 \\
\end{array}
\]

Fred \((x_1)\)

Mary \((x_2)\)

like \((x_1, x_2)\)

Given this discourse structure, anaphoric references are linked to their referents by entering them into the DRS as DMs, and linking the DMs together with the notation \(x_i = x_j\). An example of a larger discourse is given in 11.
(11) The DRS from the discourse "Fred likes Mary. He gave her a cat. It is large and cunning." (Stirling, 1993:161-2)

One advantage to DRT is that it treats anaphoric and nonanaphoric NPs similarly: in both cases, a DM is entered into the DRS, and the only difference is whether it is linked
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to another DM. However, using DRT to model my data raises several challenges, since it makes several assumptions that are in direct conflict with what is known about language processing. To reconcile DRT with my data and other psycholinguistic findings, a number of changes would have to be made to DRT.

The first problem is that DRT builds the discourse model on the basis of the syntactic parse, thus positing two separate stages for syntactic and discourse processing. However, it is well established that syntactic processing proceeds incrementally, and that parsing decisions are immediately influenced by the referential context (e.g., Tanenhaus et al., 1996). This would not be possible if the parse were needed before the discourse representation could be built. Thus, it would be necessary to implement a procedure whereby syntactic and referential processing could proceed simultaneously and incrementally, and influence each other.

A second problem is that DRT seems to allow for only two psychological states for a discourse entity: an entity can either be available for anaphoric reference, or not. In contrast, my data and other findings on reference processing have shown that referents can have differing levels of activation in the discourse representation. Thus, DRT would need some way of representing differences in activation. One possibility would be to rank the DMs relative to each other, as Centering Theory does (Gordon and Hendrick, in press). However, this approach poses two problems. First, it requires that as the discourse proceeds, the relative ranking of the entities must change. However, it is not clear when the re-ordering process should take place. Centering ranks entities at the end of each sentence, but this does not capture the incremental nature of processing. The second problem is that my data do not support ranking as a mechanism for controlling
activation. For example, the data in §4.3 showed that people used pronouns more to refer to object-of-PP-referents when they were goal referents than when they were source-referents. That is, goal / object-of-PP-referents were more activated than source / object-of-PP-referents. However, in both cases the subject-referent was relatively more activated than the object-of-PP referent. This means that a ranking mechanism would not distinguish between goal- and source-referents, because both would merely be ranked second, relative to the subject-referent.

More generally speaking, it would be necessary to modify DRT to allow it to account for dynamic processes of language comprehension. It might be possible to update the DRS at smaller increments, like after each word. This would approximate a continuous model of processing, although it would not achieve the same level of continuity that is present in real language processing. For example, even lexical access proceeds incrementally, such that listeners can often identify a word before hearing all of it (Marslen-Wilson, 1990; Tanenhaus et al., 1996).

Finally, it would be necessary to develop some mechanism for generating the link between a given anaphor and referent. As DRT stands, links are merely posited. That is, it is possible for the linguist to represent the intended interpretation of an anaphor, but the model does not specify which referent is the most natural, or which processes would drive the choice of a referent.

In sum, using DRT to model my data poses a number of challenges. I have suggested a number of issues that would require attention if DRT were used to model psycholinguistic data, a task I leave for future work.
5.3.2. Further questions

Given the model I proposed in §5.2, a logical next step is to implement it, including all factors simultaneously. Although this would be a useful exercise, the model above makes many simplifying assumptions that would be problematic for a general model of reference processing.

5.3.2.1. Language processing as a dynamic process

One thing missing from the model above is a dynamic characterization of reference processing. Although the interactive activation model has a number of advantages for this kind of data, it represents a single point in time with respect to the input. Since McClelland and Rumelhart (1981) originally designed their model to account for word recognition in reading, it was reasonable for them to restrict the focus to a single time point, corresponding to an eye fixation on a word. Discourse processing, however, proceeds dynamically over time. So, for example, some constraints may come into play before an anaphoric form is encountered, whereas others may not be available until later.

