

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.¹

¹ 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.

- (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).

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

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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,

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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.

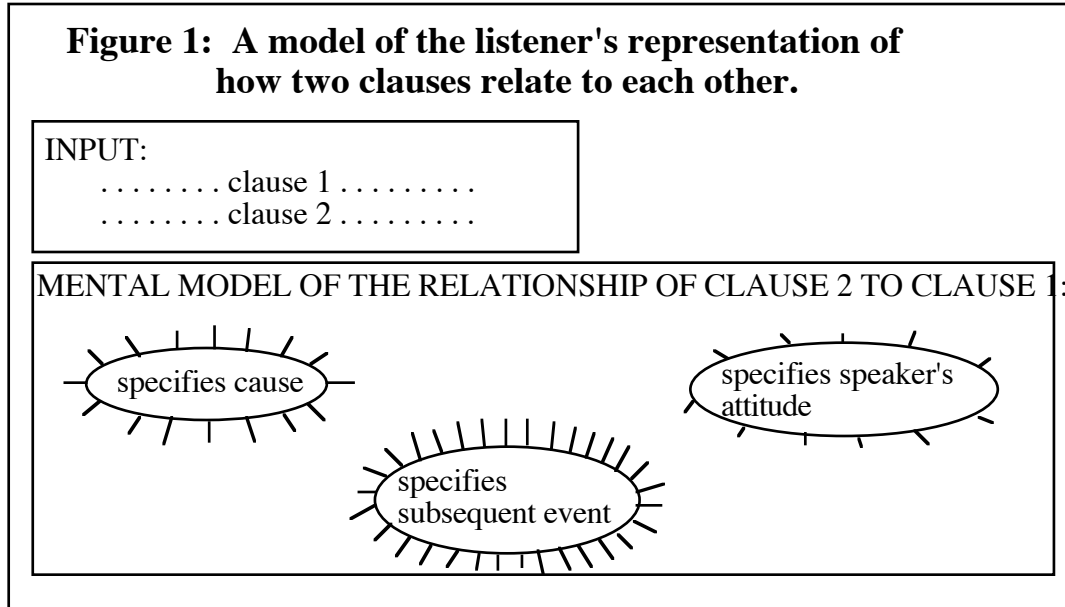
- (2) a. I sent a letter to my sister.
source **goal**
- b. My sister also received a letter from her boyfriend.
goal **source**
- (3) a. The boat traveled from Brindisi to Athens.
source **goal**
- b. I ran from my house to the corner.
source **goal**

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.

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- (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 sang¹.

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 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.

¹ This example comes from Schwenter (1998:25).

- (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

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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

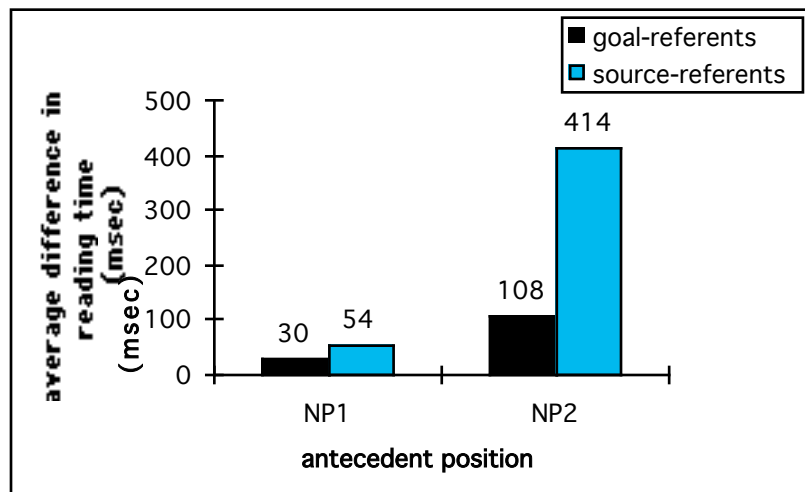
For the studies in this chapter I have chosen to focus on two thematic roles: goal and source. These roles provide a good testing ground for my ideas because they often appear together, but the subject is the source in some verbs (e.g., *send*) and the goal in others (e.g., *receive*). This feature is 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 (= (average RT for pronouns) - (average RT for names)). Figure 2 presents the average reading times separately for NP1 antecedents (i.e., subject antecedents) and NP2 antecedents.

