KEY	
U_i	An utterance, where i indicates linear position in its discourse segment
N_i	A linguistic expression in U_i
$\uparrow$	A relation of center (Cb) realization
$\boxed{Cb_i}$	The backward-looking center of U_i; a local attentional status that a discourse entity (e.g., C_i) can be assigned

$\boxed{Cb_1}$ $(=C_i)$

$\uparrow$

U_1: ..... N_1 .....

$\boxed{Cb_2}$ $(=C_i)$

$\uparrow$

U_2: ..... N_2 .....

Figure 2: Schematic Representation of Centering Context

KEY	
N_1	antecedent expression
N_2	subsequent pronoun
$\vdash$	enhanced transition
$\dashv$	suppressed transition
	neutral transition

	N_1		N_2
1.	Pro-Subj	$\vdash$	IT-Subj
2.		$\dashv$	THAT-Subj
3.			IT-NonSubj
4.		$\dashv$	THAT-NonSubj
5.	Pro-NonSubj		IT-Subj
6.			THAT-Subj
7.		$\vdash$	IT-NonSubj
8.			THAT-NonSubj
9.	NP-Subj		IT-Subj
10.			THAT-Subj
11.			IT-NonSubj
12.			THAT-NonSubj
13.	NP-NonSubj	$\dashv$	IT-Subj
14.			THAT-Subj
15.			IT-NonSubj
16.		$\vdash$	THAT-NonSubj
17.	NonNP-Subj		IT-Subj
18.			THAT-Subj
19.			IT-NonSubj
20.			THAT-NonSubj
21.	NonNP-NonSubj	$\dashv$	IT-Subj
22.		$\vdash$	THAT-Subj
23.			IT-NonSubj
24.		$\vdash$	THAT-NonSubj

Figure 1: Schematic Representation of Local Coherence Relations as a set of State Transitions

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The χ^2 is always evaluated relative to the degrees of freedom in the distribution, in this case, the number of contrasts in the row (R-1) times the number of contrasts in the column (C-1).[45] Most elementary statistics texts provide probability tables for χ^2s for a large range of degrees of freedom. A statistical correlation is generally assumed for probabilities less than 5%, and unquestionably if the probability is less than 1%.

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[45] In a 2×2 table, there is one degree of freedom. An intuitive explanation of this notion is that if the row and column totals are known, then knowing the value of any one cell determines the values of the three other cells.

	IT	*THAT*	Row Totals
+ Antecedent	30	30	*60*
− Antecedent	20	20	*40*
Column totals	*50*	*50*	
TABLE TOTAL			100

Table 5: Expected distribution, assuming the null hypothesis

The row and column totals of a contingency table provide a method for estimating a chance distribution of the population in all four cells of the sample contingency table, and thus for testing the deviation of the actual cell counts (observed frequency: f) from the number predicted by the null hypothesis (expected frequency: F). Refuting the null hypothesis confirms that the independent variable is statistically correlated with, or is a good predictor of, the dependent variable.

The expected frequencies are predicted from the row and column totals of a contingency table as follows. In Table 4 we see that the total sample size of *it* and *that* is 100 (N=100), and the ratio of *it* to *that* is 1:1, as given by the ratio of column totals. Overall, 60% of the pronouns have antecedents and 40% do not, as given by the ratio of row totals to table total. The null hypothesis predicts that the probability of occurrence of *it* versus *that* is independent of the probability that a pronoun will have an antecedent. If many samples of pronouns are tested, then the mean percentages of pronouns across samples should eventually approximate the probabilities for the population as a whole. Letting P_C represent the probablity that a particular class of observation will occur (e.g., *it*), P_C is estimated by: (Column total for that class, e.g., *it*)/N, or in this case, by 50/100. Analogously, letting P_R be the probability that a particular value of the independent variable will hold (e.g., $+antecedent$), then P_R is estimated by (Row total for that value, e.g., $+antecedent$)/N, or in this case, by 60/100. The expected frequency of each cell of the contingency table is then given by the formula:

$$P_R \times P_C \times N.$$

By applying this formula, we find the expected distribution, given the null hypothesis, that is shown in Table 5.

The χ^2 statistic is a test of the null hypothesis because it gives a quantitative measure of the discrepancies between observed frequencies (f) and expected frequencies (F)—e.g., between Tables 4 and 5—as a single sum[44]:

$$\chi^2 = \Sigma(f - F)^2/F.$$

[44]Note that what is being summed are the χ^2s of the individual cells of the contingency table, each cell χ^2 given by $(f - F)^2/F$.

pragmatic effects (local center establishment versus non-local-center retention). Of the several distinct uses of *it* and *that* manifested in my data, I have focused my efforts on explaining the canonical cases. Many of the hypotheses I have proposed need further confirmation and development, for example, in regard to the relationship between local coherence relations and the global context. Also, the contexts in which a target expression was suppressed or played no significant role need to be explained, perhaps by looking at larger contexts, or perhaps by looking at new sets of linguistic factors in the local context, such as prosodic cues. I believe such questions are answerable, and will lead us to increasingly explicit models of discourse structure.

6 Appendix: Distributional Analysis

In this study, there are two classes of observation—the occurrence of *it* and the occurrence of *that*. Let us assume for the moment a case in which the conditioning criterion is the presence of an antecedent, and that the criterion has two values: *lacks (−) antecedent*, and *has (+) antecedent*. Arranging the set of observations in a table where the classes of observation define the columns of the table (one column each for tokens of *it* and *that*), and the conditioning criteria define the rows (e.g., one row for $+antecedent$, another row for $-antecedent$), yields a 2×2 contingency table with four cells, as in Table 4. The table as a whole represents the population of observations in which *it* or *that* occur (N=100). A χ^2 for the table can provide a measure of the degree to which the classification (lexical choice of *it* or *that*) is contingent upon the conditioning criteria (presence or absence of an antecedent).[43]

	IT	*THAT*	Row Totals
+ Antecedent	34	26	*60*
− Antecedent	16	24	*40*
Column totals	*50*	*50*	
TABLE TOTAL			100

Table 4: Sample Contingency Table

The crucial question a contingency table is directed at is whether the distribution across the classes always has the same probability, i.e., is *independent* of the sampling criteria. If there is no correlation between the classification (dependent variable) and the sampling criteria (independent variable), then the frequency within each cell of the table should fall within a range predicted by chance, as described below. This is called the null hypothesis.

[43]The data for this table were fabricated so as to provide simple ratios of row and column totals.

space.

The nature of the pragmatic function of demonstrative pronouns in apparently anaphoric contexts has long been a puzzle. I have provided an explanation for certain uses of the demonstrative where there is a linguistic antecedent, based on objective contrasts between the contexts in which *that* tends to occur and those in which *it* tends to occur. The demonstrative has differing functions, depending on the form of the antecedent, thereby reinforcing the view that the form of a referring expression is a significant indicator of the current attentional status of the referent. The demonstrative does not play a role in local center establishment, but does play a role in anticipating or terminating a cohesive chain. Thus a local center is not typically accessible to a demonstrative pronoun, but a candidate or former local center is. No positive results were found pertaining to entities introduced by full noun phrases in subject grammatical role, but the typical use of the demonstrative to co-specify with a full NP antecedent in non-subject grammatical role suggests that alongside local centering, there exists an alternative cohesive relation, referred to here as non-local-center retention. It is assumed that in addition to providing an efficient mechanism for re-mentioning focussed entities, definite pronouns and other cohesive devices may also indirectly indicate whether the referent is only locally relevant, or both locally and globally relevant. I proposed that the coherence context in which the antecedent expression is an NP-nonSUBJ and the target pronoun is the demonstrative mark the entity as a non-candidate local center while permitting the entity to be referred to via a cohesive expression. Finally, I have argued that the demonstrative plays a role in adding new entities to the local focus space when the antecedent is itself not a referring expression. I have asserted that in these cases, the referent is added to the context by virtue of a referring function that is non-automatic, but dependent on reasoning. It remains to future work to specify exactly how this reasoning process is constrained.

Because local center establishment depends on a pair of utterances that are adjacent in the current segment, all utterances within a segment except the initial and final utterances play a dual role, both terminating a local coherence context and initiating the next local coherence context. Consequently, persistence or change in the status of local center takes place in successive, overlapping utterance pairs. Cohesive chains of pronouns illustrate that a local center, once established, can be maintained throughout a more or less long sequence of utterances. By this means, the local center establishment rule is presumed to contribute to discourse segmentation, and thereby to the global context.

Hopefully the methodology presented here proves itself to some degree in the plausibility and merit of the theoretical claims. But, as in any speculative work, the results include far more new questions than definitive answers. The present work demonstrates that pronominalization is a heterogeneous phenomenon: not all tokens of *it* represent local center establishment, nor do all coherence contexts have the same

contrastive pronouns. Thus most of the discussion has focussed on interpreting the contexts in which a particular pronominal choice maintains the current attentional status of its referent. In future work I will investigate the two other classes of contexts in which the choice of referring expression changes the attentional status of its referent, or makes no contribution to its attentional status.

I have tested and amplified the centering framework and have proposed how the distributional differences between *it* and *that* in contexts where there is a linguistic antecedent can be accounted for in terms of distinct cohesive functions. The data support the hypothesis embodied in the centering framework that conversational participants make use of default processes for resolving pronominal reference, and also clearly demonstrate that *it* plays a role in this default process while *that* has distinct functions even in apparently similar contexts. By investigating actual on-line linguistic choices, I have clarified the dimensions of linguistic variation which contribute to this default mechanism and have summarized the results in an operational definition of local centering. I have demonstrated that the grammatical role and surface form of both the antecedent and subsequent pronoun contribute to local centering.

A local center is a distinguished attentional status of a discourse entity within a local context consisting of adjacent utterances. It is distinct from the Cb of the centering framework in that there is only a single potential local center, rather than an ordered set of Cfs. Like Kameyama's property sharing constraint, the rule for local center establishment has a canonical and a non-canonical form. By investigating the non-canonical contexts, I have shown that there is an interaction between local centering and a competing pragmatic effect in which 1st and 2nd person pronouns pre-empt the subject grammatical role within the local context consisting of both utterances, thereby demoting the local center to non-subject grammatical roles. Thus I have provided an account of a cognitively distinct coherence phenomenon and have motivated the range of surface configurations which realize this phenomenon.

By comparing the properties of local centers with the symbolic properties of 1st and 2nd person pronouns, I have also shown that the two referring functions are quite similar, differing primarily in that the former is pragmatically realized while the latter is grammatically encoded. The cognitive mechanism for local centering is thereby accounted for in terms of a more general cognitive process pertaining to pure indexicals like 1st and 2nd person pronouns. The process of finding a referent for referring expressions that are pure indexicals depends on a fixed set of parameters in terms of which conversational participants construe the speech situation. The referent of the indexical expression is simply the current value of the relevant parameter. The cognitive mechanism for finding the local center presumably involves an automatic retrieval of the current value of the local center, and a compatibility check against the local semantic context. In contrast, resolving the referents of other sorts of referring expressions, such as full referring phrases or demonstrative pronouns, is a non-automatic process requiring reasoning and search within the current local focus

entity, but rather, plays a role in adding a new discourse entity to the context.[42] The enhanced transition arcs illustrated in contexts 22 and 24 are interpreted as other enhanced arcs have been interpreted. They indicate that the attentional status associated with the antecedent expression (nonNP) is maintained by the speaker's lexical choice of (*that*). This status is that the context contains a temporary semantic representation that can serve as an object of demonstration in intra-textual deixis, but no discourse entity. However, after the demonstrative has been fully interpreted, its referent is added to the contextual domain, thus the demonstrative also alters the prior attentional state.

5 Conclusions: Attentional State, Linguistic Representations and Discourse Models

The contributions of the present work are both methodological and theoretical. I have illustrated the application of a methodology for interpreting and collecting naturalistic data that is particularly well-suited to investigating on-line choices of conversational participants. The distributions of objectively verifiable surface linguistic features in a corpus of naturally occurring dialogues, among a number of different conversational participants, were first encoded and then analyzed. The observed distributions were statistically evaluated in order to identify significant co-occurrence patterns. I have argued that contingency tables representing successive sets of linguistic choices in local coherence contexts can be directly interpreted as state transitions. In these tables, where each cell corresponds to a type of state transition, the presence or lack of statistical significance in individual cells translates directly into communicatively significant versus non-significant combinations of linguistic choices. For significant state transitions, a particular initial state creates expectations regarding what final states will occur. Where the observed frequency is high, the final state is expected to occur; where it is low, the final state is expected not to occur. An actual instance of one of these state transitions either confirms or defeats the conversational participants' expectations, thereby acquiring communicative significance. Assuming the initial state to correspond to some abstract attentional state, a state transition that confirms conversational participants' expectations is interpreted as maintaining the attentional state. A state transition that defeats conversational participants' expectations is interpreted as altering the attentional state. A state transition with no relevant expectations is interpreted as a context where the relevant attentional state does not exist, or does not inhere in the combinations of features that were investigated.

