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ABSTRACT

A study of the process of listeners' and readers' generation and verification of expectations about spoken and written discourse presented to them examined the possible interactions between surface form and cognitive constraints, to establish baseline measures of the effectiveness of different sentence structures in constraining the production of subsequent utterances. The subjects, 32 native English-speaking university students, were assigned randomly to four groups, each using as stimuli a series of 48 sentences with a different sentence construction type but similar content for each group. The subjects were asked to write a continuation sentence for each stimuli sentence in the style of the original sentence. The continuation sentences were scored according to the entity in the stimulus sentence most strongly linked to the continuation sentence. Results show no evidence that readers automatically assume the first noun phrase to be the current discourse topic, but they do suggest that the choice of topic for an ongoing discourse can be affected considerably by the choice of syntactic construction, with readers relying on cues that mark discourse entities as potential topics. Further research on the relative importance of the variables investigated is recommended. (MSE)

# Generating a Topic: Thematic Influences on Sentence Production

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Abstract

In English, many syntactic constructions can express the same propositional content, suggesting that these forms differ in function. In a mixed design, subjects generated plausible (written) continuation sentences for 48 stimulus sentences that varied in form. The stimulus agent was always the preferred topic of the new sentence but this advantage increased from least (active) to most marked (pseudo-cleft) constructions, suggesting that speakers can grade their "promotion" of topics by the selection of appropriate surface forms.

## Generating a Topic: Thematic Influences on Sentence Production

How do listeners and readers determine that the current input is coherent? In other words, how do they decide that what has just been said (or read) is relevant to what was previously said (or read)? Listeners (and readers) must, to some extent, determine the meaning of the current input and search for points of intersection with the previous input. If comprehension depended entirely on this sort of a bottom-up approach, however, the process would clearly be labourious and might result, in the case of spoken input, in the listener falling behind the speaker. In order to resolve this dilemma, we (like many psycholinguists) propose that listeners and readers make use of expectations to narrow the set of possible topics that they consider likely for the subsequent discourse. This can lead to more efficient allocation of processing resources as the listener does not have to wait until the input has been received before engaging in semantic analysis. Evidence from the literature on speech understanding has shown that listeners even make use of local semantic information, such as transitional probability, in order to decode the acoustic input (cf. Cole & Jakimik, 1980; Dell & Newman, 1980; Morton & Long, 1976; but see also Foss & Gernsbacher, 1983). The present research was designed to explore syntactic cues to topic status, and consequently, to the process of forming expectations during comprehension.

As is well known to most students of linguistics, English permits a number of surface constructions that, at least propositionally, are said to express the same meaning. It was this insight, among others, that led to the proposal that each sentence can be described in terms of both a surface and an underlying (deep structure) form. The specification of relations between these two forms is of course what led to the development of transformational

grammar. If the transformational position is correct, one might wonder why English (and other languages) permits such a multiplicity of forms for the "same" meaning. The answer, according members of the functionalist tradition (see for example work by Bolinger, 1977, and the Prague School of linguistics, such as Daneš, 1960) is that these differences in form do not exist for purely "stylistic" reasons, but instead exist to serve different functions. Thus to paraphrase Bolinger when we say two things that are different, we mean two different things by them.

It is of course necessary to demonstrate that these variations in form have an effect on comprehension, above and beyond any inherent propositional content. In the authors' opinions, a likely function for these different constructions is that of topic promotion. Listeners and readers, typically not being mind-readers, must glean their knowledge of the discourse topic from either the current situation or from the linguistic input. Although it is often difficult to determine the speaker's (or author's) topic, there are structural cues to importance, information status, and hence to the likelihood that a particular entity or event is the current topic. In the absence of knowledge of the topic, the listener is probably likely to view the discourse as incoherent and hence incomprehensible (as for example is the case with much "thought-disordered" schizophrenic speech, Rochester & Martin, 1979). We propose that speakers choose particular constructions or "focussing devices" as the direct result of their current focus of attention. This information is in turn appropriately interpreted by listeners in such a way that it narrows, or constrains, the domain of the immediately following discourse. Violations of these expectations lead to the impression that the following utterance is not relevant (Grice, 1975) and if frequently occurring, that the discourse as a whole is incoherent.