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

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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 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

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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 2¹

Source-Goal Verbs	Goal-Source Verbs
bring	accept
give	borrow
hand	bought
loan	catch (used twice)
offer	get (used twice)
pass	grab
pay	hear
rent	inherit
sell	learn
send	purchase
show	receive
teach (used twice)	rent
tell	snatch
throw	take
toss	

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

¹ 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.

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.

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 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.

RELATION	EXAMPLE
cause	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. <u>Gabrielle's friend Phil couldn't make the concert.</u>
consequence	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. <u>It kind of put a damper on the Christmas festivities.</u>
elaboration	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. <u>That is really fast.</u>
related	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. <u>I was wondering if I should ask Scott to give me a ride also.</u>

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 significantly correlated with the dependent variable. These are the same questions that can be

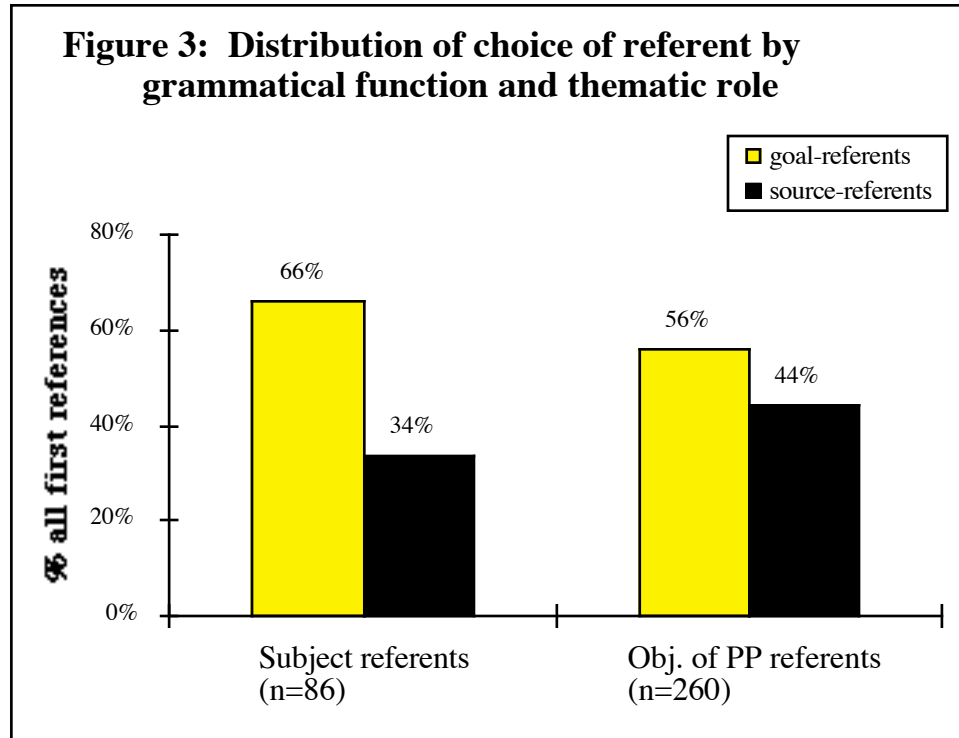
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investigated with analyses of variance (ANOVA), as I did in chapter 3. However, while ANOVA requires a scalar dependent variable, logistic regression can be used with categorical dependent variables, such as the ones investigated in this experiment. 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.



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) ($-2 * \text{Log LR} = 14.513, df=1, p < .0001$).¹ 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.²

¹ 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.

² 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 continuation referred to both the source and the goal referents. These results followed the same pattern as the results using only the first references.

% References to goal or source referents in each position	% References to goal or source referents in each position	
	goal-referents	source-referents
Subject-referents (n=126)	68%	32%
Object-of-PP-referents (n=286)	56%	44%

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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.

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 than 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.