In the analysis and interpretation of pronominal usage, my initial concern has been with establishing the most likely or canonical pragmatic functions of two semantically

[42]Note that my position on intra-textual deixis differs from Webber's position on discourse deixis, which is that the demonstrative referring function accesses a pre-existing discourse entity [41].

(28) U_1: I see that Carol$_i$ insists on sewing her dresses$_k$ from non-synthetic fabric.

U_{2a}: *That*'s an example of how observant I am.
U_{2b}: I like sewing too.

U_3: She$_i$ should try the new rayon challis, though.

(29) U_1: I see that Carol$_i$ insists on sewing her dresses$_k$ from non-synthetic fabric.

U_{2a}: *That*'s an example of how observant I am.
U_{2b}: I like sewing too.

U_3: They$_k$ always turn out beautifully.

(30) U_1: I see that Carol$_i$ insists on sewing her dresses$_k$ from non-synthetic fabric.
U_2: *That*'s an example of how observant I am.
U_3: **That*'s because she's allergic to synthetics.

(31) U_1: I see that Carol$_i$ insists on sewing her dresses$_k$ from non-synthetic fabric.
U_2: She$_i$ should try the new rayon challis, though.
U_3: **That*'s because she's allergic to synthetics.

U_1 introduces the referring expressions *Carol* and *her dresses*. Examples 28) and 29) show that the referents of *Carol* and *her dresses* are still available for anaphoric reference in U_3 even though they are not mentioned in U_2. This is the case whether the intervening utterance contains a reference to something introduced in U_1, as in the examples U_{2a}, or not, as in the examples U_{2b}. The examples U_{2a} illustrate demonstrative reference involving the nonNP antecedent, *that Carol insisted on sewing her dresses from non-synthetic fabric*. In contrast to the examples of anaphoric reference in 28) and 29), the *that*-clause cannot function as the antecedent, or demonstratum, of *that* after an intervening sentence, as illustrated by 30) and 31).

The preceding arguments suggest that nonNP constituents do not introduce entities into the discourse context. The demonstrative does not access a pre-existing discourse

as demonstrata for inter-textual deixis. In each case, the referent of the demonstrative pronoun is further constrained by the semantic properties of the sentence containing the demonstrative. Thus both the semantic properties of the deictic pronoun and the semantic context in which it occurs constrain the possible referents.

(27) U_1: I see that Carol insists on sewing her dresses from non-synthetic fabric.

U_{2a}: *That*'s an example of how observant I am.
[I see that Carol insists on sewing her dresses from non-synthetic fabric]

U_{2b}: *That*'s because she's allergic to synthetics.
[Carol insists on sewing her dresses from non-synthetic fabric]

U_{2c}: When she's feeling assertive, *that*'s what Roberta does too.
[insists on sewing her dresses from non-synthetic fabric]

U_{2d}: *That*'s one of Carol's favorite activities.
[sewing her dresses from non-synthetic fabric]

U_{2e}: *That*'s the only kind of fabric she's not allergic to.
[non-synthetic fabric]

The alternative second utterances in 27) demonstrate that many different internal constituents of the utterance U_1 can serve as the denotatum of a subsequent demonstrative pronoun. In each variant of U_2 (U_{2a}-U_{2e}), the intended demonstratum appears in italics after the utterance containing the demonstrative pronoun. In the abstract, the referent is either part of the context by virtue of the occurrence of the nonNP antecedent, or by virtue of the occurrence of the subsequent co-specifying demonstrative pronoun. If the former is the case, then all the referents illustrated in U_{2a}–U_{2d} must be part of the context as soon as U_1 occurs. Since in principle any constituent can be deictically referenced, this would mean that every constituent introduces a discourse entity into the contextual domain. However, this move would conflict with the theoretical motivation for the contextual domain, which is to indicate which entities are currently available for anaphoric reference. Some contexts allow either anaphoric reference or intra-textual deixis, as was illustrated in 11)-15). However, the constraints on the two kinds of reference are clearly distinct, as shown below.

The examples in 28)-31) show that entities introduced by referential NPs in U_1 are still available for pronominal reference in U_3.

(26) C_1:there are some books that we have that talk about interviewing
C_2:um *one*'s called Sweaty Palms
C_3:which I think is a great title (laugh)
C_4:um but *it* talks very interestingly about *how to go about interviewing*
C_5:and that's *that*'s going to be important for you now
C_6:but it's important all your life

The referent of *that* in C_5 is much harder to pin down. Determining the referent depends first on determining what is being demonstrated, which itself is problematic given that the demonstratum can be located in any number of places, including the physical surroundings or the discourse model. In this case, where the demonstratum is provided by the prior linguistic context, there are no a priori means for determining which constituent is the demonstratum. For example, is it *interviewing*, or *how to go about interviewing*?

Webber notes that deictic reference is inherently ambiguous:

> [The] ambiguity as to which segment interpretation a deictic pronoun is referring to seems very similar to the ambiguity associated with the use of deixis for pointing within a shared physical context. Both Quine and Miller have observed in this regard that all pointing is ambiguous: the intended demonstratum of a pointing gesture can be any of the infinite number of points *intersected* by the gesture or any of the structures encompassing those points [41].

Webber argues persuasively that deictic reference involving discourse segments is restricted to open segments on the right frontier, but that *there is still an ambiguity as to which segment* might be referred to, due to the recursive nature of discourse segmentation. Since an open segment on the right frontier may contain within it an embedded open segment that is also on the right frontier, a token of the demonstrative whose demonstratum is a discourse segment can be ambiguous between a more inclusive segment and a less inclusive one [41]. The ambiguity can be eliminated if the context in which the deictic expression occurs clearly selects one of the possible readings. This phenomenon pertaining to deictic reference to segments is replicated in the cases where *that* has a nonNP antecedent, thus in C_5 of 26), the demonstratum of the demonstrative pronoun could be *interviewing*, or the more inclusive expression *go about interviewing*, or the more inclusive one yet *how to go about interviewing*.

The inherent vagueness of demonstrative reference involving a nonNP antecedent is dramatically illustrated in 27). Assume for an utterance pair U_1 and U_2 that U_2 is initiated with a demonstrative pronoun and that the demonstratum of the pronoun is a non-NP constituent of U_1, possibly the entire sentence. Given this assumption, there are numerous possible demonstrata that are more or less inclusive subconstituents of U_1. Example 27) shows only some of the many possible constituents that could serve

various other kinds of sentence internal constituents are too complex to be reviewed thoroughly here (cf. [2]). However, I offer two sorts of reasons for distinguishing the referential properties of NPs from nonNPs. The first has to do with linguistic differences between NPs and nonNPs, the second with the pragmatic problem of identifying referents for nonNPs.

Unlike NPs, nonNPs cannot be marked for definiteness: **a/the carefully choosing one's words* versus *a/the careful choice of words*. Definiteness is one of the means for indicating whether a referent is presupposed to be uniquely identifiable within the current context (cf. [28]). Although the relationship between definiteness and presuppositions of existence and identifiability is not absolute, the inapplicability of the grammatical feature of definiteness to nonNP constituents perhaps reflects the irrelevance of the question of what they presuppose. Thus a difference between the interpretation of the two types of phrases *carefully choosing one's words* and *a/the careful choice of words* would have to do with whether there is a discourse entity in the contextual domain (cf. §1, discussion of [28]) either prior to or as a consequence of the occurrence of the phrase. An indefinite NP often involves a presupposition that the referent is not yet part of the current context, while a definite NP often presupposes that it is. In contrast, the interpretation of a gerundive phrase, or other nonNP constitutent, involves neither presuppositions of existence nor of identifiability.

In addition to a referential difference, there is also a difference in denotation between NPs and nonNPs. The denotations of NPs and nonNPs can be very similar, thus the NP *the careful choice of one's words* and the nonNP *carefully choosing one's words* both denote a 'choose' relation between an unspecified person and 'words' chosen by that person. But despite this similarity, there are reasons to view the denotations of NPs and nonNPs as categorically distinct. For example, all of the nonNP constituent types under consideration here permit alternations in the expression of a verbal category such as tense, perfect or progressive (e.g., *to choose/be choosing one's words*; *choosing/having chosen one's words*), whereas NPs never do (**the careful have been choice of one's words*). Thus, the denotations of nonNPs, but not of NPs, must include a specification of the temporal properties associated with tense and aspect. Also, NPs express number and permit count determiners but nonNPs do not (*three choices of words* versus **three choosings one's words*). Thomason, for example, uses the latter type of evidence to argue that NPs whose heads are derived nominals refer to individuated events but that gerundive phrases do not refer to events [40].

Because NPs are both referentially and semantically distinct from nonNPs, the cohesive relations between a token of *it* and an NP antecedent, versus between a token of *that* and a nonNP antecedent, are necessarily different. In addition, the relation of *that* to its antecedent is inherently more vague than in the anaphoric relation. Contrast the uses of *it* and *that* in the following example. The token of *it* in 26) C_4 unambiguously refers to the *one* book called Sweaty Palms, previously identified in C_2.

4.3 Establishing New Discourse Entities

In §4.1 and §4.2, I proposed hypotheses to account for the demonstrative in contexts where the entity it refers to is not a local center, and therefore more accessible to the demonstrative than a local center is. In one case, the entity is a former or potential local center; in the other, the entity is not a candidate local center. However, the most provocative results pertaining to the demonstrative concern contexts where its referent is not a discourse entity until the demonstrative reference itself has been resolved. Here, the functions of the demonstrative are first to access a semantic object that is not currently an entity within the mutually established local focus space, and secondly to increment the local focus space with this new referent.

The type of antecedent which most enhances the occurrence of *that* is also the only type of antecedent which suppresses the occurrence of *it*. In contexts 21-24, N_1 is a nonNP-nonSUBJ. Transition to *it*-SUBJ is suppressed, as shown in context 21, and both transitions to *that*-SUBJ (context 22) and *that*-nonSUBJ (context 24) are enhanced. I will argue that the latter two contexts exemplify intra-textual deixis, which is analogous to the cases of discourse deixis studied by Webber [41]. Webber defines discourse deixis to be deictic reference in which a discourse segment is the object of demonstration. She characterizes deixis as a relation between a deictic expression, some region in the context containing the ostensive object, or *demonstratum*, and the actual referent. Her primary concern is to identify constraints on which segments can serve as the demonstrata for discourse deixis [41]. She provides a useful framework for looking at the relationship between a deictic expression, a discourse segment serving as a demonstratum, and the referent of the deictic expression, in which she makes use of Nunberg's notion of a referring function [30]. I follow Webber in relying on the distinction between the referent and the demonstratum in looking at cases where the demonstrata consist of nonNP constituents. I refer to these cases as intra-textual deixis because the deictic reference involves referents related to the denotations of sentence-internal constituents rather than to discourse segments.

In previous work, I pointed out that the critical feature of the antecedent type which favors the lexical choice of *that* is syntactic, namely the distinction between true noun phrase syntax and other types of constituents [35]. Contexts where N_1 is an NP whose head is a derived nominalization (such as *the careful choice of one's words*) pattern like those where the head is a lexical noun.[41] There are a number of differences between nonNPs and canonical NPs (full noun phrases with a lexical or derived head) which have consequences on the status of their semantic interpretation.

Referential NPs have both a denotation and a referent. In contrast, nonNPs must have a denotation but do not necessarily evoke a discourse entity, or referent, into the discourse model. Questions as to the denotation and reference of sentences, NPs, and

[41]Mixed nominals, such as *the careful choosing of one's words*, occurred too rarely to have a discriminating effect on contexts favoring *it* or *that*.

LCE rule on two counts: N_1 is not a pronoun and N_1 is not a subject. This suggests that the function of the demonstrative in context 16 is to maintain reference to an entity that is not a current, former, or imminent local center. This function is referred to as non-local center retention. The pragmatic effect of the non-local center retention context would be to establish a cohesive relation between two utterances that marks the relevant entity as not having the global relevance that a local center has.[39]

Contexts where the antecedent is NP-nonSUBJ are distinctive not only because lexical choice of *that* is enhanced, but also because *it* is suppressed. The suppression of the transition from NP-nonSUBJ to *it*-SUBJ (context 13) conflicts with many persons' intuitions.[40] For many people, examples such as those in 23)-25), exemplifying context 13), are naively expected to be quite frequent.

(23) S: I'd always liked *history* (pause) um *it* seemed like a
S: like a good jumping off point for everything else uh languages
S: philosophy art religion

(24) C: I know people who have uh who have been successful doctors
C: who haven't enjoyed *the emergency room*—
C: *it*'s not the kind of work they want to do

(25) C: I had *a bad upper respiratory infection* and she she told
C: me what to take and and she was right and *it* went away

These excerpts illustrate how natural the suppressed transition appears. Why would the transition to *it*-Subj be suppressed? When N_2 is an *it*-nonSubj, transition to *it*-Subj is not suppressed (context 15). When N_1 is an NP-Subj instead of an NP-nonSubj, transition to *it*-Subj is not suppressed. I conclude that the combination of factors that N_1 is neither a pronoun nor a subject marks the entity being referred to as an unlikely candidate for local center status. Enhanced transitions are interpreted here as contexts in which the attentional status of the entity is maintained. Context 16 in which N_2 is the demonstrative rather than *it*, and is not a subject, signals an entity as an unlikely candidate for local center status throughout the utterance pair (cf. [32]). The communicative effect of violating this expectation, i.e., producing the unexpected transition to *it*-SUBJ at N_2, would be to cause a shift in the attentional status of the entity. Context 13 may thus exemplify a mechanism for transforming an entity that is expected not to be a local center into one that is expected to be a local center.