Most psycholinguistic studies of the effects of variations in surface form have concentrated on comprehension rather than production. Furthermore, these studies of "thematic" variables (the term derives from Halliday's seminal work on theme and information structure, Halliday, 1967, 1968, 1970) have typically concerned the relation between an utterance (or more typically, a written sentence) and the preceding discourse. For example, Hornby (1972) presented subjects with one of seven different surface forms of a stimulus sentence and asked them to choose which of two presented pictures the sentence was "about". In neither case did the picture accurately represent all of the information in the sentence although some of the information contained in each picture was correct. By manipulating the surface form of the stimulus sentence such as changing (1) ***The igloo is being built by the Indian*** to (2) ***What the Indian is building is the igloo***, Hornby was able to affect the choice of picture. The results demonstrated that subjects were more likely to choose the picture that represented ***given*** or presupposed information. In example (1) the ***igloo*** is ***given*** because the sentence can be interpreted as stating that the speaker assumes the listener knows someone is building the igloo, thus the subject would choose a picture of an Eskimo building an igloo; similarly, in example (2) the Indian is known to be building something, thus the subject would be more likely to choose the other picture, that of an Indian building a teepee.

Hornby's experiment can be interpreted as showing that listeners (readers) use surface information to assess the current status of potential topics but the unnaturalness of the task limits the generality of the results. Subsequent research by Clark and Haviland (Clark & Haviland, 1977; Haviland & Clark, 1974) demonstrated that during comprehension readers make use of the ***given*** information of the current sentence in order to integrate it with

previous input. Yekovich, Walker, and Blackman (1979) presented additional evidence for the importance of thematic links between sentences showing that readers could more rapidly comprehend the second sentence of a pair when the noun phrase was focussed in the first sentence and *given* in the second sentence. These and other recent studies used real-time measures of sentence comprehension thereby strengthening Hornby's original demonstration that the form of an utterance strongly affects the comprehender's interpretation of the discourse topic.

The previously discussed studies do not, however, provide much insight into the process of expectation generation and verification that listeners (and readers) almost certainly engage in. By focussing exclusively on the anaphoric (backward) relation between a particular sentence and preceding discourse, they only provide part of the information necessary to develop an adequate model of discourse processing. Previous research by one of the authors has focussed on the link between a target utterance (where form is always manipulated) and subsequent, or continuation sentences. These earlier studies have concentrated on spoken input in which the stress pattern of the target utterance was manipulated. Newman (1978) demonstrated that variations in the location of an emphasized word restricted the possible context sentences generated for the stimulus and even more effectively constrained the production of plausible continuation sentences. A subsequent study (Newman, 1979) replicated this result using a task in which listeners were forced to choose a context or continuation sentence from an experimenter-generated set. Finally, a series of three real-time studies of comprehension (Newman, 1985) showed that listeners rely on the most recently presented

noun phrase in an utterance (typically the object, *new*, and the default focus of the intonation contour) in order to make judgments about the discourse relevance of the subsequent utterance.

The present study was designed as an extension of the research effort described above. It represents the first in a series of studies exploring possible differences in the interaction between surface form and cognitive constraints during the processing of spoken and written discourse. This first study was designed to establish baseline measures of the effectiveness of different sentence structures in constraining the production of subsequent utterances. The written sentences produced by readers in this experiment will be compared to the spoken utterances generated by listeners in response to the same stimuli in a subsequent study. In addition to providing information concerning the differential reliance on recency in the two modalities (and hence the differential effectiveness of the various surface structures across modalities), this study allows us to compare directly the "topic promotion" functions of four syntactic constructions. A second set of planned experiments will explore the effects of these surface forms on comprehension, again comparing them across modalities in order to assess possible interactions with cognitive constraints.

## Method

*Subjects.* Thirty-two[1] undergraduate students at the University of New Mexico participated in the experiment to obtain bonus course credit for introductory psychology courses. All were required to be native speakers of English (defined as being the participant's primary language). No restrictions were placed on the age or sex of the participants.

*Materials and Design.* Forty-eight stimulus sentences of the form *The adjective noun verbed the adjective noun* were devised. In addition to the original (3) active sentence, three other constructions were devised for each stimulus: (4) passive, (5) cleft, and (6) pseudo-cleft. An example of a stimulus set is given below:

(3) *The old storekeeper chased the stray dog.*

(4) *The stray dog was chased by the old storekeeper.*

(5) *It was the old storekeeper who chased the stray dog.*

(6) *The one who chased the stray dog was the old storekeeper.*

Four stimulus groups were formed from the four versions of the 48 sentences. Each group contained an equal number of each syntactic construction (12), and all 48 sentences, but only one of the four versions of each sentence. Thus if the example sentence were in active form in stimulus group 1, then it would be presented in passive form in group 2, and so on. The stimulus groups were printed in different booklets and presented to four different groups of subjects. The manipulation of syntactic construction was therefore within-subject, although the specific combination of sentence by construction was a between-subject variable.