5.3.2.2. How continuous is Recency?

The model in §5.2 also presents an overly simple view of recency as a dichotomous variable: recent vs. not-recent. However, the data in chapter 2 showed precisely the opposite, that recency influences reference form in a continuous way. At the very least, a model of reference processing needs to represent smaller distinctions in recency for referents, such as the number of clauses since the entity was first mentioned. One question for future research is whether recency is a completely continuous constraint, or whether it can best be characterized as discrete, on the level of the clause or
a clause-segment. My data also show that recency effects are modulated by such factors as differential interference from main and subordinate clauses (§2.3.1.3). Further work is needed to understand how this difference interacts with recency in a processing model.

5.3.2.3. Linguistic and nonlinguistic aspects of joint activities

A third area that needs development is the relation between reference and other ways of maintaining coherence in a discourse. I have focused on the forms of anaphoric reference used to evoke previously-mentioned entities. However, speakers often use other forms of linguistic cohesion such as bridging inferences (Clark and Haviland, 1977; Haviland and Clark, 1974). In an example like 4, above, the interpretation of the second sentence requires the comprehender to access the representation of "picnic supplies" and integrate with it the representation of "beer". The same factors discussed here should influence such inferences: they should be easier if "picnic supplies" had appeared recently, in subject or focus position, or as the goal of the previous proposition.

By the same token, people's knowledge of Subjecthood, Focus, and other factors is built from their experience with both anaphoric reference and other inferential processes. That is, Mark's experience with English has shown him that when something is mentioned in subject position, it has a high probability of being important to the following discourse. I have discussed this mostly in terms of direct anaphoric references. However, I have assumed that the association between these factors and Reference Continuation encompasses cases where the subsequent reference is indirect, as with inferences and part-whole relationships. For example, imagine that Jane says to Mark "The fruit at Safeway is really good this week. I especially like the oranges." Mark's comprehension of "oranges" requires accessing the previous referent "the fruit at
Safeway". Even though this is not a direct anaphoric reference to a specific entity, Mark can still take it as evidence that the most topical referent of the first sentence was "fruit at Safeway", in the sense that this is what Jane intended to talk about. This example would count as an instance in which the subject-referent of the first sentence was continued in the next one, thus contributing to Mark's knowledge of the correlation between Subjecthood and Reference Continuation. I have assumed that Reference Continuation is sensitive to part-whole relationships and other types of anaphoric links; this is what motivated my decision to include categories "part of" and "related to" in the corpus analyses in chapters 3 and 4.

This idea can be extended even further. When Mark learns that the subject-referent is what is most likely to be important to the speaker in the following discourse, he knows more than just how the speaker will use that referent linguistically. More generally, he knows that the referent is important to the speaker, and will be important to their joint activity as a whole. I have focused here on linguistic factors and linguistic patterns, but language is often just one part of a joint activity, used along with non-linguistic types of action (H. Clark, 1996). Thus, once an entity has been brought into the common ground, participants in the joint activity can cause other participants to access it again, using either linguistic or non-linguistic means. For example, imagine that Jane and Mark are baking a cake together. If Jane hands a cake pan to Mark, she does not need to say anything, yet Mark will activate a representation for the pan. This could be called nonlinguistic reference -- Jane referred to the pan, but not with words.

Nonlinguistic reference probably plays a role in the formation of the categories of Recency, Subjecthood, Focus, and Goal Status. It would not play a role in Parallelism,
because this depends on the structural relation between a linguistic anaphor and its linguistic antecedent. For the other factors, once a referent has been mentioned, especially as subject, as focus, or in the role of goal, it becomes more probable that it will be important to the following activity. This activity may include discussing it linguistically, manipulating an object physically, both. In all cases, the frequency with which it is important to the following activity is stored as a part of an individual's knowledge of that category (perhaps as a ratio of the number of times a particular type of referent is continued out of the total number of times that type of referent is encountered).

Thus, Mark's experience with English and the world leads him to believe that things mentioned in subject position have a higher probability of being important to the speaker than things mentioned in object position. His experience comes from exemplars where the speaker said "Frank is late. He got stuck in traffic," as well as cases where the speaker said "The pizza's here!" and handed him a slice.