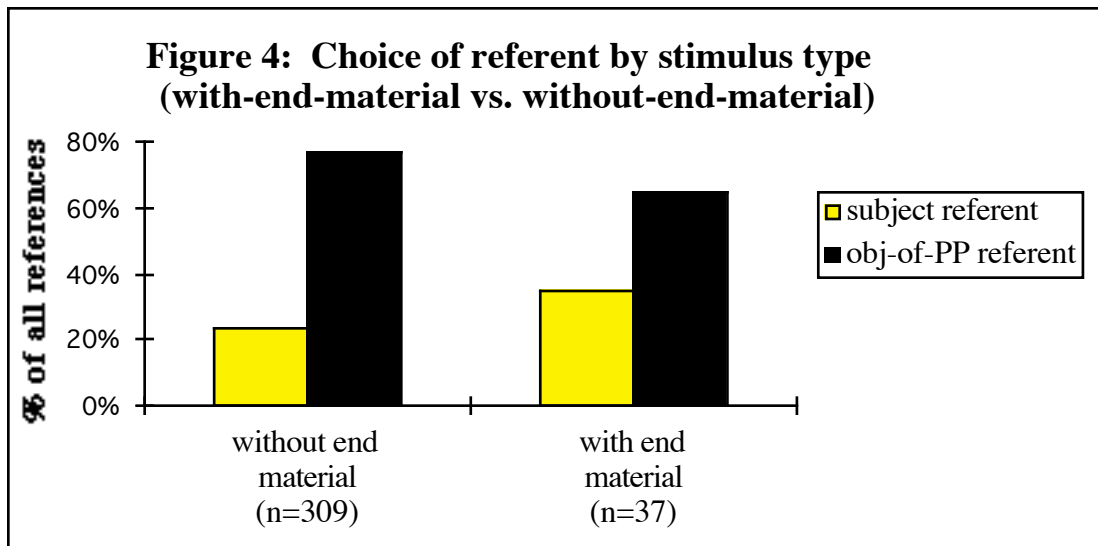


Figure 4 shows that participants referred to the object of preposition more often when there was no intervening material. This effect of end material (present vs. absent) was significant ($-2 * \text{Log LR} = 3.962$, $df=1$, $p < .05$). However, the presence of end material did not entirely

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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.

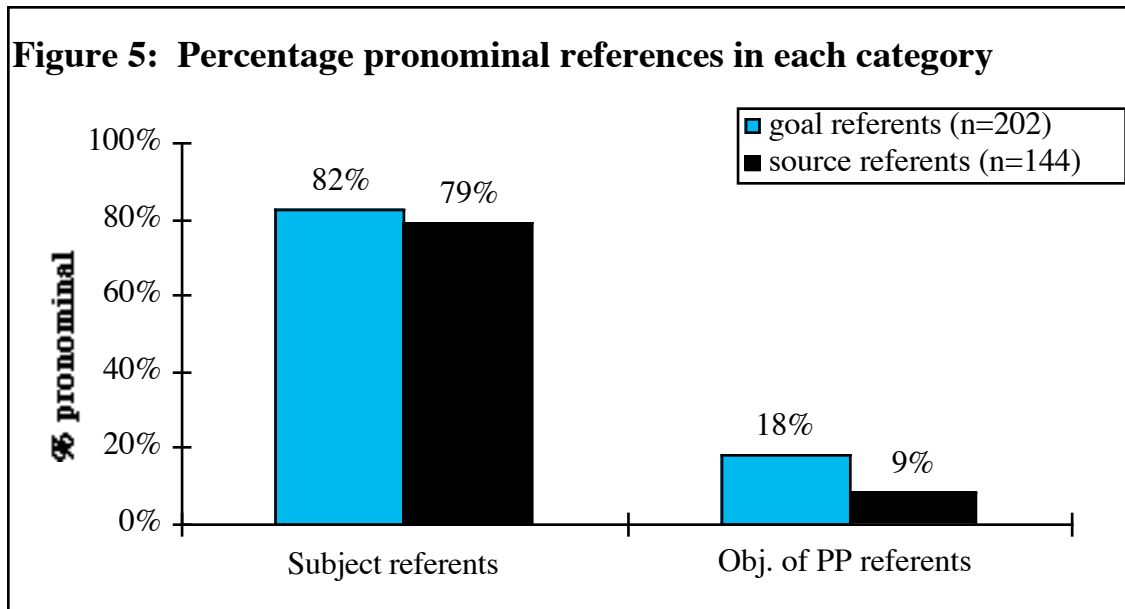
4.3.3.2. Were pronouns used more for goal or source-referents?