*Procedure.* Subjects were assigned randomly to stimulus groups as they showed up for the experiment. More than one individual participated in each running of the experiment. Subjects were instructed to read each sentence in the booklet, one at a time, and immediately write down a plausible continuation sentence for it. They were instructed to treat the continuation sentence as if it were produced by the same person who had written the first sentence. They were discouraged from writing personal comments that would not be generally understandable and were urged to write complete sentences. Subjects were encouraged to ask questions prior to signing an informed

consent form at the start of the experiment. At the end of the experiment they were fully debriefed as to the purpose of the study. The experiment lasted approximately 45 minutes.

## Results

The data of interest are the continuation sentences but in their raw state they are not very amenable to quantitative analysis. It was therefore necessary to devise a scoring system to code the responses. Representative continuation sentences for the example stimulus set (3-6) illustrate this problem and are given below:

(3') *The dog was trying to get in out of the cold.*

(4') *The storekeeper didn't realize the dog was only hungry.*

(5') *He is an old grouch.*

(6') *He was sad to see so many stray dogs but would not have them in his store.*

*Scoring procedure.* The purpose of scoring the continuation sentences was to determine the relation between the continuation topic and the stimulus sentence. The scoring method was designed to indicate, when possible, which entity in the stimulus sentence was most strongly linked to the topic of the continuation sentence. The criteria for making this judgment were as follows:

1. The grammatical subject of the continuation sentence is the most likely topic of that sentence. The clearest cases are:
   a. The use of a pronoun (the stimulus sentences were designed to minimise ambiguous responses).
   b. The use of lexical repetition, a synonym, a super-subset relation, or a strong association.

(e.g., *The howling baby disturbed the next-door neighbours. The mother....).*

2. Decisions were made for the following cases and the relation was noted for future study:
   a. An event is described, consisting of a noun related to an entity in the stimulus sentence and a verb.
   b. There is an inferential relation between the subject of the continuation and a specific entity in the stimulus sentence. For example, an inference concerning ownership must be made for a continuation starting with *The girl* when the stimulus sentence was *The antique car ran over the baby doll.*
3. No decision was made for ambiguous continuations and they were noted for future study. Examples are given below:
   a. Both entities are referred to simultaneously. For example, *The confident actress rode the beautiful bay horse. They made such a pretty picture.*
   b. The continuation relies on an event involving all elements of the stimulus sentence equally.
   c. New characters or events are introduced in the continuation, without a clear inferential link to the stimulus sentence.
   d. A contrast is used for the second sentence. For example, *The old lady drove the pickup truck. The old man drove the motorcycle.*

In order to ensure that the judgments relied as little as possible on subjective impressions, a randomly selected subset of the generated sentences

were scored by both authors. The inter-rater reliability was 88%. Almost all of the disagreements were cases of ambiguity, inferences or responses involving both the agent and patient.

***Dependent measures.*** Three different methods of determining the choice of a topic were used. The entity in the first sentence forming the strongest link between the two sentences was scored for its status as *agent* or *patient*, first (*NP1*) or second (*NP2*) noun phrase, and *given* or *new* information. The *agent* of a sentence is the entity that performs a particular action on the *patient*. In example sentence (3) the *old storekeeper*, because she or he is doing the chasing, is the agent, and the *stray dog* is the patient. This relation (derived from *case grammar*, Fillmore, 1968) is semantic and is thus invariate across syntactic construction. The critical question to be addressed by this analysis is whether readers are more likely to treat the entity performing the action as the topic. Such a prediction makes intuitive sense if comprehenders perceive actions from the perspective, or order, in which they occur. Some evidence from comprehension in children (Clark, 1971) would suggest that such a bias may exist in adults.

The remaining two methods of determining the topic necessarily involve different entities depending on the construction in question. The analysis of a positional link is straightforward: *NP1* is the *old storekeeper* for the active and cleft constructions but the *stray dog* for the passive and pseudo-cleft constructions. Conversely *NP2* is the *stray dog* for the active and cleft but the *old storekeeper* for the passive and pseudo-cleft. The predictions concerning the positional analysis are quite straightforward also; many linguists (see discussion in Brown & Yule, 1983) have suggested that topic be defined as the grammatical subject or first noun phrase (as distinct from the logical subject which, since it refers to the relation between a specific noun

phrase and the verb, must vary with syntactic construction). Furthermore, MacWhinney's discussion of the importance of a "starting point" (MacWhinney, 1977) for comprehension would suggest that the first noun phrase would have the greatest influence on the choice of a topic. It should be noted, however, that the pseudo-cleft construction presents a particular problem in that the pronoun *one* in fact occurs prior to what we are terming NP1 (the ***stray dog***, in our example). Because *one* is coreferential with the ***old storekeeper*** (which we label as NP2) it is possible to argue for the opposite description of this sentence. We will return to this point, and the reasons for our decision, in the discussion.