One direction for future exploration is the relation between linguistic factors like Subjecthood and the speaker's nonlinguistic actions. This poses numerous challenges, one of which is how to define "nonlinguistic reference". How do speakers make someone else pay attention to a particular object in the environment? Likely candidates are eye gaze or gestures (e.g., handing an object to someone). Another issue is the difference between things that attract attention for communicative reasons, and things that attract attention because of some inherent salience, like a loud explosion. If Jane and Mark are co-present during an explosion, Mark can assume that the event was activated for both of them, but he cannot assume any relation between the explosion and Jane's prior utterances. In contrast, if Jane says "the pizza's here!" and hands Mark a slice, he
can reasonably infer a relation between the utterance and the subsequent gesture, and thereby learn facts about how people use language (see Baldwin and Tomasello, 1997).

5.3.2.4. Comprehension and production

I have discussed my general findings in terms of the activation of referents, focusing on how certain constraints are likely to influence reference comprehension. I have assumed throughout that the comprehension of referring forms is important to the speaker's choices of form. I made this assumption on the basis of the observation that discourse is a joint activity, and therefore speakers design their utterances for the purpose of communicating with their interlocutors (H. Clark, 1996). I therefore assumed that speakers' choices are made in part to facilitate comprehension for the listener, which will have the overall effect of facilitating communication. This assumption of "listener accommodation" contains the additional assumption that speakers maintain a representation of the common ground they share with their interlocutors (H. Clark, 1996:43). They believe this representation is shared to a certain degree by all discourse participants (p. 49).

These assumptions raise two questions. First, how detailed is the representation of the common ground? If Jane has a conversation with her mother, does her model include the history of their shared experiences? Does she construct active representations of every object in their physical surroundings? Clark and Marshall (1981) suggest that communication follows certain "co-presence heuristics", such that discourse participants construct detailed models of the interlocutors, based on both their shared experience (linguistic and nonlinguistic) and their knowledge of each others' community membership. These proposed models are fairly detailed:
When Ann talks to Bob, she creates in memory a model of what is in Bob's mind - his knowledge, his perceptions, his current thoughts -- and she constantly updates it. Bob carries along a similar model of what is in Ann's mind. These models must include the right diary entries and encyclopedia chapters. Ann's model of Bob would contain all those chapters of her encyclopedia that correspond to communities she knows he belongs to.

(Clark and Marshall, 1981:56)

Clark and Marshall's argumentation supports the idea that speakers are able to access extremely specific knowledge about their interlocutors during conversation. On the other hand, memory limitations would prevent people from maintaining detailed models of their interlocutors in working memory. Do speakers represent every detail of the listener's knowledge in working memory, or is some information stored in a semi-accessible region in long-term memory, like Kintch's (1993) "extended working memory"? How much of this information is used on-line during language production?

There is evidence that speakers do not maintain models of every piece of information that is relevant for efficient communication. Anderson et al. showed, for example, that speakers speak less clearly during face-to-face conversations, when it was possible for the listeners to use visual articulatory information from faces (mouth gestures) to aid comprehension. However, they also showed that pronunciation did not vary according to whether speakers and addressees were looking at each other at a
APPENDICES

particular moment in the conversation. They concluded that speakers kept track of listener needs at a very gross level, but were not able to make finer, moment-to-moment distinctions. Further research on speakers' representations of common ground is important to understanding the relationship between reference comprehension and the choice of reference form in production.

A second question is whether Jane's choice of referring form is entirely driven out of consideration for her mother. Some production decisions may occur for "selfish" reasons, driven by constraints on planning and production. For example, in Arnold et al. (1998) we followed Wasow (1997) in arguing that constituent order is influenced at least in part by ease of production. With respect to patterns of reference and choice of referring form, it is important to discover whether any speaker choices are made with complete disregard for the listener's needs. The answer to these question would indicate the degree to which discourse patterns are driven by conscious, communicative strategies of the speaker, and the degree to which listener needs are taken into account in choice of reference form.