[39]This hypothesis has been substantiated; cf. [32].

[40]Wlodek Zadrozny, Candy Sidner, and others have expressed surprise at the infrequency of this context, thus bringing its significance more to my attention.

another token of the demonstrative. The demonstrative is rare in cohesive chains, but when it occurs, it tends to recur right away. Thus, whatever attentional status is signaled by the demonstrative within cohesive chains tends to persist at least across consecutive utterance pairs. Actual inspection of these contexts indicates that the utterances within cohesive chains that contain consecutive occurrences of *that* are often verbatim or near verbatim repetitions, as in 22).

(22) C_0: ya know if you can't teach don't do it

C_1: some people do it because they also do research here yeah
S_1: they have to yeah

C_2: [*that*'s] a real problem
S_2: uhhuh

C_3: [*that*'s] a real problem

The cohesive chain data indicate that the demonstrative pronoun rarely occurs within cohesive chains, but can occur initially or finally in a cohesive chain. These are the two contexts in a cohesive chain that are most likely to deviate from local centering, and the increased likelihood of the demonstrative in just these two contexts is compatible with the view that an entity can be more easily accessed by the demonstrative if it is about to be established as a local center, or if is a former local center, and much less so if it is a local center. In the majority of mid-chain contexts, the LCE context is preserved, but it is not known what factors correlate with deviation from the LCE context within a chain. It is shown, however, that once the demonstrative has occurred within a cohesive chain, it is likely to occur in the very next position within the chain.

4.2 Non-Local Center Retention

By definition, the referent of a full noun phrase is not a local center at the time of the full noun phrase specification. There are two significant contexts where N_1 is a full NP (contexts 13 and 16), and they exemplify complementary patterns of significance. If N_1 is an NP-nonSUBJ, then transition to *it*-SUBJ is suppressed (context 13) and transition to *that*-nonSUBJ is enhanced (context 16).[38] This pattern suggests that the NP-nonSUBJ configuration signals an attentional status for the referent that conflicts with local centering because subsequent reference by an expression that would initiate the LCE context is inhibited. Furthermore, this type of antecedent conflicts with the

[38]Subsequent research has shown that the givenness of the antecedent correlates with lexical choice between *it* and *that* when the antecedent is an NP [32].

Grammatical Role and Form of Ant. (N_1)	Subsequent Pronoun (N_2)			
	IT-GR_i	THAT-GR_i	IT-GR_k	THAT-GR_k
IT-GR_i	73	18	32	11
	65.4	24.5	29.4	14.7
	.9	1.7	.2	.9
THAT-GR_i	7	12	4	7
	14.6	5.5	6.6	3.3
	4.0	7.7	1.0	4.1
Table χ-Square				20.5
Degrees of Freedom				3
Probability				.017%

Table 3: Local Centering Within Chains

the relationship between antecedent/pronoun pairs. Table 3 presents the results of examining each type of antecedent/pronoun sequence for all the Mid pronouns, and demonstrates an interesting result about the occurrence of demonstratives within chains. The two row headings represent the two cases where the antecedent (N_1) is either *it* or *that*, with the symbol GR_i to indicate that it has a particular grammatical role status (SUBJ or nonSUBJ). The column headings represent the four cases where the subsequent pronoun (N_2) is:

1. a token of *it* that **matches** the grammatical role status of the antecedent (GR_i),
2. a token of *that* that **matches** the grammatical role status of the antecedent (GR_i),
3. a token of *it* that **does not match** the grammatical role status of the antecedent (GR_k),
4. a token of *that* that **does not match** the grammatical role status of the antecedent (GR_k).

Thus the first cell of the table represents the canonical and non-canonical LCE contexts: both N_1 and N_2 are *it*, and both have the same grammatical role status. None of the cases where the antecedent is *it* are significant. Since most of the mid pronouns are *it* anyway, it is not significant that 73 out of 164, or 45%, of all the mid pronouns conform to the LCE context. What is highly significant is that there are an unexpectedly frequent number of cases where the demonstrative is followed by

Chain Position	Lexical Choice		Row Totals
	IT	*THAT*	
FIRST	85	86	171
	113.9	57.1	
	7.3	14.6	
MID	134	30	164
	109.2	54.8	
	5.6	11.2	
LAST	118	53	171
	113.9	57.1	
	.1	.3	
Column Totals	337	169	506
Table χ-Square			39.1
Degrees of Freedom			2
Probability			0.00001

Table 2: Relative Position in Cohesive Chains: Effects on Lexical Choice

of chain position.[35] First, note that chain position is strongly correlated with lexical choice (p=.001%). Secondly, the relative distribution of the two pronouns varies with position in the predicted manner. As shown, the two pronouns occur equally often in First position, which is statistically significant, relative to the overall distribution; *it* occurs significantly infrequently (cell χ^2=7.3) and *that* occurs significantly frequently (cell χ^2=14.6). Also as expected, *it* occurs significantly frequently (cell χ^2=5.6) and *that* occurs significantly infrequently (cell χ^2=11.2) in Mid position. Finally, it is particularly interesting that in Last position, the frequencies of *it* and *that* are quite close to the expected frequencies. In Last position, the likelihood of an *it* or a *that* is dependent only on their relative distribution in the chain data set as a whole.[36] That is, as soon as the LCE context is necessarily not maintained, the lexical choice of pronoun becomes a chance event, rather than constrained by the properties of the prior context or the current attentional status of the referent.

The data in their current form do not make it possible to determine the precise degree to which pronouns in Mid position conform to the LCE rule, or to account for the cases which deviate from the LCE rule. Answering such questions depends on being able to evaluate progression throughout a chain, and to compare such progressions across cohesive chains.[37] It is only possible in the current data set to examine

[35]Each cell of the table gives the observed frequency, the expected frequency, and the cell χ^2, in that order.

[36]Cf. column totals for *it* (N=337) and *that* (N=169).

[37]The data is currently being recoded in order to permit this type of analysis.

the preceding utterance. No new effects were found. Factors arising from properties unique to cohesive chains such as the length of the chain, absolute position of a token within a chain, whether the initial pronoun token in the chain had an antecedent, and if so, the syntactic form of this initial antecedent, all had no effect on the behavior of pronouns within chains (cf. discussion in [31] [36]). The absence of any effects of properties peculiar to cohesive chains suggests that they should be viewed in terms of the local contexts for which we have already found significant characteristics. We have seen that the form and grammatical role of a referring expression depends upon the form and grammatical role of a co-specifying expression in the preceding utterance, if there is one, and conversely, that it constrains the form and grammatical role of a co-specifying expression in the subsequent utterance, if there is one. The local center establishment rule specifies the nature of these bi-directional effects when the referring expressions are pronouns. Since the successive utterance pairs in a cohesive chain are potentially local center contexts, the LCE rule should predict the behavior of pronouns within chains. To a large degree, this is the case.

The LCE rule makes the following predictions regarding cohesive chains. First, it predicts that there should be a strong effect of *relative* position of a pronoun in a cohesive chain. By definition, all the pronouns in cohesive chains have a pronominal antecedent except for the initial pronoun. Consequently, the LCE rule makes no predictions about the lexical choice or grammatical role of the initial pronoun in a cohesive chain. Instead, we should expect a relatively equal distribution of *it* and *that* in initial position because if the initial pronoun has an antecedent, it must be an NP or a nonNP. In addition, the cohesive chain data include many cases where the initial pronoun had no antecedent. Within a cohesive chain, each pronoun token plays a dual role, both as the subsequent referring expression in the second utterance of a pair, and as the antecedent referring expression for a following utterance conforming to the LCE rule. The LCE rule predicts that within chains, most tokens should be *it*, and that the grammatical role status of the initial token should be maintained throughout the chain. The last position in a chain, like the initial position, is distinctive. It is the only token not followed by a co-specifying pronoun. That is, the last utterance in a cohesive chain is the first point where the local center context is necessarily not maintained. Thus, the last pronoun token should deviate from the LCE context, either in its form or its grammatical role. That is, the demonstrative should occur more often in the final position, and the transition to the final position should less often maintain the same grammatical role status. Unfortunately, given the current format of the data, it was not possible to directly test the effects of grammatical role. However, the effects of relative position are just as expected, as shown in Table 2.

Chain position encodes relative position, and discriminates among three contexts: the initial pronoun of a chain (First), pronouns within a chain (Mid), and the last pronoun (Last). Table 2 depicts the cohesive chain data, showing the expected effects

The other logical possibility is for there to be a class of entities that have been mentioned in the local context, but which, perhaps because they are merely transitory vehicles for making assertions about more relevant entities, do not have the requisite longer-term relevance associated with past, present and future local centers. Given the possibility that such a class of entities can exist at any particular time, and that the class membership will certainly change over time, it is entirely reasonable to suppose that any such entity may need to be mentioned more than once. It is also reasonable to suppose that such entities can be referred to in such a way that the absence of longer-term relevance is overtly signaled in order to distinguish such entities from past, present and future local centers. I will refer to this function as *non-center retention* and provide examples supporting the hypothesis that certain uses of *that* perform this function (cf. §4.2)

The final function proposed for the demonstrative pronoun is also the most distinct from local centering, both in terms of its statistical significance as reflected in the data in §2, and in terms of its theoretical consequences. A precondition for local centering is that there be an entity in the local focus space that can be assigned the local center status. Thus the final possible function for the demonstrative pertains to cases where the referent does not exist as an entity in the local focus space at all, prior to the use of the cohesive device itself. Here the pragmatic effect of the demonstrative is to bring a new entity into the local focus space. In §4.3 I will argue that demonstrative pronouns whose antecedents are nonNPs trigger the creation of new discourse entities in a manner analogous to that proposed for demonstrative pronouns whose antecedents are discourse segments, as described by Webber [41].

4.1 The Role of the Demonstrative in Bracketing Cohesive Chains

So far, the cohesive contexts examined here have consisted of utterance pairs. In the original investigation from which the data is drawn, only one larger type of context was examined, referred to as a cohesive chain. A cohesive chain is a succession of utterance pairs in which every utterance contains a co-specifying pronoun token.[33] Here I will briefly describe the contextual features affecting lexical choice of pronoun within this more global context.[34] The data illustrate a contrast between the role of the demonstrative when it introduces or terminates a cohesive chain, versus when it occurs within a cohesive chain.

There were 101 cohesive chains in the interview data ranging in length from 2 successive utterances to 13. For any pronoun token within a chain, lexical choice and grammatical role depended only on characteristics of the prior pronoun token in

[33]The term seems to have appeared in the philosophical and linguistic literature at about the same time, e.g., in works by K. Donnellan, C. Chastain, M. Halliday and D. Zubin.

[34]Cf. [31], and especially, chapter 6 of [36].

4 Discussion II: Coherence Functions of the Demonstrative Pronoun

The hypothesis that the demonstrative pronoun contrasts with *it* even in apparently anaphoric contexts is borne out by the very distinct distributional facts represented in the data reviewed above. Here I will develop and evaluate the more specific hypothesis that the demonstrative pronoun exhibits a variety of pragmatic functions corresponding to distinct dimensions of contrast with the local center. I will propose that using a demonstrative pronoun in an apparently anaphoric context indicates two things: that a referent for the pronoun can be located somewhere in the current context, and that the relevant contextual location is distinct from that for referents of the definite pronoun. As a preliminary step in developing this hypothesis, I will first consider the general range of possibilities for referring expressions other than those which participate in local centering.

I presume local centering to be a cognitively and formally distinct coherence phenomenon in which an entity already in the local focus space serves as a default referent in a manner analogous to the symbolic function of first and second person pronouns. If the pragmatic function of local centering is strictly to constrain the interpretation of pronouns within a local utterance context, then pronouns which do not contribute to local centering may yet pertain to the process by which entities in the local focus space become candidate local centers. It is possible that the referents of all pronouns—or even all referring expressions—within a local segment, have a certain likelihood for becoming local centers. This likelihood may be predicted in some fashion resembling the proposals for ordering the Cfs of an utterance found in the centering framework (cf. [38] [5] [22]). However, as noted above, I have as yet found no evidence of such an ordering.

Another possibility is that local centering not only constrains the interpretation of pronouns, but also indicates the longer-term relevance of locally centered entities in a larger discourse segment, or in the discourse as a whole. The conviction that there is a relationship between local coherence phenomena and discourse relevance may in fact motivate the assertion in the centering literature that the Cb of an utterance is the entity of most concern. For present purposes, it does not matter precisely how the notion of longer-term relevance is construed, merely that we assume that this is another pragmatic function, perhaps even a side-effect, of local centering. In this case, entities that are not currently local centers can fall into two classes. One class would consist of those entities that are not currently local centers, but have or will have an overtly signaled longer-term relevance either as a consequence of having been local centers or by being candidate local centers. I will review one class of uses of the demonstrative pronoun where its function seems to pertain to accessing candidate or former local centers. In other words, the demonstrative seems to be used to make a transition towards or out of a local centering context (§4.1).

tional participants mutually attend to and talk about a succession of different entities. Following Kaplan [23], I'll use the term *pure index* to mean an expression that indexes a unique, non-arbitrary, non-linguistic component of the speech situation, e.g., the first person pronoun *I*. The demonstrative pronoun, whose defining characteristic is that it demonstrates an object or phenomenon in the non-linguistic context, is also indexical. However, the demonstrative is not a pure index because its referent is not completely determined by the context.