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.¹

¹ 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

	Goal (n=245)	Source (n=167)
Subject referent	71%	70%
Object of PP referent	21%	11%



These data reveal two patterns. First, the use of pronouns was far greater for subject referents ($-2^* \text{Log LR}=131.640$, $df=1$, $p<.0001$). 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 ($-2^* \text{Log LR}=4.076$, $df=1$, $p<.05$). 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.

4.3.3.3. The relationship of continuation sentences to the story

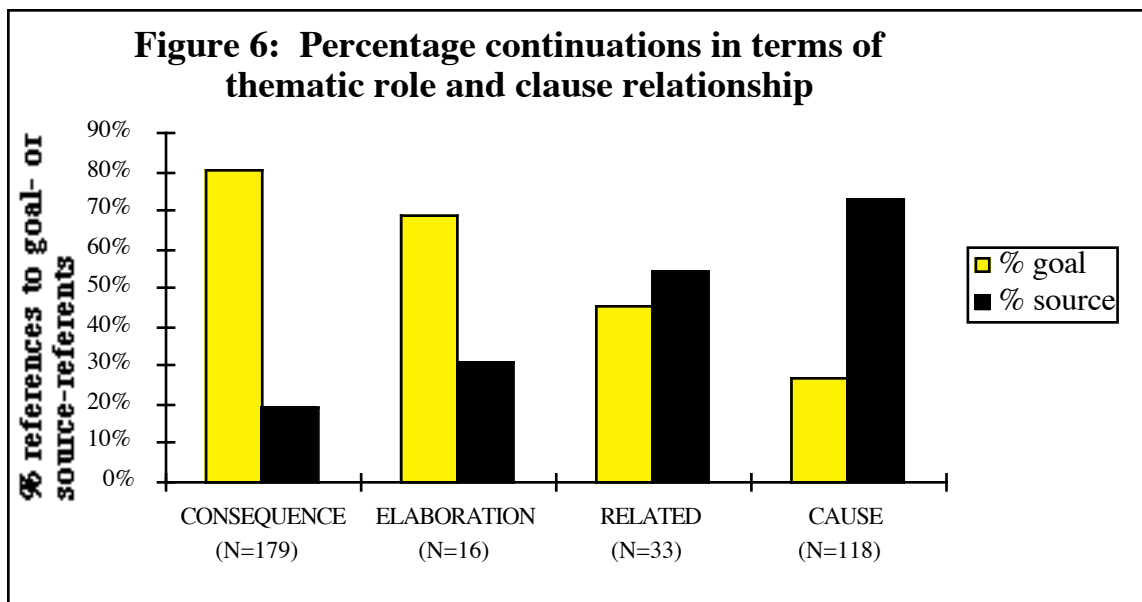
As I mentioned above, the stimuli contained no overt connectors to bias the relationship of the continuation sentence to the rest of the story. Instead, the types of continuations that people produced were the result of their reaction to other aspects of the stimuli. As participants read the stimulus 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

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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 ($-2*\text{Log LR}=34.264$, $df=3$, $p<.0001$), the grammatical function of the last reference to the entity ($-2*\text{Log LR}=8.234$, $df=1$, $p<.05$), and an interaction between the two ($-2*\text{Log LR}=29.993$, $df=3$, $p<.0001$).

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

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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.

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

SOURCE-GOAL VERBS		GOAL-SOURCE VERBS	
<u>verb</u>	<u># examples</u>	<u>verb</u>	<u># examples</u>
give	22	get	19
send	19	accept	18
teach	1	receive	25
offer	20	buy	2
pay	20	take	20
		learn	5
<hr/>		<hr/>	
TOTAL	82		89

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.