One area to study this issue is where the referring form is ambiguous with respect to the discourse context. With the factors discussed here, there is no a priori way to distinguish between the speaker's needs and the listener's. Since all five constraints (Recency, Subjecthood, Focus, Parallelism, and Goal Status) are properties of the linguistic context, an alternate story is possible: speakers could use pronouns only for the referents that are most activated in their own minds. Under this view, the correlation of each factor with Reference Form and Reference Continuation would have nothing to do
with the listener's needs, but would merely reflect the fact that the things speakers talk about are active, so they use pronouns for them.

However, this story would not account for the tendency for speakers to use pronouns more often in situations where they are unambiguous. One feature of pronouns is that they provide very little information about their referents, so in many cases they may be ambiguous, as in 12a. However, often there is only one matching referent in the discourse situation, in which case there is no real ambiguity, as in 12b.

\[(12)\]

- a. Nancy invited Alana to a party. She...
- b. Nancy invited Ted to a party. She...

Francik (1985) investigated reference form by having people look at comics and describe the story. Some people saw stories about a boy and a man (same-gender condition), some saw stories about a girl and a man (different-gender condition). Overall, people used pronouns more often in the different-gender condition.

Francik's data would be difficult to account for without assuming that speakers are at least somewhat sensitive to the needs of their addressees. Assume that in both 12a and 12b, the speaker wanted to talk about Nancy in the second utterance. 12a and 12b are identical except for the gender of the second character. Thus, from the speaker's perspective, the referent for "Nancy" should be equally active in both cases. The only difference is the degree to which the referring form would be ambiguous. From the listener's perspective, on the other hand, the importance of ambiguity is obvious. The gendered pronoun provides unambiguous information about the referent in 12b, but not in
12a. Therefore, if the speaker's decision is influenced by the potential ambiguity of the referring form, it signals an attempt to facilitate comprehension for the listener.

Finally, the data and model I presented raise another question: do these factors influence on-line processes? I have argued that they are relevant because they facilitate or inhibit the process of anaphor resolution in language comprehension. However, with the exception of the experiment in §4.3., most of my data came from off-line measures. Other researchers have shown with on-line studies that anaphor resolution is influenced by Subjecthood (Gordon et al., 1993; Hudson-D'Zmura and Tanenhaus, 1998), Focus (Almor, 1995), Parallelism (Smyth and Chambers, 1996), Recency (Clark and Sengul, 1979), and Goal Status (Stevenson, 1995). The next step would be to show that these factors also influence on-line processes in the speaker's choice of referring forms in production.

5.4. Final words

The most important contribution of the present studies is that they reveal a commonality among Recency, Subjecthood, Focus, Parallelism, and Goal Status. Until now, these factors merely looked like a laundry list of things that affected anaphor resolution and choice of reference form. I have shown that they are all associated with an increased probability of subsequent reference to their referents. I suggested that this association leads them all to facilitate anaphor resolution. The reasons these patterns exist are somewhat different for each factor, but they all derive from generalizations about how people use language. My proposal predicts that choices in reference form should be influenced by any factor in a given language that is related to regular patterns of reference in that language. In sum, the cognitive processes involved in communication
are the result of the social experience of individuals, and their ability to convert experience into knowledge for future use.
Appendices

Appendix A: Stimuli from Topic/Focus Experiment

1. **Without cleft / NP1 referent**
The camp counselors took all the children and paired them up randomly for a game. Fortunately, Judy ended up with Sarah.
{Judy/ She} was glad to be with someone she knew.

**Without cleft / NP2 referent**
The camp counselors took all the children and paired them up randomly for a game. Fortunately, Judy ended up with Sarah.
{Sarah/ She} was known as the best kid in camp at all sports and games.

**With cleft / NP1 referent**
The camp counselors took all the children and paired them up randomly for a game. Fortunately, the one Judy ended up with was Sarah.
{Judy/ She} was glad to be with someone she knew.