Finding the referent of a pure index depends only on the fact of a speech situation taking place. Its referent is a necessary component of the ongoing speech situation. Thus, the process of interpreting a pure index requires no search or inference, but depends only on the manner in which the speech situation is currently construed. The denotatum of a pure index can be viewed as a contextual parameter—e.g., *current speaker*—that must have a particular referential value whenever an utterance occurs. The pragmatic interpretation is the current value of the relevant parameter, and shifts as the crucial components of the speech situation shift. I assume that a non-linguistic processing mechanism insures that the current value of the parameter is updated whenever necessary.

In many ways, a pronoun referring to a local center is like a pure index. Discourse initially, there is no local center, because the LCE rule depends minimally on an utterance pair. The first time there can be a local center is for the utterance pair $< U_2$, $U_3 >$, assuming that the relevant entity is introduced by a full referring expression (or a deictic pronoun) in U_1. For any pair of utterances where the LCE rule has applied, there will be a discourse entity that is by default indexed to the use of subsequent referring expressions with the right lexico-grammatical properties. For such a pair, there exists one of the preconditions of an index, i.e., the local center has been established as a transient parameter of the speech situation analogous to the permanent parameter *current speaker*. The processing mechanism for interpreting subsequent expressions conforming to the LCE rule is thus analogous, although not identical, to the process for pure indices. The difference is that the local center is only a candidate referent, and after the current value of the local center is accessed, it can be rejected if it is not semantically coherent in the local context.[32]

There are three key differences between a pure index and a local center. First, the denotata of pure indices are non-accidental properties of the speech situation, and therefore inherent at all times in every speech situation, whereas the local center must be established for a particular context, and then maintained. Second, the former are directly encoded in the grammar while the latter are realized through non-conscious conventions of use. Third, the latter represents a default mechanism only, and can be overridden.

[32]As noted in [32], in roughly 10% of contexts that looked like LC contexts, the two relevant pronouns did not co-specify.

phenomenon, it is still possible for the attentional status of local center to be realized by another inter-clausal configuration: sharing of non-subjecthood by co-specifying pronouns in adjacent utterances. Thus an essential aspect of the grammatical role dimension is that it must be shared by N_1 and N_2. On these grounds, the data can be viewed in yet more abstract terms such that there is only one context that favors lexical choice of *it*. The non-canonical local center context is in fact a variant of the first, where the pragmatic motive for the alternation arises from the occasional conflict with 1st and 2nd person pronoun subjects within the same utterance pair.

3.2.3 Indexical Basis of Local Center

The motivation for distinguishing local center from other kinds of centering is that the data reviewed here strongly support this interpretation. But there are other reasons for the plausibility of such a construct, given the general properties of indexical expressions. I will argue that the LCE rule is a mechanism for creating a pure index, albeit one which is pragmatically realized rather than grammatically realized, and therefore not obligatory. Doing so alters the processing demands of a pronoun that typically functions anaphorically into one that requires no search or inference. In order to provide a basis for this argument, I first review the notion of indexicality.

Peirce's tripartite classification of signs—icons, indices and symbols—has had a long influence in semantics [33] [6]. For Peirce, an index was a sign which signified by virtue of a *dynamical connection both with the individual object [or denotatum], on the one hand, and with the senses of the person for whom it serves as a sign; [it represents] a junction between two portions of experience* [6]. In other words, the defining property of an indexical expression is that the expression and some phenomenon in the world must co-occur, which the expression becomes an index of. Peirce's concept of an indexical sign persists in formal semantics, for example, in the notion of a coordinate in a model (cf. [23] [4]). Expressions whose reference depends on circumstances of the co-occurring speech situation, such as 1st and 2nd person pronouns, tense, demonstrative pronouns, and so on, are all indexical expressions. First and 2nd person pronouns, which refer to the current speaker and addressee, cannot be anaphoric. Their referents, in contrast to anaphoric pronouns, are non-arbitrary, fixed components of the non-linguistic context. As a consequence, there is no need to add them to the contextual domain in order to insure successful reference.

Jakobson [19] discusses another important distinction between 1st and 2nd person pronouns versus 3rd person pronouns. Since the conversational roles of speaker and addressee change during the course of a speech situation, the referents of the pronouns *I* and *you* correspondingly *shift* as the conversational roles shift. The referents of third person pronouns, whether established linguistically or non-linguistically, do not shift along with corresponding shifts of components of the speech situation. Rather, they refer now to one thing, now to another, as a consequence of the fact that conversa-

and how to re-mention the entity $\mathcal{E}$ are guided by the LCE rule. Like the center rule, the LCE rule is a pragmatic one and can be violated to good communicative effect, as demonstrated by the fact that although certain contexts are suppressed, they still occur (e.g., cf. discussion of 23)-25) in §4.2). However, as noted in §2, violations alter the presumed attentional status whereas adherence to the rule maintains it.

3.2.2 Non-Canonical Local Center

Since there are two inter-utterance configurations that select for *it*, both are assumed to reflect a common attentional mechanism. In this and the following subsections, we examine this assumption further. Here we look at why there should be two ways to realize a local center. In §3.2.3, we consider the relative processing efficiency of local center contexts.

The non-canonical local center contexts can be seen to exhibit the interaction of two distinct pragmatic effects. The question that naturally suggests itself about the non-canonical context is, given that N_1 and N_2 are not the subjects of their clauses, what kinds of constituents do occur as the subjects. In this data, the subjects in the non-canonical contexts were most often 1st or 2nd person pronouns.[31] After that, there was a very small heterogeneous category. These data conform to a proposal made by Givon and others [11] [26] that preferred subjects are animate rather than inanimate, definite rather than indefinite, full expressions rather than pronominal, and 1st or 2nd person rather than 3rd person. The interview dialogues examined here are intentionally biased towards the discussion of non-animate entities, e.g., college courses, degree requirements, career options, resumés, and so on. For every matrix clause utterance, there can be only one subject. But if a non-animate entity and an animate one are mentioned within a single utterance, Givon's subject hierarchy predicts that the latter will more often occur as the subject. My conclusion is that the non-canonical local center context involves an interaction between two separate organizing forces: the local center status of the referent—which in this data is necessarily a non-animate entity—and the attentional prominence of animate entities, in particular the speaker and hearer themselves.

Given two conceptually distinct classes of entity that can be referred to with distinct types of pronouns in the same sentence—e.g., animate and non-animate pronouns—there is a potential for competition as to which entity will be expressed as the subject. Given that the subject role has both an intra-clausal function, with respect to argument structure, and an inter-clausal function, with respect to attentional status, there will be various forces shaping the competition for subject role. The non-canonical LCE context illustrates that if the subject role is pre-empted by a distinct pragmatic

[31]The two next most likely possibilities were that the subject was an animate full referring phrase, or a non-referential (expletive) expression, e.g., existential *there*; in this study, the category subject always refers to a surface grammatical function.

(21) C_1: well *public relations* is basically representing people

C_2: ideas things in a very positive way to others
S_2: uhhuh

C_3: and [*it*'s] doing it in a written form

C_4: [*it*'s] doing it in a crowd control (laugh) form
S_4: (laugh) yeah

C_5: [*it*'s] doing it in a in a verbal form
S_5: uhhuh

(Cf. utterances S_4 and S_5 in 20) for an illustration of a non-canonical local center.) The very next local context, or overlapping utterance pair, starts at the current U_2, which is then the initial utterance of the next utterance pair. As exemplified in 21), once a local center is established, it is often maintained. (Contexts maintaining an LC beyond the initial utterance pair are discussed in §4.1.)

The conversational data demonstrate that participants can presume that they and other participants will adhere to the LCE rule.[30] This presumption has consequences on the form and the interpretation of an utterance U_2. If an utterance conforms to the requirements imposed by the LCE rule on the initial utterance of a pair, this creates strong expectations that a local center is to be established. It is easy to see how such expectations on the part of the hearer would influence the hearer's interpretation of N_2. But the presumption of conformity to the LCE rule presumably affects the actual form of N_2 as well. It is presumably the case that when uttering U_1, the speaker has already selected an entity to be the local center for the utterance pair that U_1 initiates. But the speaker might have a change of mind before completing utterance U_2. It is through the speaker's commitment or lack of commitment to the local center throughout the utterance pair that the form of U_1 has consequences on the form of U_2.

It is also possible that the current hearer might become the speaker at U_2. In my previous analyses of the interview data, speaker alternation was examined as a possible conditioning factor for lexical choice [36]. Although there was often a change of speaker from the antecedent expression to the target pronoun, this factor was found to have absolutely no effect on lexical choice. This indicates that speakers cooperatively conform to the local center establishment rule. Thus if the speaker at U_2 is different from the speaker at U_1, the new speaker's decisions about whether

[30]Reliability measures are not explicitly discussed here, but cf. [36] for evidence that all the participants in the interview data and all the distinct interviews adhered equally to the effects presented in Table 1.

figurations of contexts were examined, with the conclusion that the most significant factors affecting lexical choice of *it* and *that* were those represented in Table 1. There was no evidence for the hypothesis that there is a gradient of contexts which increasingly favor *it*. This indicates that individual tokens of *it* either participate in local centering or not and that other tokens of *it* bear other kinds of coherence relations to the prior context that cannot be scaled according to a gradient of more to less typical of local center establishment.

Local Center Establishment The data support the conclusions that the most cohesive context is the local center context, that there is a preferred realization of local center, and that lexical choice of *that* conflicts with the context in which the form of N_1 anticipates the preferred, or canonical local center.[29] These findings are summarized in the following local center establishment (LCE) rule. The rule has two parts pertaining to understanding ($\mathcal{A}$) and generation ($\mathcal{B}$).

Local Center Establishment Rule

$\mathcal{A}$: Recognizing a Local Center
Two utterances U_1 and U_2 that are adjacent in their segment establish an entity $\mathcal{E}$ as a local center only if U_1 contains a third person, singular, non-demonstrative pronoun N_1 referring to $\mathcal{E}$, U_2 contains a co-specifying third person, singular, non-demonstrative pronoun N_2, and N_1 and N_2 are both subjects or both non-subjects, in that order of preference.

$\mathcal{B}$: Generating a Local Center
Precondition: To establish an entity $\mathcal{E}$ as a local center, $\mathcal{E}$ must be in the current focus space, and it must be possible to refer to it with a singular, third person, non-animate pronoun.

To establish $\mathcal{E}$ as a local center in a pair of adjacent utterances U_1 and U_2, use an expression of type N to refer to $\mathcal{E}$ in both utterances where each token, N_1 and N_2, is a third person, singular, non-demonstrative pronoun. Both should be subjects or both non-subjects, in that order of preference.

A context conforming to the local center establishment (LCE) rule establishes an entity $\mathcal{E}$ as a local center, which thereby becomes the default referent for an immediately following local center context, as in 21:

[29]Note: the data presented here pertain to the formal choices correlating with two co-specifying expressions. Complementary data shows that two expressions are very likely to co-specify given the formal features corresponding to local center contexts [32].

differences between NP and nonNP antecedents are discussed.

There are two possibilities regarding the attentional status of entities in the two classes of contexts where N_1 is not a pronoun. One possibility is that the relevant entities have a totally distinct attentional status from that associated with the local center. Another possibility is that the means for signaling the attentional status of local center, given the use of a full expression at N_1, are distinct from the means used when N_1 is a pronoun. Given the distributional evidence of features selecting for *it*, I propose that one component of the operational definition for local center is to overtly exclude non-pronominal constituents from realizing the local center; both relevant referring expressions must be definite pronouns, and in particular, N_1 must be unstressed and non-demonstrative.[27]

Grammatical Role According to Kameyama's property-sharing constraint, if two unstressed, definite pronouns retain the same Cb in adjacent utterances, both should be subjects or both should be non-subjects, corresponding to canonical and non-canonical Cb-retention, respectively [21]. Transition to *it* was enhanced in both contexts conforming to the property sharing constraint (contexts 1 and 7). In context 1, where both expressions were grammatical subjects, there was far more significant enhancement. Table 1 shows that the cell representing the canonical context (cell 1) has a much higher cell χ^2 (27.1), and is therefore much more significant, than the cell representing the non-canonical Cb-retention context (cell 7; cell $\chi^2 = 6.7$). On the other hand, the lower cell χ^2 of 6.7 is still much higher than in the non-significant cells, where it ranges from .0 to 1.9. The positive deviation from expected frequency is what tells us that the cells represent enhancement. The data thus support the two hypotheses embodied in the property sharing constraint that sharing of the same subject role status by two successive referring expressions—both subject or both non-subject—contributes to greater cohesiveness, and that sharing of subject role has the more cohesive effect. Following Kameyama, I will use the terms canonical and non-canonical to refer to these two local center contexts. The evidence also indicates that lack of property-sharing inhibits local centering. This leads to a stronger characterization of the local center because it allows us to make bi-directional claims, thus supporting generation or understanding.[28]

Other Surface Features As pointed out in §2, many other classifications of grammatical role and antecedent type, as well as other multi-valued variables and con-

context were subjects of their clauses. But nonNPs were subjects of their clauses at only half that rate, 11% of the time. For the sake of completeness, note that antecedent pronouns were subjects more often than they were non-subjects, at a ratio of 3 to 1.