The third analysis concerns the role of a thematic variable, information structure. Simply stated, each utterance minimally contains ***new information*** and optionally contains ***given information***. New information is essentially the point of the utterance as it is information that the speaker assumes the listener does not already have in consciousness because it has not previously been mentioned or is not situationally salient. Given information, in contrast, provides a link to the current status of the listener's consciousness as it is related to the preceding discourse or current situation. This distinction has been the subject of considerable linguistic and psycholinguistic inquiry over the years, particularly since Halliday's discussion of information structure (Halliday, 1967, 1968). Although Halliday's original dichotomy has been criticised on terminological (see for example Chafe, 1976) and empirical (see for example Brown, 1983) grounds and considerably expanded (see for example Prince, 1981) it will serve as a starting point for the present discussion.

There are many linguistic means of marking information structure. In spoken discourse intonation provides a strong cue; new information is typically the nucleus of the contour, receiving the greatest degree of pitch

movement and is usually accompanied by greater intensity and longer duration. In the "unmarked" case, such as an active sentence with a "neutral" (non-emphatic) intonation contour, new information occurs later in the sentence, usually identified as the last noun phrase (this may also include the verb, depending on whether the action, but not one of the actors, is already known to the listener or reader).

The distribution of information can also be affected by the choice of syntactic structure; the three alternative constructions used in the present experiment represent "marked" cases of information structure. The active is typically viewed as "unmarked" in that all three functions, agent, NP1, and given, coincide. The passive, by reversing the position of the logical subject and object, thereby marks the object (or the patient) as given information, and the subject (or agent) as new information. Thus in example (4), the existence of the *stray dog* is already presumed (and perhaps also the fact that it was chased), that it was chased by the *old storekeeper* is new information. The pseudo-cleft sentence even more strongly marks the *old storekeeper* as new by employing a dummy subject (*the one who*) that sets up the expectation of an important, and new, piece of information to follow. The cleft construction (5) performs the same function as the active, though like the pseudo-cleft, it appears to be a much stronger form of marking. (There is some reason to believe that the given-new distinction is very weak for out-of-context actives.) The question to be addressed by the results of the present study is whether readers will assume that given information should be treated as the topic of the on-going discourse because it has priority of mention in the discourse or whether new information, by being the "point" of the utterance, will attract attention and serve as the topic.

*Data analysis.* Separate analyses of variance were performed for each dependent measure: percent agent choice, percent NP1 choice, and percent given choice. In each case the design was a 4 (syntactic construction) by 4 (stimulus group) factorial, with subjects nested within stimulus group. The results for agent choice are presented in Figure 1. The graph clearly illustrates an increasing tendency, ranging from 60% to 75%, to choose the agent as the topic as the syntactic structures change. In all cases the overall choice of agent was greater than 50%, even for the active which may be viewed as less marked. The effect of syntactic construction was significant, $F(3,84) = 7.22$, $p < .001$, however there was also a significant syntactic construction by stimulus group interaction, $F(9,84) = 5.44$, $p < .0001$. This interaction was due primarily to the behaviour of subjects in group 2 who chose the agent only 42% of the time for active sentences compared to 62%, 63%, and 72% for groups 1, 3, and 4 respectively and subjects in group 4 who chose the agent only 50% of the time for clefts in contrast to 81%, 77%, and 79% for the subjects in groups 1, 2, and 3 respectively.

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Insert Figure 1 About Here

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Perhaps the most surprising finding for these data is that the passive apparently did not focus the patient (although this is commonly described as one of its major functions, see for example Anisfeld & Klenbort, 1973) but instead appeared to favour the agent. Post hoc comparisons using the Scheffé test with an alpha level of .05 revealed significant differences between the passive and pseudo-cleft but not between the passive and remaining two constructions. The other significant pairwise comparisons were those between the active and cleft and active and pseudo-cleft ($t(112) = 1.639$, $p < .05$).