**With cleft / NP2 referent**
The camp counselors took all the children and paired them up randomly for a game. Fortunately, the one Judy ended up with was Sarah.
{Sarah/ She} was known as the best kid in camp at all sports and games.

2. **Without cleft / NP1 referent**
The faculty met the other day to discuss the candidates for the new job. Carol supported Eleanor.
{Carol/ She} tried earnestly to convince the other members of the faculty as well.
Without cleft / NP2 referent
The faculty met the other day to discuss the candidates for the new job. Carol supported Eleanor.
{Eleanor/ She} was the youngest candidate but the most impressive.

With cleft / NP1 referent
The faculty met the other day to discuss the candidates for the new job.
The one Carol supported was Eleanor.
{Carol/ She} tried earnestly to convince the other members of the faculty as well.

With cleft / NP2 referent
The faculty met the other day to discuss the candidates for the new job.
The one Carol supported was Eleanor.
{Eleanor/ She} was the youngest candidate but the most impressive.

3. Without cleft / NP1 referent
By the time the project was turned in, everybody in the group hated everybody else. Stacy hated Diane the most.
{Stacy/ She} couldn't stand people who didn't pull their weight in a group project.

Without cleft / NP2 referent
By the time the project was turned in, everybody in the group hated everybody else. Stacy hated Diane the most.
{Diane/ She} had done nothing but complain and boss other people around.

With cleft / NP1 referent
By the time the project was turned in, everybody in the group hated everybody else. The one Stacy hated the most was Diane.
{Stacy/ She} couldn't stand people who didn't pull their weight in a group project.

With cleft / NP2 referent
By the time the project was turned in, everybody in the group hated everybody else. The one Stacy hated the most was Diane.
{Diane/ She} had done nothing but complain and boss other people around.

4. Without cleft / NP1 referent
The fencing coach told everyone in the class to find a partner. Tim asked Sean.
{Tim/ He} always tried to fence with people who were better than he was.

Without cleft / NP2 referent
The fencing coach told everyone in the class to find a partner. Tim asked Sean.
{Sean/ He} was not only a good fencer but also a good teacher.
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With cleft / NP1 referent
The fencing coach told everyone in the class to find a partner. The one Tim asked was Sean.
{Tim/ He} always tried to fence with people who were better than he was.

With cleft / NP2 referent
The fencing coach told everyone in the class to find a partner. The one Tim asked was Sean.
{Sean/ He} was not only a good fencer but also a good teacher.

5. Without cleft / NP1 referent
The coach told all the girls on the varsity team to help those on the JV team. Erica had to help Elaine.
{Erica/She} hated having to spend time helping the younger players.

Without cleft / NP2 referent
The coach told all the girls on the varsity team to help those on the JV team. Erica had to help Elaine.
{Elaine/She} was hard to help because she wasn't very motivated.

With cleft / NP1 referent
The coach told all the girls on the varsity team to help those on the JV team. The one Erica had to help was Elaine.
{Erica/She} hated having to spend time helping the younger players.

With cleft / NP2 referent
The coach told all the girls on the varsity team to help those on the JV team. The one Erica had to help was Elaine.
{Elaine/She} was hard to help because she wasn't very motivated.

6. Without cleft / NP1 referent
The guests were nervously standing around the living room, trying to decide which person to talk to. Ann decided to say hi to Emily first. {Ann / She} hated to be in a room full of people where no-one was talking.

Without cleft / NP2 referent
The guests were nervously standing around the living room, trying to decide which person to talk to. Ann decided to say hi to Emily first. {Emily/She looked like the friendliest person in the group.

With cleft / NP1 referent
The guests were nervously standing around the living room, trying to decide which person to talk to. The one Ann decided to say hi to first was Emily. {Ann / She} hated to be in a room full of people where no-one was talking.
The guests were nervously standing around the living room, trying to decide which person to talk to. The one Ann decided to say hi to first was Emily.

Emily looked like the friendliest person in the group.

The runners stood at the starting line, sizing each other up. Amy had to watch out for Cynthia. She was cautious of anyone who looked that confident.