[27]Recall that in most cases, N_1 was *it*; cf. n. 10.

[28]Kameyama [22] asserts the need for bi-directional constraints, but doesn't explicitly discuss the difference in applying her constraints for generation versus understanding. Her examples only pertain to understanding.

they do not necessarily co-occur, but it will be seen that their co-presence strengthens the relevant attentional state. The fact that *that* is suppressed where these features co-occur,[25] and that where these features do not occur *that* is sometimes enhanced and *it* is suppressed or unaffected, are also taken as supporting evidence that the local center context represents a distinctive pragmatic function.

Surface Form of the Antecedent The data include all the cases in the transcripts where, given a pair of co-specifying phrases N_1 and N_2, N_2 is *it* or *that*. The centering rule says nothing about the effect of the form of N_1 on the likelihood that N_2 will be a definite pronoun. It does predict that if the same entity continues to be maintained as the Cb in subsequent utterances, expressions realizing that entity will be pronouns. The data demonstrate a very strong effect of the form of N_1 in line with this prediction. The two cases of enhanced transitions where N_1 is a pronoun both favor the choice of *it*. When N_1 is not a pronoun, a transition to *it* is never enhanced, but is in fact sometimes suppressed, as in contexts 13 and 21 of Table 1 and Fig. 1. Since no context where N_1 is not a pronoun leads to an enhanced transition to *it*, no contexts other than 1 and 7 contribute to local centering.

It is notable that no context where N_1 is a full noun phrase favors *it* as the choice for N_2. In fact, if N_1 is a full noun phrase and is moreover not the subject of its clause, then *it* is suppressed (context 13) and *that* is enhanced (context 16); this is exactly the opposite of the pattern observed for cases where N_1 is a pronoun. Unfortunately, the data provided here do not include cases where N_2 is not a pronoun. As a consequence, we do not have the opportunity to compare the likelihood for N_2 to be a co-specifying pronoun as opposed to a co-specifying full referring expression. Lacking this data, and having no evidence in the current data to assume that the attentional status of referents in contexts where N_1 is a full NP resembles that of local center, these cases are excluded from the local center context on the basis of the contrast between the full NP contexts and the local center context.

The centering literature does not mention cases of co-specifying phrases where the antecedent phrase is neither a pronoun nor a full noun phrase, but is instead a clause-like argument (nonNP). This case, represented by contexts 17-24 in Table 1 and Fig. 1, comprises yet a third class where the form of N_1 affects pronominalization patterns. It is distributionally distinct from the cases where N_1 is a pronoun, because transition to *it* is never enhanced whereas transition to *that* is enhanced in two contexts (22 and 24). It is also distinct from the cases where N_1 is a true noun phrase. For example, noun phrases often occur as the subjects of their clauses in cases where the subsequent utterance contains a co-specifying pronoun, but nonNPs much less so.[26] In §4, other

[25] Elsewhere I have argued that the entities in Kameyama's canonical center retention context are in an attentional state which makes them relatively inaccessible to demonstrative reference [31].

[26] By computing the row totals for NP-Subjects shown in Table 1, and dividing by the sum of the row totals for NP-Subjects and NP-NonSubjects, we find that 22% of NPs in the relevant cohesive

factors that most clearly differentiate among the contexts—the grammatical roles of N_1 and N_2, and the form of the antecedent expression N_1—contribute to a complex interrelation among surface form, the paired grammatical roles of N_1 and N_2, and the lexical choice of N_2 that suggests quite distinct coherence functions for the two pronouns.

3.2 Local Center

The centering model reviewed in the preceding section acknowledges the multiple dependencies of linguistic factors and local attentional state on processing referring expressions. However, as noted, many aspects of the model are not verifiable. By comparing the distributions of *it* and *that*, I identify contexts which definitively select for the definite pronoun. My analysis of these contexts leads to an operational definition of a theoretical construct referred to here as *local center*. I use a distinct term to emphasize that the definition of local center is narrower than that of center, while acknowledging the similarity of assumptions regarding attentional state.

3.2.1 Establishment of a Default Referent

Occurrence of *it* is enhanced in precisely two of the twenty-four contexts in Table 1: the contexts represented in cells 1 and 7. The two contexts selecting for *it* are where N_1 is a pronoun and both N_1 and N_2 are SUBJ (cell 1) or both nonSUBJ (cell 7). The two properties characterizing these contexts are: pronominalization of both N_1 and N_2, and sharing of the same grammatical role property (both SUBJ or both nonSUBJ). The context with the highest significance—where N_1 is a pronominal subject—is also where *that* turns out to be most significantly suppressed (cf. contexts 2 and 4). In the discussion below, I will describe how surface form and grammatical role each contribute to maintaining a referent in a particular attentional state.

Of the two pronouns, *it* is the minimal form along the several dimensions reviewed in §1.1, and is thereby expected to add the least new information, and to be the more cohesive pronoun. Consequently, the context in which *it* is most enhanced is taken as the baseline context for understanding the distinct contributions to local cohesion of surface form and grammatical role. The underlying attentional state which these surface choices are assumed to be a reflection of will be referred to as the establishment of a local center (LC). Given the strong statistical significance of the LC contexts, they presumably serve some communicative function. In the discussion that follows, we will see that the local center bears a strong resemblance to proposed realizations of the backward-looking center (Cb). But unlike the Cb, LC is defined only in terms of the observed distributional pattern, and its communicative function is a matter of investigation rather than stipulation. The individual features of the contexts where *it* is enhanced are assumed to contribute separately to local centering, in the sense that

and interpreting their contributions to interactive discourse.

Although we cannot definitively identify the center of any utterance, we can assume that since all of the contexts depicted in Fig. 1 involve an explicit cohesive tie between adjacent utterances, then a significant portion of them should (theoretically) exemplify centering. All the contexts conform to the schematic representation of Fig. 2, insofar as any of the relevant referents are centers. All the contexts involve two successive linguistic expressions (N_1 and N_2) evoking the same conceptual object (C_i), where the second expression is often a definite pronoun. Also, the two expressions N_1 and N_2 occur in objectively adjacent utterances roughly two thirds of the time,[23] in the same utterance about a sixth of the time,[24] and in contexts where at least one utterance intervened between those containing the pronoun and its antecedent roughly one sixth of the time. As shown elsewhere, this distance measure had no effect on the lexical choice between *it* and *that* [36]. Although the cohesive relation linking N_1 and N_2 does not always involve two literally adjacent utterances, it is extremely likely that the two non-adjacent contexts (remote utterances; same utterance) are virtually equivalent to the adjacent one. In the cases where there were intervening utterances, the intervening material was often apparently part of a distinct discourse segment, making it possible to see U_2 as a continuation of the segment containing U_1. In the case where the successive clauses containing N_1 and N_2 were in the same sentence, the syntactic linkage between the two clauses was often relatively loose, e.g., via subordinating conjunctions. The centering literature explicitly allows for the former case [13] [14], as noted above, but to my knowledge does not discuss the issue of coordinated or loosely subordinated clauses. However, the cohesive relations between such clauses have been argued to be similar to those between independent clauses [39] [9].

To establish incontestable criteria for *virtual adjacency* would require a separate investigation. However, people apparently arrive at a rough consensus when asked to segment a discourse [15], thus I believe that my assumption of virtual adjacency could be corroborated. In any case, since the objective distance between N_1 and N_2 had absolutely no statistical effect on the distributions represented in Table 1, it is safe to assume that N_1 and N_2 were utterances adjacent in their segment in all cases.

Given that all the contexts in Fig. 1 conform to the prototypical context for the original centering rule—keeping in mind the qualification that there is no way to determine definitively whether the entity referred to in each inter-clausal context is the Cb of its utterance—then all of the state transitions should be equally likely unless the two pronouns do not function equivalently. As shown by the extremely significant χ^2 of Table 1, the state transitions are definitively not equally likely. The

[23]Since the speakers in the interview data use far more sentence coordination than is typically found in prose, an utterance was operationally defined as an independent clause, possibly introduced by one of the conjunctions *and*, *or* or *but*.

[24]In these cases, the pronoun and its antecedent were generally in distinct tensed clauses.

S_3: uh with that level students um
C_3:

S_4: maybe with time and experience I'll gain $\boxed{it}$
C_4:

S_5: but I don't have $\boxed{it}$ now
C_5: uh huh

The pair of utterances S_4 and S_5 contain co-specifying instances of the pronoun *it*, both of which are direct objects. The full referring expression that introduces the conceptual entity being referred to occurs in the utterance spanning S_0 through S_1: the italicized noun phrase *the mental capacity to handle uh what I would like to teach.* In both S_4 and S_5, the grammatical subject of the clause is a first person pronoun.

It is not obvious that all the utterances in 20) have centers. What is the center of the long utterance spanning S_0-S_3? Is it the entity that is evoked by the NP *the mental capacity* ...? The fact that this entity is later re-evoked by a pronoun in S_4 suggests so. But perhaps this is not a fair question because we do not have here the utterance that preceded S_0. On the other hand, if we can't determine the center without the prior utterance, why is the center said to be a property of an utterance? The utterance pair S_4 and S_5 contains two co-specifying pronouns. Is the entity evoked by these pronouns the center? If so, when does it become the center? Is it the center when it is first introduced, i.e., in the utterance spanning S_0-S_3? If so, then why does the utterance pair S_4 and S_5 seem more cohesive than the pair S_0-S_3 and S_4? Is there a context in 20) for which we can confidently identify the center? The utterance pair S_4 and S_5 looks promising because it contains two co-specifying pronouns in the same grammatical role, thus conforming not only to the center rule, but also to Kameyama's property sharing constraint. On what basis can we say that the entity of most central concern at either S_4 or S_5 is the referent of the two italicized tokens of *it*, as opposed to the referent of the subject pronoun *I*—the speaker herself? In fact, the centering literature never addresses the issue of 1st and 2nd person pronouns; centering is implicitly concerned with 3rd person reference. Questions arise as to how the attentional status of 1st and 2nd person pronouns differs from 3rd person pronouns, and what happens when both types of pronoun occur in the same utterance or the same local context.

These are some of the numerous problematic questions about identifying the Cb of an utterance, questions which I do not attempt to answer directly. I believe a more promising approach to investigating local coherence phenomena is to work from operational definitions of presumed attentional constructs in order to construct predictive models. The ultimate goal is for the operational definitions to eventually account for the processing strategies that conversational participants actually use in producing

3.1.3 Do All Sentences Have a Center?

The definition of center relies on the highly subjective notion that there is an entity of most central concern in every utterance, and assumes that the attentional status of this entity always constrains pronoun usage. Local coherence relations are not yet well enough understood to generate a fully comprehensive algorithm for finding the center of an utterance. In fact, centering is not a mechanism pertaining to an utterance alone, but rather to an utterance in a particular context of occurrence. For a sentence such as *Max saw Rosa*, 'Max' is said to be the center in 18) and 'Rosa' is said to be the center in 19):[21]

(18) a. Who did Max see yesterday?
b. Max saw Rosa. (Cb = 'Max')

(19) a. Did anyone see Rosa yesterday?
b. Max saw Rosa. (Cb = 'Rosa')

Note that if 19b) had been the utterance *Max did*, 'Rosa' would presumably still be the center of the utterance, thus illustrating the partial independence of the pragmatic notion of center from surface linguistic form.

Like various other concepts that have been proposed in attempts to account for discourse constraints on definite referring expressions, such as topic (as in the topic/focus distinction), givenness (as in the given/new distinction), and so on, the notion of center becomes more elusive as one considers a broader range of examples and possible contexts. For example, in 19b), how do we know 'Rosa' is of more concern than 'Max', and what consequences should the presumption that 'Rosa' is the center have on subsequent discourse? Example 20) is an excerpt from the interview data that can be used to illustrate several such questions about the nature of centering.[22]

(20) S_0: I don't have *the mental capacity*
C_0:

S_1: *to handle uh what I would like to teach*
C_1:

S_2: which'd be philosophy (or) history at U of C
C_2: (hm) uh huh

[21]These two examples are taken from [13]. Cf. n. 15 *in re* typographical conventions.