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Insert Figure 2 About Here

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The results of the analysis of position effects, shown in Figure 2, clearly indicate that there is no evidence that readers universally prefer the first noun phrase as the topic of subsequent discourse. Instead, the type of syntactic construction clearly affects the choice of topic, $F(3,84) = 56.37$, $p < .0001$. The cleft improves on the effect of the active in promoting NP1 as the topic, whereas the pseudo-cleft similarly boosts the NP2 focussing effects of the passive (see Figure 2). There was, however, a significant syntactic construction by stimulus group interaction ($F(9,84) = 3.27$, $p < .01$), and as a result the stimulus group main effect was also significant ($F(3,28) = 9.03$, $p < .001$). Once again, this interaction was due to the behaviour of group 2 for actives and group 4 for clefts. The Scheffé tests showed that all pairwise comparisons were significantly different ($t(112) = 1.639$, $p < .05$).

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Insert Figure 3 About Here

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The final analysis concerns the fate of the given information of the stimulus sentence. As Figure 3 shows, the active was the only construction that favoured the choice of given information for the topic of the continuation sentence, and that bias was not much above chance (60%). New information was clearly the preferred topic even when, in the case of passives, it was not the "focus" of the construction. The overall advantage for new information was 62.5% with active sentences and 70% without actives. The analysis of variance showed a strong effect of syntactic construction, $F(3,84) = 36.45$, $p < .0001$, but also a significant interaction of syntactic construction and

stimulus group, $F(9,84) = 3.49$, $p < .01$ and, consequently, a main effect of stimulus group, due again to group 2 actives and group 4 clefts. Scheffé tests showed that active sentences behaved differently from the other three constructions and that passives and pseudo-clefts also differed ($t(112) = 1.639$, $p < .05$). No other comparisons yielded significant differences.

## Discussion

The question guiding our research has been to determine the means by which listeners and readers decide that the current discourse is coherent. The assumption of coherence is a necessary prerequisite for comprehension. We view this decision as depending, in part, on determining the relevance of the current input to the preceding input and, no less importantly, on the process of generating expectations concerning the probable topic of subsequent discourse. Although semantic content is probably the most important influence on comprehension there are surface structure variables that serve to mark the speaker's current focus of attention. The present sentence generation study investigated the effect of one class of these variables, variations in syntactic construction, on subjects' determination of a topic for a subsequent, and relevant, utterance.

No evidence was found to support the hypothesis that readers automatically assume that the first noun phrase (usually the grammatical, or surface, subject) is the current discourse topic. The first noun phrase may be the default topic for active sentences but this is impossible to determine unequivocably for these stimuli because it is also the agent and given information. Although the second noun phrase in the pseudo-cleft undoubtedly receives additional marking from the presence of a pronoun in sentence-initial position, in our view it is the surface location of the referent

that most directly affects its status as topic. A similar, though smaller, focussing effect for the second noun phrase in passives supports the view that the change in surface location affects perceived topic status.

The choice of topic can also be viewed in terms of the entity's semantic role (agent vs. patient) and its contribution to information structure (given and new information). The analysis of agent choices makes it clear that readers in this study prefer the agent over the patient as the topic of the continuation sentence even for passives, which are usually said to focus the patient. This may reflect a preference for animate, rather than inanimate, entities as topics. Forty-three of the stimulus sentences employed animate agents, whereas only 12 employed animate patients; the effects of this variable will be explored in subsequent experiments. The critical comparisons are within-sentence, however, and thus should not be affected.

One likely source of a discourse topic is the current given entity. Two of the constructions, active and passive, are typically assumed to favour given information (the passive more so than the active) although the given information in the active is the agent, whereas it is the patient in the passive. The other two constructions, cleft and pseudo-cleft, explicitly mark the agent as new information (it is possible, however, to have passive versions of each that focus the patient). The results of this experiment show a preference for new information as the topic of subsequent discourse for the three "marked" constructions. This finding contradicts the popular view of the likely topic status of given information. Furthermore, the results show that as the degree of markedness increases, the constraining effect of new information also increases. Thus passives and pseudo-clefts both promote the agent as topic but the pseudo-cleft, because it both employs a dummy subject and moves the surface position of the agent, has a signficantly greater influence on topic

choice. Similarly, the cleft has a correspondingly greater focussing effect on the agent than the active, presumably because of the explicit marker *It was...who*. Of course the presence of the marker also indicates new information so it is again difficult to determine unequivocably which is the critical variable (if in fact there is only one).

In order to determine the importance of an entity's status as new information *per se*, it will be necessary to conduct further experiments involving a number of different ways of marking new information. The results of Newman (1985) using a timed coherence judgment task and spoken input indicate that new information can be the basis of expectations for the topic of a subsequent utterance in active sentences. This result was shown to be dependent on the time interval between sentences suggesting that the role of new information is to provide attentional focus for a candidate topic. I would not expect a similar effect to be obtained in the present experiment because the stimulus sentence was continuously available and subjects were not under time pressure. Out-of-context, written, active sentences provide very few cues to the discourse importance of their constituents, unlike the three marked constructions employed in our experiment.