Amy had to watch out for Cynthia. She was known for tripping her opponents at the far end of the track.

The Smith brothers were trying to decide which friend to invite skiing. Ron wanted to invite Fred. He felt guilty not being able to bring all his friends.

Fred had never been skiing before and would love the chance to try it.
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9. **Without cleft / NP1 referent**
The students found out that somebody had vandalized the classroom, but nobody knew who.
John suspected Tom.
{John/He} couldn't imagine anyone else doing such an awful thing.

**Without cleft / NP2 referent**
The students found out that somebody had vandalized the classroom, but nobody knew who.
John suspected Tom.
{Tom/He} was the most violent student in the class.

**With cleft / NP1 referent**
The students found out that somebody had vandalized the classroom, but nobody knew who.
The one John suspected was Tom.
{John/He} couldn't imagine anyone else doing such an awful thing.

**With cleft / NP2 referent**
The students found out that somebody had vandalized the classroom, but nobody knew who.
The one John suspected was Tom.
{Tom/He} was the most violent student in the class.

10. **Without cleft / NP1 referent**
The students filed into the class on the first day of school and looked for seats.
Alex sat next to Tony.
{Alex/ He} was careful to sit next to someone he liked on the first day.

**Without cleft / NP2 referent**
The students filed into the class on the first day of school and looked for seats.
Alex sat next to Tony.
{Tony/ He was the new kid and looked like he needed a friend.

**With cleft / NP1 referent**
The students filed into the class on the first day of school and looked for seats.
The person Alex sat next to was Tony.
{Alex/ He} was careful to sit next to someone he liked on the first day.

**With cleft / NP2 referent**
The students filed into the class on the first day of school and looked for seats.
The person Alex sat next to was Tony.
{Tony/ He was the new kid and looked like he needed a friend.
11. **Without cleft / NP1 referent**
The TAs for the class were trying to think of someone to invite as a guest lecturer. Immediately Jason suggested Andy. {Jason/He} had been a TA before and knew who would be good.

**Without cleft / NP2 referent**
The TAs for the class were trying to think of someone to invite as a guest lecturer. Immediately Jason suggested Andy. {Andy/He} was a salient researcher as well as a good speaker.

**With cleft / NP1 referent**
The TAs for the class were trying to think of someone to invite as a guest lecturer. The person Jason suggested immediately was Andy. {Jason/He} had been a TA before and knew who would be good.

**With cleft / NP2 referent**
The TAs for the class were trying to think of someone to invite as a guest lecturer. The person Jason suggested immediately was Andy. {Andy/He} was a salient researcher as well as a good speaker.

12. **Without cleft / NP1 referent**
At the end of each year the high school basketball team votes for "Player of the Year". This year, Eric voted for Nathan. {Eric/He} always voted for the best defense player rather than the best all-around player.

**Without cleft / NP2 referent**
At the end of each year the high school basketball team votes for "Player of the Year". This year, Eric voted for Nathan. {Nathan/He} was the best all-around player on the team.

**With cleft / NP1 referent**
At the end of each year the high school basketball team votes for "Player of the Year". This year, the one Eric voted for was Nathan. {Eric/He} always voted for the best defense player rather than the best all-around player.

**With cleft / NP2 referent**
At the end of each year the high school basketball team votes for "Player of the Year". This year, the one Eric voted for was Nathan. {Nathan/He} was the best all-around player on the team.
Appendix B: Stimuli from Goal/Source Experiment

Goal-Source Verbs

1. I hate getting sick. It always seems like everyone gets sick as soon as it's vacation. Marguerite caught a cold from Eduardo two days before Christmas.

2. My physics class gets out at 7 pm and it's already dark then. A lot of people have trouble getting home. Annette usually catches a ride from Scott.

3. The U2 concert was sold out a week before the show. Scalpers were selling tickets for ridiculous prices. Fortunately Rafael got a ticket from Gabrielle.

4. My high school friends really try to keep in touch with each other. It's a lot easier now that we have email. Today Gladys got three emails from Carlos.