[22]In all examples taken from the the career-counseling interviews, S stands for the student and C for the counselor. Pairs of co-subscripted lines (e.g., C_1 and S_1) co-occur in time. The use of parentheses around expressions in cotemporaneous lines, e.g., *or* and *hm* in S_2 and C_2, indicates coarticulation by the two participants. Note that the transcripts include repetitions.

rent center, both within and across languages. On the basis of her analysis of Japanese and English data she claims that the relevant pronominal expressions vary from language to language, but tend to be those with less phonetic content. For Japanese, this pertains to zero pronominals, and for English, it pertains to unstressed rather than stressed definite pronouns [21]. She also claims that pronominal expressions for realizing the same center in two successive utterances must obey what she terms the property sharing constraint[19]:

> Two *unstressed* definite pronouns that retain the same center in adjacent utterances should share one of the following properties, in order of preference: preferably, both should share the grammatical role of subject (SUBJ), or alternatively, both should be non-subjects (nonSUBJ).

In Kameyama's terminology, sharing of SUBJ grammatical role constitutes canonical Cb-retention; sharing of nonSUBJ grammatical role constitutes non-canonical Cb-retention.[20] Note that the center rule as stated applies to all center continuation contexts, whereas the property sharing constraint applies only to the subset of center continuation contexts where the centers of a pair of adjacent utterances are both realized by pronouns.

Kameyama has attempted to delimit more precisely the relevant class of pronouns as well as the separate contributions of pronominalization and grammatical role to the realization of the center. However, this initial extension needs further development if theories of the attentional mechanisms that constrain local coherence phenomena are to account for the rich variety of contexts in which pronouns and other cohesive devices occur. A preponderance of the examples that have been investigated are restricted to animate rather than non-animate pronouns, and to singular rather than plural pronouns, while other linguistic factors, such as demonstrativity or prosody, are ignored. Because I examined pronoun distributions in naturally occurring dialogues, my data provide evidence about actual attentional processes—which are to some degree out of awareness—in a way that constructed examples cannot. By focusing on non-animate pronouns, and by including demonstrative pronouns, the present study has been able to clarify Kameyama's property-sharing constraint. As she implicitly predicts, property-sharing applies to *it* but not *that*. Also, the non-canonical context is shown to interact with the occurrence of 1st and 2nd person pronouns in the same utterance pair (§3.2.2).

[19]Cf. [5] for a slightly different proposal that treats grammatical role status as a side-effect of Cf ranking, rather than as an independent dimension.

[20]What Kameyama refers to here as Cb retention is termed center continuation in [14], as noted above in *n.* 18.

is that it is impossible to determine for any particular utterance how to identify unequivocally the unique Cb that it is asserted to have. In other words, attempts at data collection and analysis are hindered by the inability to make use of the initial assumption that every utterance indeed has a Cb (cf. §3.1.3).

3.1.2 Centering Model: Claims And Observations

Although unequivocal identification of the center (Cb) of an utterance is impossible, observable effects on surface form are proposed with respect to the distribution of definite pronouns. There are two major claims. The first takes the form of a general principle, or default rule, regarding pronominalization [13]. The second claim adds another dimension—grammatical role—to the linguistic cues that establish the current center [21] [22].

The centering rule states a relationship between continuation of the same discourse entity as center (Cb) in two adjacent utterances and the form of the expression which realizes the center (Cb):

> If the center of the current [utterance] is the same as the center of the previous [utterance], a definite pronoun should be used [13].

Thus the center rule pertains to the form of expression that realizes the Cb in a context of center *continuation*.[18]

Fig. 2 schematically represents the type of context in which the centering rule applies. Assume that U_1 and U_2 are adjacent utterances, that Cb_1 and Cb_2 are their respective centers, and that N_1 and N_2 are referring expressions which realize Cb_1 and Cb_2. The centering rule says that if Cb_1 and Cb_2 are the same entity (e.g., C_i), then N_2 is likely to be a pronoun. It makes no predictions about the form of expressions in U_2 if Cb_1 and Cb_2 are not the same entity, or about the form of N_1. It also makes no predictions about the likelihood of Cb_2 being the same as Cb_1 if U_2 contains a pronoun, since other factors may presumably lead to the occurrence of a pronoun in U_2 besides the centering rule (cf. discussion pertaining to example 16) above).

INSERT FIG. 2 HERE

Kameyama addresses what other linguistic factors contribute to signaling the cur-

[18]Center continuation, as defined in [14], refers to cases where the same entity is the center (Cb) of two adjacent utterances; this contrasts with center retention, where the center of U_n is one of the forward-looking centers (Cfs) of U_{n+1}, but is not the Cb .

terrupted by intervening material.[16] While the notion of a center is not restricted to constraints on pronominal usage, that will be the major focus here. Of special concern is the *center rule*, a proposal regarding constraints on the production and interpretation of definite pronouns within a local discourse context.

Since centering pertains to a cohesive link between two utterances in a discourse, it provides indirect evidence about the local segmental structure of that discourse. As noted in [13], local coherence relations pertain to the individual subconstituents, or segments, of a discourse, which can include two (or more) contiguous utterances; equally, *two utterances that are not contiguous [can be] members of the same subconstituent* [15]. Given a linear sequence of utterances in a discourse (U_n, U_{n+1}, ..., U_{n+k}), if an utterance U_n and an utterance U_{n+2} comprise a single centering context, then they are presumed to be *virtually adjacent* within a single discourse segment that is temporarily interrupted by the intervening utterance U_{n+1}. Henceforth, when I talk about two utterances being adjacent, I will mean adjacent within their segment.

Every utterance is said to have a unique *backward-looking center (Cb)*—generally referred to as *the center* of a sentence—and an ordered set of *forward-looking centers (Cfs)* [13].[17] The Cb provides a cohesive link between the current utterance and the prior discourse, whereas the Cfs are the referents of expressions in the utterance that are potential points of cohesive linkage to subsequent discourse. Thus in one sense, the utterance is the relevant context. But given the prototypical case of a Cb of one utterance that is the same as the Cb or one of the Cfs of the preceding utterance, the relevant context becomes the pair of utterances that are thereby cohesively linked. When I later introduce the notion of a local center, I will show that it pertains only to an utterance pair, not to an individual utterance. I later argue (§4.1) that the relevant domain for local centering is no larger than an utterance pair.

By definition, a center is a conceptual object rather than a linguistic one. That is, a discourse entity in the evolving model can be a center, but linguistic expressions which refer to those entities are not centers. Further, a center may be *realized by* a linguistic expression N in a given utterance U, or alternatively, the center may be implicit in the utterance rather than overtly expressed. Center realization may involve any of a number of semantic relationships between linguistic expressions and conceptual objects, including but not restricted to the relation: *N denotes c* (cf. [13]).

The nature of the conceptual relation between the center of an utterance and the linguistic structure of that utterance is purposely left open so as to accommodate a number of distinct syntactic, semantic and pragmatic phenomena within the single rubric of local coherence relations. However, a consequence of this open-endedness

[16] In [13], the terms sentence and utterance are used interchangeably. I will follow linguistic usage by distinguishing between a sentence—a syntactically characterized unit abstracted away from any particular context—and an utterance, which may or may not be a complete sentence, but which is viewed as occurring in a particular context. Cf. [22].

[17] Kameyama [22] differs from [13] in viewing the Cb as optional.

events in 17) predisposes an interpretation in which the perceiver and perceived participants of both events remain the same (interpretation 17b)) [8] [21]. Centering has been proposed as a processing mechanism to account for the preference for the interpretation in 16a), where attentional rather than semantic considerations constrain pronoun interpretation. An intuitive characterization of the center is that it is the single entity that an individual utterance most centrally concerns. If this entity has already been made attentionally prominent by the prior context, it can subsequently be referred to by a pronoun. As illustrated in 16), other pronouns can occur within the same sentence, and can refer to entities other than the center.

Centering simplifies an earlier model proposed by Sidner [37] that included two types of focus—discourse focus and actor focus—to account for certain kinds of sentences with more than one definite pronoun. This earlier proposal failed to account for cases where only the discourse focus was pronominalized, in case a sentence mentioned both foci. Grosz et al. [13] simplified the model of local focussing constraints by using a single type of local focus—*Backward-Looking Center (Cb)*—and were able to provide an account that was compatible with a broader range of data. In one sense, the predictive power of the emerging model of local focus was thereby strengthened. Their claim that other entities can be referred to pronominally within the same sentence as long as the Cb (the center) is pronominalized is very specific, and empirically useful to the degree that one has a means for identifying the center. As we will see in the following section, however, there is a lack of objective criteria for identifying the center. Either 'Marjorie' or 'her mother' could be the center of 17), depending on the preceding context.[15] In other ways, the predictive power of the centering model is relatively weak. It makes only relative predictions about the form of referring expression for entities other than the current center. For example, it predicts that, given an entity that is the Cb of an utterance U, if this entity is also the highest ranking Cf within the utterance and is expressed as a pronoun, then other Cfs in U can also be expressed by pronouns. The centering framework treats pronominalization as a more homogeneous phenomenon than is warranted, as if the same constraints—but more weakly enforced—influence the occurrence of all pronouns. As we will see, it is also somewhat ambivalent regarding the boundaries of the segment that centering pertains to.

3.1.1 Centering Model: Definitions

The centering mechanism pertains to *local*, as opposed to *global*, coherence relations [13] [15]. The local context consists of two utterances in the same discourse segment that are objectively or virtually adjacent, depending on whether the segment is in-

[15] Following the conventions used in [13], I use italic typeface for an expression qua linguistic object, and single quotes for the entity that the expression refers to.

in linguistic theory if they are to handle a significant range of phenomena within and across languages in an efficient and compelling fashion. In this section I examine the data presented in §2 with the goal of formulating an approach to local coherence phenomena that has greater explanatory power than the centering model can provide. The two means towards this end are to formulate operational definitions of local coherence phenomena, and to explain them in terms of other independently motivated theoretical constructs.

The first step in arriving at a revised view of the centering model is to determine exactly what claims are currently made, which claims can be tested, and what range of phenomena is brought within its scope (cf. §3.1). When weighing the pronoun data against the specific claims of the centering model, one must keep in mind the earlier discussion of how to evaluate the data as evidence for attentional processes. The data are evaluated in section §3.2 with respect to three issues: delimiting the relevant utterance context, specifying the relevant surface linguistic features of those contexts, and grounding the observations in terms of independently motivated processes. As a result of this evaluation, I posit a new attentional construct, referred to here as local center, that is similar to but more narrowly defined than the backward-looking center (Cb) of the centering framework [13] [21]. In §3.2.1, I summarize the new operationally defined construct of a *local center* and in §3.2.2 I present an account for why there are two distinct surface realizations of local center. Finally, in §3.2.3 I ground the notion of a local center in the distinct theoretical notion of an *indexical*.

3.1 Review of Centering Model

The centering model is not a fully elaborated predictive model, but is rather a proposal for how to start constructing one. Centering is a processing mechanism originally posited by Joshi and Weinstein [20], and in more detail by Grosz, Joshi and Weinstein [13]. One goal of [13] was to explain the default reasoning processes by which definite pronouns are produced and understood. Positing such a default mechanism explains the preference for interpreting the pronouns in the sentences in 16) below according to the subscripting shown in 16a) over that in 16b):

(16) Marjorie$_i$ drove slowly past her mother$_k$.
  a. She$_i$ waved at her$_k$.
  b. She$_k$ waved at her$_i$.

(17) Marjorie$_i$ saw her mother$_k$ yesterday.
  a. She$_i$ looked fine to her$_k$.
  b. She$_k$ looked fine to her$_i$.

The semantic contexts in 16) do not predispose a particular interpretation of the pronouns in the a) and b) sentences. In contrast, the relation of the 'see' and 'look'

forming to the expectations, in which case the current attentional status of the referent is actively maintained; or by defeating the expectations, in which case the current attentional status of the referent is changed

As previously noted, there are three possible outcomes for every cell in Table 1 representing three distinct types of state transition. Each reflects a different outcome regarding the hypotheses.

1. A low cell χ^2:
   This outcome refutes the hypotheses that there are any expectations triggered by the form and grammatical role of N_1, and that the form and grammatical role of N_2 reflect some outcome regarding these expectations.

2. A high cell χ^2 with a positive deviation, i.e., the observed frequency is much higher than predicted by the null hypothesis:
   This outcome indicates that the form and grammatical role of N_1 establish expectations regarding N_2, and that the subsequent referring expression (N_2) confirms these expectations. As a consequence, it can be assumed that a particular attentional status of the referent is signaled by the features of the local context, and is maintained as is from N_1 to N_2.

3. A high cell χ^2 with a negative deviation, i.e., the observed frequency is much lower than predicted by the null hypothesis:
   This outcome indicates that the form and grammatical role of N_1 establish expectations regarding N_2, and that the subsequent referring expression (N_2) defeats these expectations. A particular attentional status of the referent is signaled by the features of the local context, and is changed from N_1 to N_2.

In the following two sections, I discuss the specific cohesive effects consequent upon the lexical choice of *it* (§3) or *that* (§4) in the significant state transitions of Fig. 1.

3 Discussion I: Implications for the Centering Model

Computational models of focus and attention have been successful in demonstrating that pragmatic phenomena can and need to be implemented if natural language systems are to deal with ordinary language input and output. Pragmatic phenomena, by definition, are not directly encoded in linguistic structure, and they are context dependent. Since context is both transitory and very rich, pragmatic theories must be carefully formulated so as to be testable, and then tested against various kinds of observational and experimental data.[14] Additionally, they need to be firmly grounded

[14]Cf. the review chapters in the recent dissertations [17] and [29] for discussions of experimental literature on discourse coherence.