The conclusion to be reached from this study is that the choice of a topic for on-going discourse can be affected considerably by the choice of syntactic construction. Readers rely on cues that "mark" discourse entities as indicative of their status as potential topics. An entity's status as new information, and its semantic role as the agent, both contribute to its perceived appropriateness as the discourse topic. The relative importance of these variables needs to be explored in future research, however one conclusion is clear: the more strongly the author marks an entity, the more likely it is that the reader will perceive it as the current discourse topic.

## Footnote

[1] Of the original volunteers, data from 2 subjects were not scored because one was found to have acquired Spanish at the age of 2, and the second at the age of 7. Data from 7 other volunteers were not scored because these individuals failed to follow instructions (see Procedure); 5 used a large number of personal comments, and 2 merely paraphrased the stimulus sentences. Data from the first 8 subjects in each stimulus group (see Materials and Design) with scorable responses were analysed for this paper. Data from 5 remaining subjects, currently unscored because their inclusion caused an unbalanced design, will be reported in a later version of this paper.

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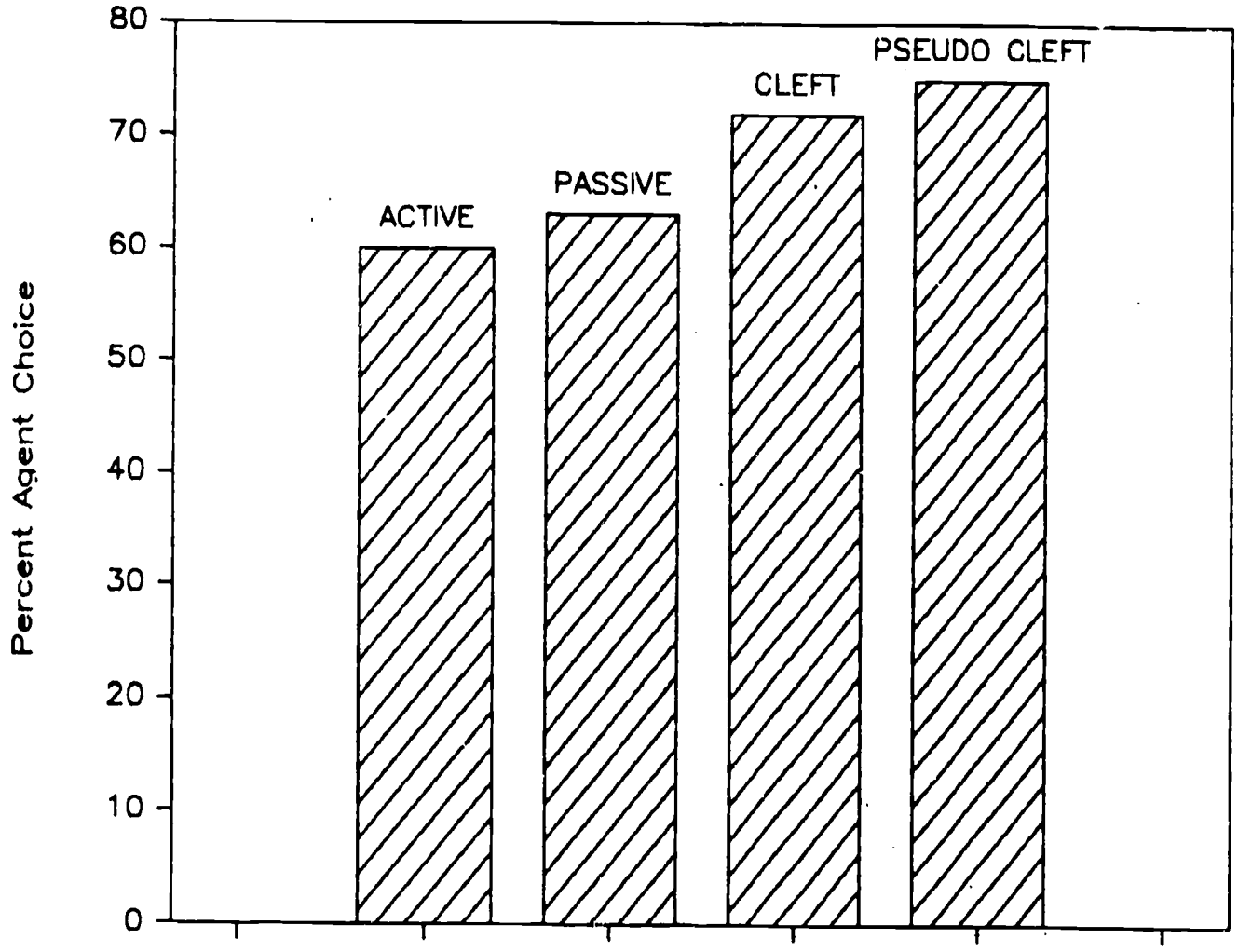
## Figure Captions