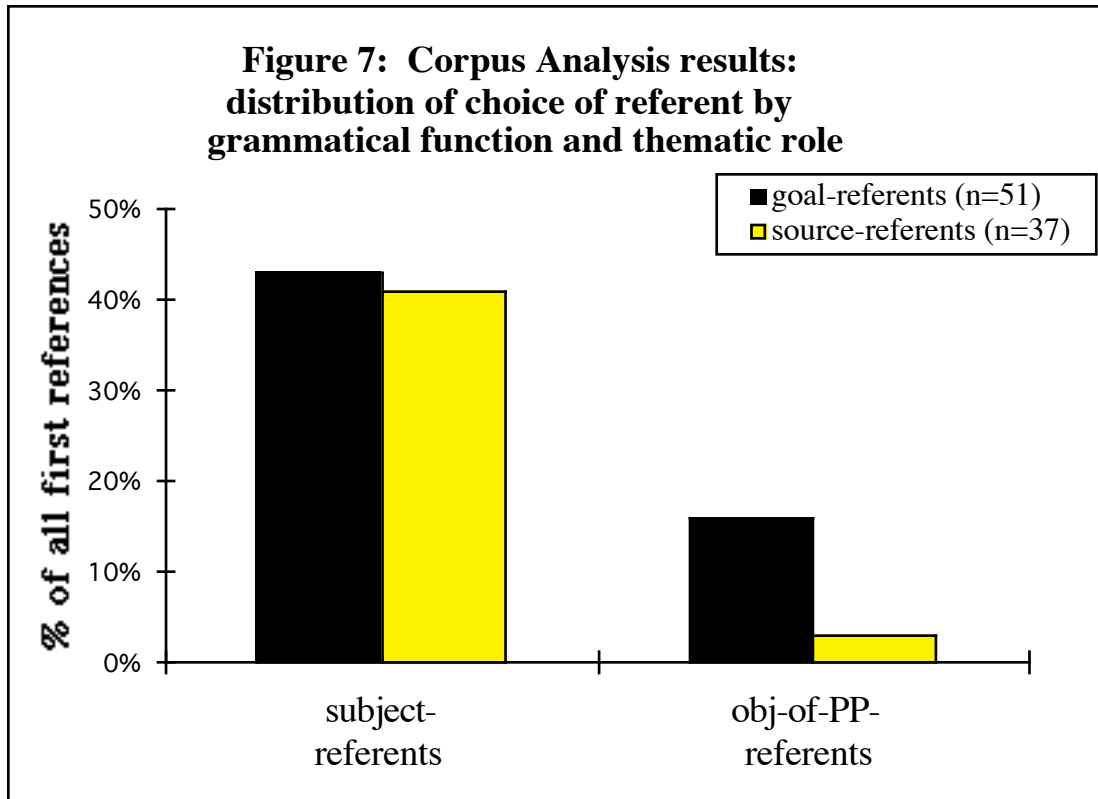
(11) Examples from the thematic roles corpus analysis.

first ref.	example
goal (subj)	S1: <u>We</u> will buy what we want offshore from the United States or elsewhere. S2: <u>We</u> do not have to care whether . . .
source (subj)	S1: Individuals write, phone and visit us and all ask if <u>we</u> can give any assistance to them, their relatives or friends who are seeking gainful employment. S2: <u>We</u> know their frustration . . .
goal (obj of PP)	S1: Mr. Speaker , I rise today to pay special homage to <u>a truly vibrant and magnificent lady</u> on her sixtieth birthday. S2: <u>She</u> has always had a reputation for congeniality and fairness toward all mankind.
other	S1: I will hasten to send <u>this good message</u> to the Quebec Minister of Finance. S2: <u>It's</u> 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 each sample, but Figure 7 does not include the cases when S2 did not contain a reference to either the goal- or source-referent.



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-referent. 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.

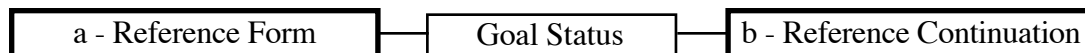
Third, there was an interaction between Subjecthood and Goal status. That is, for subject referents, it did not matter much whether the referent was also a goal or not. But for

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 Subjecthood 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.¹ 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,

¹ 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.

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who makes the winning basket in the last 5 seconds of the game.¹ 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.

- (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.

¹ The names of the players are real, but to my knowledge the event is completely fictitious.

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 understand (Clark,

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1996).¹ 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 (Garnham et al., 1996; McDonald and MacWhinney, 1995). Under either account, the discourse patterns observed in the corpus analysis could play a role.

¹ 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 an individual appears to be speaking and writing without an addressee, Clark argues that the addressee is implicit.

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.