5. Getting a telegram always scares me. It has to be either great news or awful news. Juan received a telegram from Claire when their mother died.

6. No-one was supposed to know about the lay-offs in our company. Of course, everyone did anyway. Jennifer heard the news from Pablo.

7. The high school prom was around the corner. The whole senior class had agreed to do a performance of the "Macarena". Sonia quickly learned the steps from Allen.

8. The day before the exam, my whole study group was in a panic. It was 3 am, and no-one could figure out problem #3. Elizabeth had to borrow the notes from Art.

9. Anyone who's anyone in Washington should be seen at the presidential inauguration. It's also really important who your date is. Courtney accepted an invitation from Bruce.

10. Our class presentation went okay, but not great. No-one in our group is a good speaker, but some are better than others. Craig should take some lessons from Pam.

11. Yesterday was probably the most exciting football game in the high school's history. A fight broke out, but not among the players - it was among the cheerleaders. It started when Blaire grabbed the megaphone from Ed.

12. My little brother and sister got into a big fight the other day. They both wanted the last piece of Halloween candy. The fight ended when Greg snatched the candy from Linda.
13. Summer weekends are the perfect time to get away. There are many ways to travel besides cars. Last summer, Mimi rented an old bicycle from Victor.

14. It's funny how people like to point out how kids resemble their parents. But in fact it's often really striking. In my family, for example, Nick inherited big feet from Christine.

15. The amateur art show was held yesterday at the local high school. Some of the items were even for sale. Dan purchased a painting from Barb.

16. It's amazing the things you can buy used at Stanford. You can get things really cheap, especially at the end of the year when everyone is leaving. Last year Ryan bought a stereo from Delia for $50.

Source-Goal Verbs

1. It was the final game in our company's softball tournament. The game was tied and everyone was on the edge of their seats. Fred threw the ball to Ginny.

2. The whole office was busy getting ready for the big presentation. It seemed like they would never be done. Finally Christopher handed the report to Stacy.

3. Yesterday we had our annual church picnic. We had a great game of "Toss the Egg". The best part was when Brett tossed the egg to Cathy.

4. The drama club was worried that no-one would come to the opening performance of their play. Everyone agreed to try to get all their friends to come. Erin sent an invitation to Bill.

5. Information travels fast in my school, especially gossip. When Jan and Andy broke up, everyone knew when, why, and how within days. It started when Marie told the story to Rick.

6. Yesterday our dorm's intramural basketball team played in the last game of the season. It was a big deal, because this game determined who would go to the finals. With 30 seconds to go, Holly passed the ball to Jason.

7. The students in my English class had to decide what order to give our presentations in. It was hard, because no-one wanted to go last. Tina offered the first slot to Matt.

8. The Jacksons had no trouble getting their beach house taken care of while they were on sabbatical. Lots of people offered to look after the place for them. However, Eloise had already rented the house to Andy.

9. Everyone pitched in to get the neighborhood party off the ground. Lots of people brought burgers and chicken patties. Phyllis loaned a barbecue to Wiley.
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10. The professors in the music department were all in a good mood. The first day of music lessons had gone unexpectedly well. Melora taught a sonata to Mike in an hour and a half.

11. I'll never forget the Christmas party this year. Even the shy people were dancing. Cynthia taught the lambada to Sean.

12. Everyone was shocked when the Cowan family got into a car wreck. Everyone wanted to do something to show their sympathy. Sam brought flowers to Ali in the hospital.

13. There was so much food for Thanksgiving, we didn't even eat half of it. Everyone got to take some food home. Lisa gave the leftover pie to Brendan.

14. The Donaldsons recently moved to India. They had to get rid of everything before they left. Anna sold the couch to Frank.

15. The art museum was packed when the fire broke out. Everyone can remember exactly what they were doing when the alarm sounded. Ray was showing a Van Gogh to Betty.

16. There are lots of opportunities for teenagers to make money in part-time jobs. It's possible to make quite a bit of money by babysitting. Phil paid $200 to Emily for a full weekend.
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