Figure 1. Semantic analysis: Mean, percent choice of the agent as the topic for the subject-generated continuation sentence as a function of the syntactic construction of the stimulus sentence.

Figure 2. Order analysis: Mean percent choice of the first noun as the topic for the subject-generated continuation sentence as a function of the syntactic construction of the stimulus sentence.

Figure 3. Thematic analysis: Mean percent choice of given information as the topic for the subject-generated continuation sentence as a function of the syntactic construction of the stimulus sentence.


Percent Agent Choice
80
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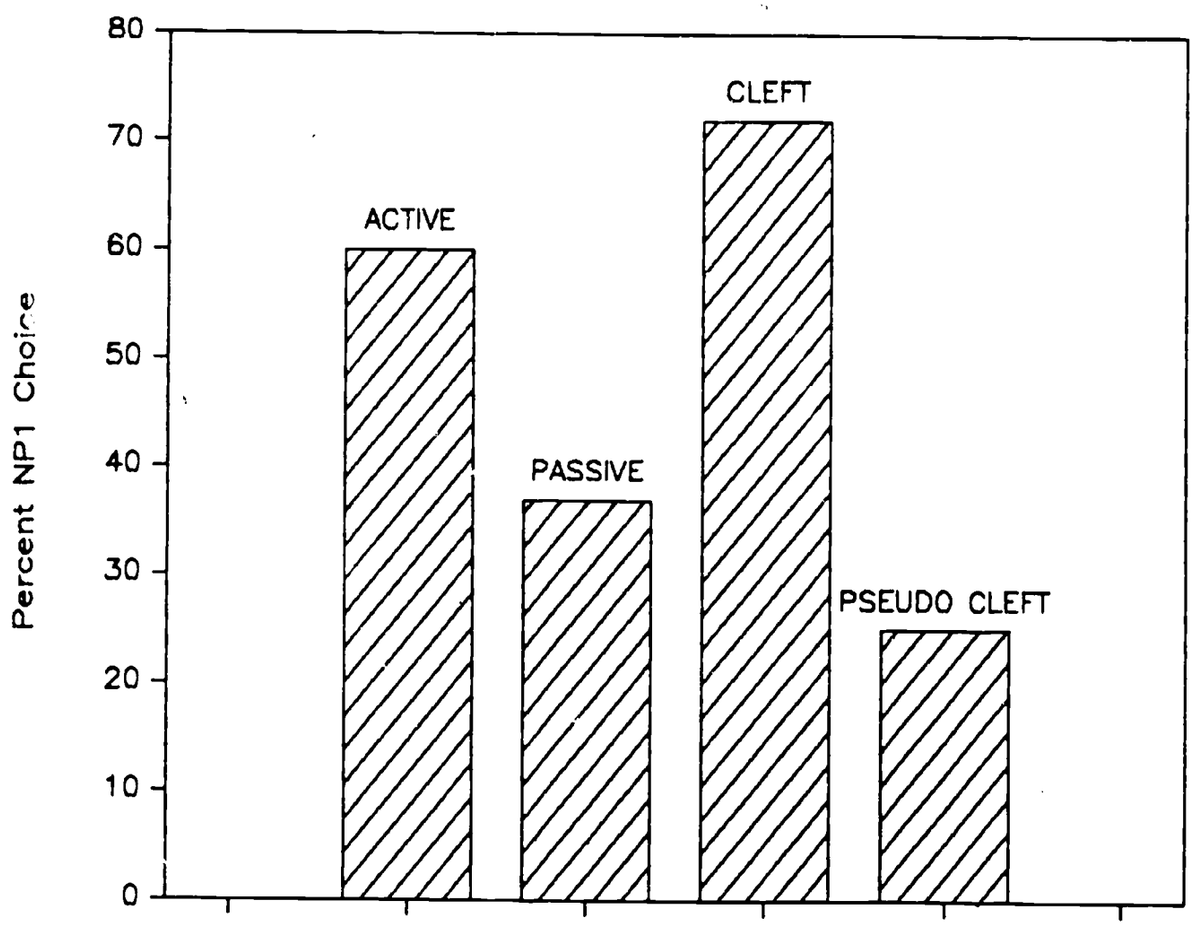
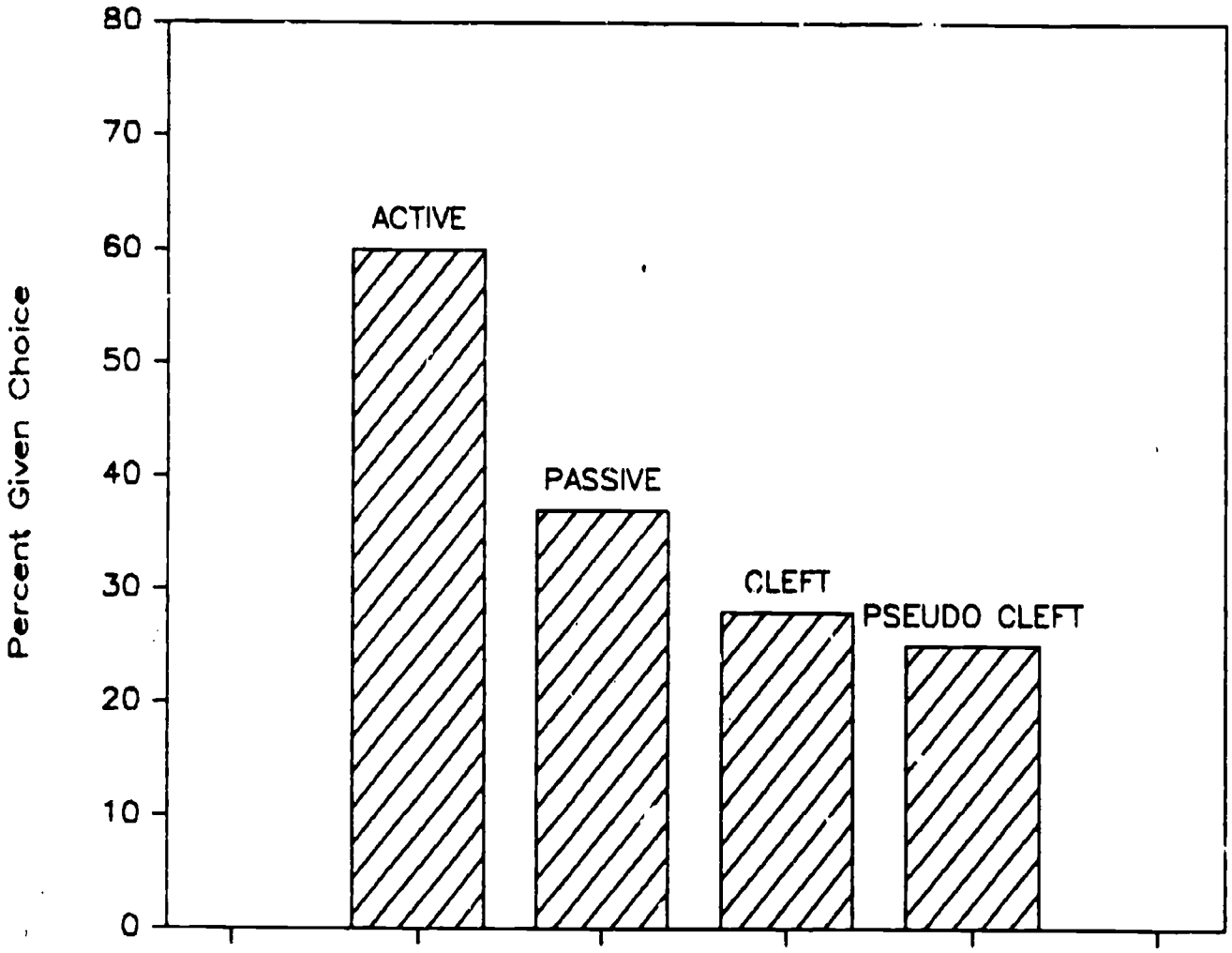
ACTIVE
PASSIVE
CLEFT
PSEUDO CLEFT


Percent NP1 Choice
80
70
60
50
40
30
20
10
0
ACTIVE
PASSIVE
CLEFT
PSEUDO CLEFT


Percent Given Choice
80
70
60
50
40
30
20
10
0
ACTIVE
PASSIVE
CLEFT
PSEUDO CLEFT