2.3 Analysis

As noted above, each cell of Table 1 represents a transition from a particular initial state (N_1) to a particular final state (N_2). The statistics in each cell indicate the likelihood of the transition. Thus, cell 1 represents the state transition from an antecedent PRO-SUBJ to a co-specifying *it*-SUBJ. The observed frequency of 147 is higher than the expected frequency of 96.0 (cf. appendix), so much so that it contributes a cell χ^2 of 27.1, or nearly a quarter of the χ^2 for the whole table. There are 9 significant cells, as indicated by the boldface cell χ^2s. The significance results either from a much higher or a much lower frequency than predicted by the null hypothesis, which is that the row and column variables *do not* co-vary. Thus there are three possible types of state transition: a likely, or enhanced transition, an unlikely or suppressed transition, or a chance transition (non-significant). The three transition types in Table 1 are represented graphically in Fig. 1, with the symbol $\vdash$ representing enhanced transitions, $\dashv$ representing suppressed transitions, and chance transitions represented by the absence of a symbol. Note that each cell from Table 1 is represented in Fig. 1 with the line numbers of the state transition contexts matching the cell numbers of the table. Note also that the nine significant cells of Table 1 appear as the five enhanced contexts ($\vdash$) and four suppressed contexts ($\dashv$) of Fig. 1.

INSERT FIGURE 1 HERE

Every cohesive choice made by a conversational participant has a dual nature [18]. First, it is constrained by the prior context with which it has a cohesive link. But it also immediately becomes part of, and thus increments the context. It affects the cohesivness of the emergent discourse, perhaps maintaining the existing attentional state, perhaps changing it. Due to the dual nature of every linguistic choice, each state transition, represented quantitatively in Table 1 and schematically in Fig. 1, simultaneously represents two hypotheses, one pertaining to the constraints of the prior context on the target pronoun, one pertaining to the manner in which the target pronoun increments the context.

- *Hypothesis 1:*
  The form and grammatical role of the antecedent—N_1—reflects the current attentional status of its referent, and thereby establishes expectations regarding the form and grammatical role of a subsequent co-specifying expression N_2

- *Hypothesis 2:*
  The subsequent referring expression—N_2—increments the context either by con-

Grammatical Role and Form of Ant. (N_1)	Subsequent Pronoun (N_2)			
	Subject		Non-Subject	
	IT	THAT	IT	THAT
Cell No.	*(1)*	*(2)*	*(3)*	*(4)*
	147	31	39	19
PRO-SUBJ	96.0	48.7	48.7	42.4
	27.1	**6.4**	1.9	**12.9**
Cell No.	*(5)*	*(6)*	*(7)*	*(8)*
	37	21	34	14
PRO-NonSUBJ	43.1	21.9	21.9	19.1
	.9	.0	**6.7**	1.3
Cell No.	*(9)*	*(10)*	*(11)*	*(12)*
	18	6	11	10
NP-SUBJ	18.3	9.3	9.3	8.1
	.0	1.1	.3	.1
Cell No.	*(13)*	*(14)*	*(15)*	*(16)*
	43	33	36	45
NP-NonSUBJ	63.9	32.4	32.4	28.2
	6.8	.0	.4	**10.0**
Cell No.	*(17)*	*(18)*	*(19)*	*(20)*
	8	5	1	1
NonNP-SUBJ	6.1	3.1	3.1	2.7
	.6	1.2	1.4	1.1
Cell No.	*(21)*	*(22)*	*(23)*	*(24)*
	23	44	19	33
NonNP-NonSUBJ	48.4	24.6	24.6	21.4
	13.3	**15.3**	1.3	**6.3**
Table χ-Square				116.3
Degrees of Freedom				15
Probability				0.00001

Table 1: A Two-Way Distribution of the Data, Showing Absolute Frequency, Expected Frequency, and χ-squares for each Cell (individual cells are numbered for convenient reference)

two values of grammatical role were found to be subject (SUBJ) and non-subject (non-SUBJ). The three values for antecedent form consist of pronoun (PRO),[10] full noun phrase (NP), and non-noun phrase constituents (NonNP). The cross-classification of these two variables ($2X3$) gives the 6 rows shown in the table. Noun phrases headed by lexical or derived nouns and with the syntactic structure of true noun phrases (determiners, prepositional phrase modifiers, etc.) were classified as NPs. Non-noun phrase constituents included other phrases that can fill a grammatical role, such as gerundive and infinitival phrases, *that*-clauses, and so on.[11] The relevant characteristics of the pronoun are represented in the column headings. They include the grammatical role (also SUBJ versus nonSUBJ) and lexical choice of the subsequent pronoun. Thus, each data point in Table 1 represents a succession of two communicative events: an expression N_1 of a particular form with a particular grammatical role, followed by a co-specifying pronoun N_2 of a particular lexical choice and grammatical role. The χ^2 for the table is very high (116.3, with 15 degrees of freedom), giving the extremely low probability of .001% for the observed distribution.[12] Thus the χ^2 confirms the predictive force of the data classification. The individual cells of the table indicate the absolute frequency, the expected frequency (assuming the null hypothesis; cf. the appendix), and the cell χ^2, with the latter in boldface type in cells where the χ^2 is significantly high. Also, the 24 cells of the table are numbered (in italics) for ease of cross-reference.

Finding a statistical correlation between dependent and independent variables (columns and rows) confirms the predictive power of the distribution. However, a predictive model does not necessarily translate directly into an explanatory one.[13] Explanatory power comes from positing a plausible relationship between the independent and dependent variables, such as one of cause-and-effect. Here, the independent and dependent variables pertain equally to surface structure choices in local coherence contexts. As opposed to a causal model, finding an explanatory model for these data consists in positing abstract attentional states that can plausibly account for the various configurations of linguistic choices represented in the statistical model. The next section outlines how to interpret Table 1 as a set of attentional state transitions.

[10] The pronoun antecedent was *it* 64% of the time, *that* 34% of the time, and *this* 2%.

[11] For an account of how these variables were determined to best fit the data, cf. [34], [35], [36] and [31].

[12] In [31], I incorrectly reported this table to have only 7 degrees of freedom and a probability of only .1%.

[13] The classic example of a valid statistical correlation with no explanatory force is the discovery of a correlation between increased soft drink consumption and increased incidence of polio. This correlation was later shown to result from a direct link of each with a third factor; both increase in the summer months [10].

2 An Observational Study of On-Line Local Coherence Phenomena

2.1 Goal of Study

The data I present in this section were originally gathered as part of a larger investigation conducted independently of the centering framework.[8] However, the data from the original study that pertain specifically to the apparently anaphoric uses of *it* and *that* lend themselves to an examination of the roles of *it* and *that* in centering. The data presented here, drawn from a corpus of naturally occurring dialogues, include all the tokens of *it* and *that* in the corpus that had an explicit linguistic antecedent. I examined numerous linguistic features of the local context consisting of each pronoun/antecedent pair. Thus the data can be used to partly test three hypotheses: 1) that the centering framework makes reliable predictions about the behavior of speakers in actual, on-line, dialogic interaction, 2) that *it* is a more likely choice than *that* for realizing the center, and 3) that *that* has a deictic function that conflicts with centering, even in apparently anaphoric contexts. In the next subsection (§2.2), I present the results of a statistical analysis of the distributional data. The results show markedly distinct patterns of usage for *it* and *that*. (The statistical tool used here, the χ^2 statistic, is explained in the appendix.) In §2.3, I argue that the distributional tables of conversational data can be interpreted as state transition models of changes in attentional state.

2.2 Results

The principal tool of the methodology presented here is a statistical test of the *goodness of fit* of a particular classification of observations with respect to a set of criteria upon which the classification is presumably dependent, or contingent. In short, I present hypotheses about lexical choice as contingency tables and use the χ^2 *goodness of fit* test to quantitatively assess the hypotheses. I refer readers unfamiliar with this tool to the appendix.

Table 1 presents the two-dimensional table that best predicts the lexical choice between *it* and *that*, given the contextual features that were examined.[9] The row headings represent the categories pertaining to the antecedent expression (N_1): the grammatical role of the antecedent, and the syntactic form of the antecedent. The relevant

[8] The earlier study investigated a larger variety of discourse functions of *it* and *that*, including discourse deixis [34] [36]. Additionally, I tested and ultimately rejected several hypotheses regarding the effects of the distance between an anaphoric or deictic pronoun and its antecedent, where distance was construed in various ways [36].

[9] Roughly a dozen features were analyzed; cf. [36], esp. chapter 2.

inapplicable, as in cases similar to the excerpt about Mozart, where the antecedent is a type of constituent that cannot express number or animacy (as in 1) above; cf. [7]). The principal difference in semantic content between the two pronouns, however, is that the feature of demonstrativity, typically construed as having deictic force, is associated only with *that*.

In order to illustrate *it* and *that* in contexts where they have antecedents,[5] I present some excerpts from several interview dialogues I recorded for the purpose of data collection.[6] For each token of *it* or *that* I've also included the alternate form in parentheses in order to illustrate the acceptability of the pronoun substitutions.[7]

(11) C: so [you plan to] work for a while, save some money, travel—
S: save *some money* and then blow *it (that)* off

(12) C: what does *notoriety* mean to you
C: where does *that (it)* put you

(13) S: I didn't really want *to [unfilled pause] teach people*,
S: *that (it)* wasn't the main focus

(14) S: the drawback is *that I'm on call 24 hours a day*
S: but *it (that)* also means I get different periods of time off

(15) S: I don't think *each situation is inherently different from the other*,
S: at least, *that (?it)*'s not the way I look at it

Various syntactic types are found as the antecedent expressions in these examples, including simple noun phrases (eg. 11)), infinitival phrases (e.g., 13)), and embedded clauses with or without a *that* complementizer (e.g., 14) and 15)). In each case (with the possible exception of 15)), the non-occurring pronoun can be substituted for the occurring one without altering the acceptability or the truth conditions of the utterances. However, there is a subtle and as yet inexplicable pragmatic difference between the altered and unaltered texts. The hypothesis that even in these contexts the two pronouns have distinct functions is supported by, but not directly explained by, their distinct linguistic properties. The data presented in §2 will demonstrate that the apparently anaphoric contexts for the two pronouns are distributionally very distinct. As noted, the results will be accounted for in §3 and §4 by positing distinct pragmatic functions pertaining to the attentional status of their referents. It is perhaps these functional differences which underly the subtle differences between the alternative texts presented above.

[5] I use the term antecedent in a neutral sense to refer to the antecedent of an anaphoric expression or to a consitutent serving as the object of demonstration of a demonstrative one.

[6] The interviews were career-counseling sessions that took place at the University of Chicago. In these examples, C denotes the counselor and S denotes the student.

[7] In each example, the relevant pronoun token and its phrasal antecedent are italicized.

a. The cassette player shuts *itself* off.
b. * The cassette player shuts *thatself* off.

On the other hand, the demonstrative—like quantifiers that can become NP heads and unlike *it*—is not absolutely prevented from occurring with certain post-nominal modifiers, e.g., relative clauses:

(7) a. *All* who want cake should clear their plates.
b. *That* which I see before me is a dagger.
c. * *It* which I see before me is a dagger.

The morpho-syntactic differences between *it* and *that* illustrated in examples 5)-7) provide grounds for the claim that they are categorially distinct. A true pronoun is a phrasal word that can be viewed as syntactically reduced in the sense that a minimal syntactic unit—a word—occurs in the place of a syntactically more structured one—a phrase. While the demonstrative seems to function as a single-word phrase, it neither allows the morphological reflexes of a true pronoun, nor absolutely excludes post-modification within the phrase.

Semantic differences: referentiality. *It* can function referentially or as an expletive (non-referential) expression. The demonstrative cannot occur in the expletive contexts that *it* can occur in, e.g.:

(8) a. *It*'s raining.
b. * *That*'s raining.

(9) a. *It*'s difficult to please everyone.
b. * *That*'s difficult to please everyone.

The definite pronoun, but not the demonstrative, can occur in contexts in which it corefers with a c-commanding NP[3]:

(10) a. I prefer the table with a drawer in *it*.
b. * I prefer the table with a drawer in *that*.

Thus non-referential contexts exclude *that* but allow *it*.[4]

Semantic differences: demonstrativity. Both pronouns have the same values of the features of number, animacy and person—singular, non-animate and third person—where these features are applicable. Number and animacy are sometimes

[3]I am using the term c-command purely descriptively to identify a class of contexts, not to imply anything about the syntactic properties of those contexts. This class of examples was brought to my attention by Jerry Sadock.

[4]Demonstrative pronouns occur in what Ball has referred to as *th*-clefts, as in *That was in 1962 that Peter met Betsy*, which she once argued to be non-referential uses [1]. If these are indeed non-referential, they constitute an exception. However, Ball has recently suggested that there may be grounds for considering these to be referential after all (personal communication).