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-

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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

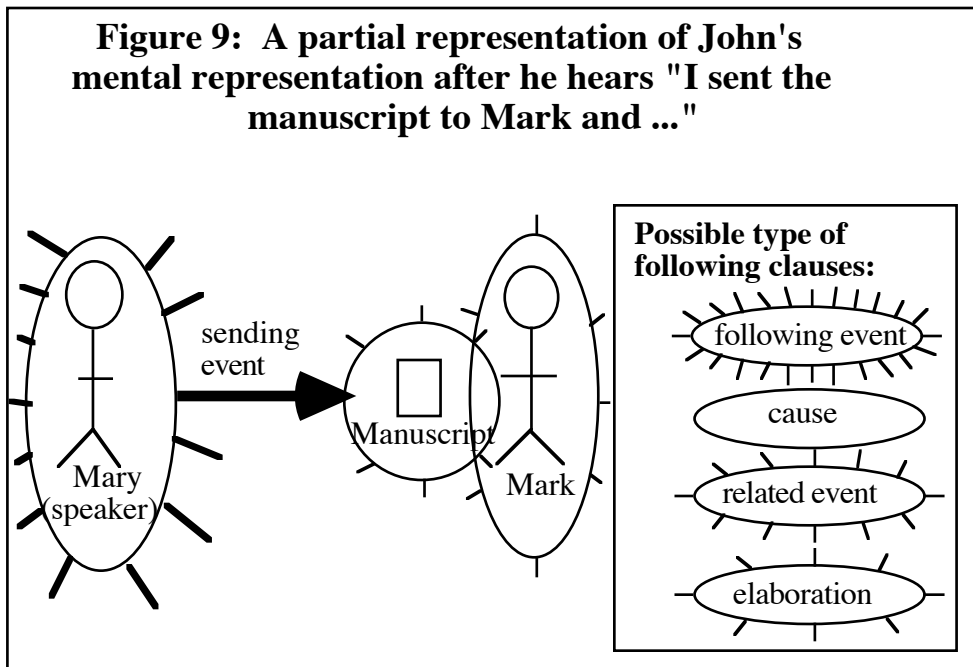
Let me illustrate how thematic roles and clause-relationships influence the mental representation of the listener and the processes of anaphor resolution. The following scenario would account for the data in §4.3 and §4.4, and follows from constraint-based models of language processing (e.g., MacDonald, 1994; Tanenhaus and Trueswell, 1995). It is, nevertheless, speculative, and does not include all the relevant information.

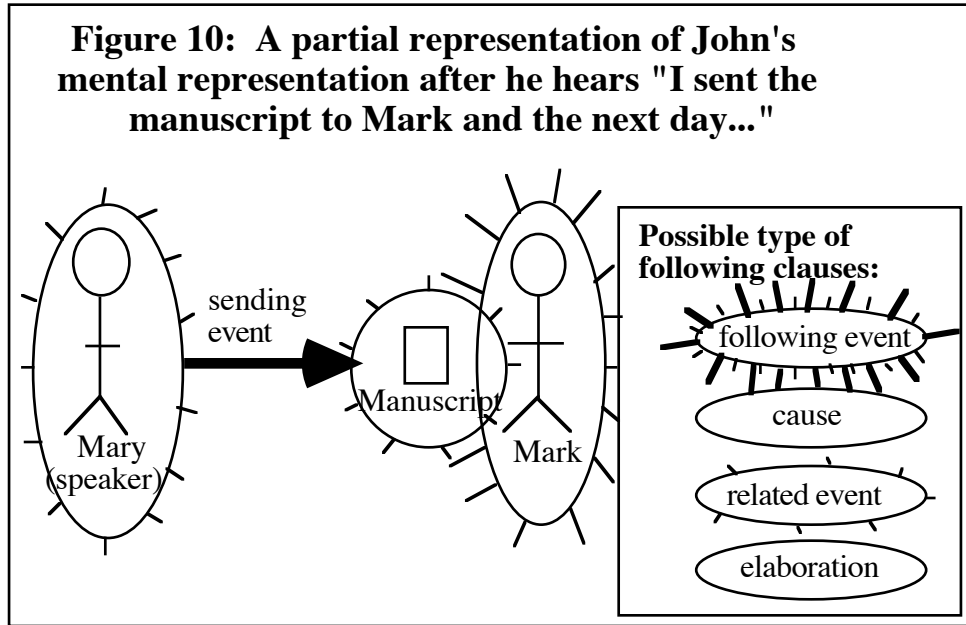
Imagine that Mary says to John "I sent the manuscript to Mark, and..." At this point in the discourse, John knows that Mary is probably in the process of producing another clause. But he doesn't know what Mary wants to say. He doesn't know who or what she will refer to, nor how her next clause will relate 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).





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

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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).