- *it* is prosodically reduceable, and more restricted in its stress possibilities, than *that*
- *it* is syntactically a true pronoun whereas *that* is more properly a prenominal modifier functioning as a phrasal head
- *it* is semantically a pronoun whereas *that* has some of the properties of a full referring expression
- *it* and *that* have the same values of a number of grammatical features, including person, and number, but *that* has the additional semantic feature of demonstrativity

Please note that while I claim that *that* is not a true pronoun, for the sake of convenience I still refer to the relevant usage of *that* as pronominal.

Prosodic differences. The vowel of *it* can be pronounced either as the short front vowel of words like *hit, kit* and so on, or as the reduced mid vowel (schwa) found in most unstressed syllables of spoken English. The vowel of *that* cannot be reduced. Lexical stress placement is irrelevant to both *it* and *that*, since they are both monosyllabic, but in addition to the vowel reduction difference there is a phrasal stress, or pitch accent difference (cf. e.g., [3] on pitch accent in English). The demonstrative can take various pitch accents, whereas *it* typically cannot, except in special cases, such as in meta-linguistic reference to the lexical item itself: *the pronoun I'm studying is 'it'.* In sum, *it* has a reduceable vowel while *that* does not; *it* is more restricted with respect to pitch accent.

Syntactic differences. Both *it* and *that* can occur where full NPs occur, and can have explicit linguistic antecedents that introduce the referent of the pronoun:

(4) I have *a new dress* to wear to Marcia's party.

a. I bought *it* last week.
b. I bought *that* last week.

But there are several morpho-syntactic facts differentiating *it* and *that* which put the former in the class of pronouns and the latter in the class of determiners. The demonstrative but not the definite pronoun can occur as a determiner (*that/*it book*). The demonstrative pronoun shares with other prenominal modifiers acting as head—such as quantifiers—certain properties that distinguish it from true pronouns. Thus, unlike a true pronoun, *that* does not have a possessive form:

(5) a. The car is new but *its* engine is old.
b. * The car is new but *thats* engine is old.

nor a reflexive form:

(6)

Grosz and Sidner define attentional state as *an abstraction of the focus of attention of the discourse participants [that] summarizes information from previous utterances crucial for processing subsequent ones.* Attentional state has a hierarchical structure paralleling the segmental structure of the discourse. Each focus space in the current attentional state corresponds to a discourse segment that is currently in focus. Each focus space contains, among other things, representations of the discourse entities that have been mentioned within the corresponding discourse segment. The primary function of the representation of focussed discourse entities is to provide referents for anaphoric expressions, including definite (but not demonstrative) pronouns.

Recent work by Webber on uses of demonstrative pronouns where discourse segments are the demonstrata has provided another use for representing focussed discourse segments. She argues [41] that only segments which are currently in focus can be demonstrated. Thus, the current attentional state serves to represent segments that are currently available for supporting what she refers to as discourse deixis. However, neither Webber [41] nor Grosz and Sidner [15] attempt to model the distinction between anaphoric and demonstrative reference in cases where the pronoun has an explicit linguistic antecedent.

The on-line choices that conversational participants make are extremely rapid ones, and the complex contextual factors that condition those choices change very rapidly. Despite the difficulties of confronting a rich, uncontrolled context as opposed to a selectively constructed one, I believe it is particularly useful to examine actual interactive conversational data as a means of understanding changes in attentional state. The processes by which we as conversational participants select and interpret anaphoric or demonstrative pronouns are patently outside our conscious control. As soon as one brings conscious awareness to the process of selecting and interpreting pronouns, one has altered the process that normally takes place in actual conversational interaction. Also, conversational interaction is a shared activity, and the discourse phenomena that constrain pronoun selection and interpretation are mutually supported by multiple participants. By examining data from actual conversational interaction, one can be sure to have a situation in which there is a jointly established and maintained attentional state, complete with actual intentions, that is reflected in the linguistic structure of the interaction. The analytic method presented here allows one to abstract significant factors from such naturalistic, interactional data, and to investigate how the current attentional state is actively maintained or altered.

1.2 Comparison of the Linguistic Properties of *It* and *That*

The motivation for comparing the uses of *it* and *that* is to determine what differences in the attentional status of their referents correlate with the distinct linguistic properties of the two pronouns. The major linguistic differences between the two pronouns *it* and *that* can be summarized as follows:

in local coherence contexts. The demonstrative can signal a change in local center status, or it can indicate that an entity within the current focus space should not be regarded as a candidate local center even though it is referred to by a pronoun. Or finally, it can trigger a process by which a new discourse entity is constructed from non-referential constituents of the linguistic structure.

1.1 Background on Attentional State

The question of how pronouns are selected and interpreted directly addresses the broader issue of the relationship between language use and the organization of conversational participants' attentional processes in actual communicative situations. Given a pronoun that is used referentially, its reference is resolved to a large degree on the basis of the participants' understanding of the current context of use, rather than on the descriptive content of the referring expression itself. By definition, pronouns have very little syntactic or semantic content. Syntactically, a pronoun is a single-word phrase; it generally excludes any pre- or post-modification:

(3) * the big it
* clever she
* they working for the Daily News

Semantically, pronouns encode grammaticalized semantic features such as number, person, gender and so on [11], but little, if any, other semantic content.

I assume the basic components of the model of discourse structure proposed by Grosz and Sidner [15], which has the three distinct components of attentional state, segmental structure, and intentional structure. Although there are no hard and fast criteria for assigning segment boundaries within a discourse, evidence suggests that segmental divisions have processing consequences along several dimensions. The same word has been shown to occur with distinct prosodic features depending on whether it functions to mark a discourse segment boundary or to contribute to the propositional level of an utterance [16]. Contrastive choices of referring expressions and of verb form have been shown to correlate with episode boundaries in narrative [27] [25]. Early work by Grosz on task-oriented dialogues indicated that when a pronoun occurs long after its nearest antecedent expression, the apparent remoteness of the two co-specifying expressions can be reanalyzed as proximity within the same focus space, where the focus spaces [12] defined by the discourse parallel the task structure. Grosz and Sidner's more recent formulation of segmental structure as essentially a projection of intentional structure [15] is more general because it is independent of discourse genre. A segment is characterized as a unit of discourse exhibiting a single communicative purpose. Segments can be hierarchically related to one another, reflecting hierarchical relations in intentional structure.

on music for private concerts? Towards the middle of 1791, *that* is what he proceeded to do.

Note that *it* can occur with the same types of antecedents as *that*:

(2) Mozart decided to *concentrate on music for private concerts. It* seemed like a good thing to do at the time, and *it* would please his wife.

Rather than begin from the theoretical contrast between anaphora and deixis in attempting to understand the functional contrast between examples like 1) and 2), I report on the results of an empirical study in which I compared tokens of *it* and *that* having linguistic antecedents. I account for the observed differences in terms of the presumed attentional status of the referents of the two types of pronouns, building on the centering framework found in the computational literature on discourse reference. Comparing definite and demonstrative pronouns in contexts where each has a linguistic antecedent provides an arena for investigating two distinct kinds of pronominalization, thus separating the issue of pronominalization *per se* from that of whether there are distinct means for managing attentional processes, corresponding in some degree to the theoretical distinction between anaphora and deixis.

In the next subsection (§1.1), I briefly review Grosz and Sidner's model of discourse structure [15] with particular reference to their construct of attentional state. Then I review (§1.2) the major linguistic differences between *it* and *that*, and illustrate through examples that despite these differences, the two pronouns seem to have a similar cohesive function in apparently anaphoric contexts. In §2 I present a general method for abstracting significant contextual features from naturalistic data, and demonstrate its use in identifying other linguistic choices that are correlated with the lexical choice between *it* and *that*. I argue that contingency tables that correlate one set of cohesive choices with another can be interpreted as state-transition models of attentional state. In §3 and §4, I account for the distinct distributions of *it* and *that*, respectively, in terms of functional contrasts between the two pronouns.

Grosz and Sidner posit a local focussing mechanism they refer to as centering. In §3, I first review the centering model and propose an alternative approach to analyzing attentional state based on empirically established coherence relations across utterances. I then present evidence that one function of *it* is to establish what I refer to as a local center from among the entities within the current focus space, and that the demonstrative typically does not serve this function. *Local center* extends rather than replaces the notion of a center. The crucial distinction between a local center and the Cb of the centering framework is that there is only a single potential local center rather than an ordered set of Cfs. The local center is argued to constitute a reference point in the model of the speech situation in a manner analogous to 1st and 2nd person pronouns. In contrast, I posit deictic functions for the apparently anaphoric uses of *that*. I present evidence for three functions of the demonstrative

their contexts of occurrence should be attributed to the critical semantic difference between them, the presence or absence of the feature of demonstrativity. By looking at contexts in which the two pronouns *it* and *that* have superficially similar functions, I have found new evidence about the relationship between pronouns and their contexts of occurrence. The evidence indicates that in addition to the lexical distinction between distinct types of pronouns, the inter-utterance configuration in which a pronoun and its antecedent occurs also contributes to distinct means for establishing and maintaining discourse reference. I posit distinct pragmatic functions for the two pronouns based on their contrastive contexts of use, and also posit distinct functions for the same pronoun, based on contrasts between one context of use and another.

Apart from the semantic property of demonstrativity, referential tokens of *it* and *that* are similar enough to be mutually replaceable in many of their contexts of occurrence, as will be demonstrated shortly (§1.2). *It* has generally been classified as having a primarily anaphoric function, and *that* a deictic one. Anaphora and deixis are variously described in a large body of linguistic and philosophical literature that will not be reviewed here.[2] But simply put, an anaphor is said to acquire its reference by virtue of a previously occurring referential expression whose referential value it shares, or is inferentially related to. The referent must have been added to the context prior to the anaphoric pronoun in order for the speaker to take for granted that the hearer will be able to identify it. Referents for such pronouns are represented in a component of the discourse model that McCawley [28] refers to as the *contextual domain*. He defines contextual domain as *the set of objects that have been [mutually] identified up that that point in the discourse*. Further, McCawley takes the contextual domain to be hierarchically structured in a manner that anticipates the hierarchically structured focus spaces of Grosz and Sidner's discourse model.

In contrast with anaphoric pronouns, the reference of a deictic pronoun depends on an ostensive relation to some object in the non-linguistic context (cf. [23]). The actual object of demonstration may be directly or indirectly related to the referent. One may look at a disordered room (the object of demonstration, or *demonstratum*) and say *That's the biggest mess we've ever made*, referring (directly) to the state of the room, or *That was a great party*, referring (indirectly) to the cause of the disorder.

The apparent parallel of the functional contrast between anaphora and deixis with the morpho-semantic contrast between *it* and *that* is belied by the fact that the demonstrative pronoun often occurs in purely textual contexts in which there is no non-linguistic context within which to point, but where there is a linguistic antecedent, as illustrated in this excerpt from a recent book about Mozart ([24], p. 35):

(1) Being much more of a pragmatist than is generally realized, Mozart was quick to shift his emphasis as circumstances required. If public concerts were now scarce, why not *concentrate*

[2]Cf. [36] for a discussion of these terms as they relate to *it* and *that*.

GETTING AND KEEPING THE CENTER OF ATTENTION[1]

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Abstract

The present work investigates the contrastive discourse functions of a definite and a demonstrative pronoun in similar contexts of use. It thus provides an opportunity to examine the separate contributions to attentional state [15] of two linguistic features—definiteness and demonstrativity—independently of pronominalization *per se*. The two pronouns, *it* and *that*, have clearly contrastive contexts of use, explained here in terms of distinct pragmatic functions. Certain uses of *it* are claimed to perform a distinctive cohesive function, namely to establish a *local center* (which modifies rather than replaces the notion of a center). The crucial distinction between a local center and the Cb of the centering framework (cf. [38], [13], [14], [21]) is that there is only a single potential local center rather than an ordered set of Cfs. The local center is argued to constitute a reference point in the model of the speech situation in a manner analogous to 1st and 2nd person pronouns. In contrast, a deictic function is posited for apparently anaphoric uses of *that* whereby the attentional status of a discourse entity is changed, or a new discourse entity is constructed based on non-referential constituents of the linguistic structure. Since it is impossible to observe attentional processes directly, I present an empirical method for investigating discourse coherence relations. I analyze statistically significant distributional models in terms of three types of transitions in the cognitive states of conversational participants: expected transitions, unexpected transitions, and transitions with no relevant effect.

1 Pronouns: A Heterogeneous Category

Pronouns are semantically inexplicit referring expressions whose referents are resolved in complex, context dependent ways. I have compared a pair of semantically and syntactically similar pronouns on the hypothesis that the subtle pragmatic differences in

[1]Revised as of July 5, 1991; supercedes previous report of same number. The initial phase of this work was supported by Sloan Foundation Grant 1-5680-22-4898, while the author was a graduate student at the University of Chicago. Initial reinterpretation of the data with respect to the centering framework was carried out at Unisys and partially supported by DARPA Contract N000014-85-C-1002 [31]. The paper in its current form was completed at Columbia University under the support of DARPA grant N000039-84-C-0165 and NSF grant IRT-84-51438.