

On the Generation and Interpretation of Demonstrative Expressions*

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This paper presents necessary and sufficient conditions for the use of demonstrative expressions in English and discusses implications for current discourse processing algorithms. We examine a broad range of texts to show how the distribution of demonstrative forms and functions is genre dependent. This research is part of a larger study of anaphoric expressions, the results of which will be incorporated into a natural language generation system.

1. INTRODUCTION

The primary purpose of this paper is to present a set of necessary and sufficient conditions for the use of demonstrative expressions in English, based on a corpus of naturally occurring discourse from a variety of spoken and written genres. We propose a comprehensive set of constraints on demonstrative use and suggest how they can be incorporated into a computational processing model which integrates the local centering and global focusing aspects of discourse structure. Finally we show how our proposed algorithm for demonstratives can account for stressed pronouns as well.

Existing computational work on demonstratives has been based on examples from only three genres: experimentally-elicited apartment descriptions (Linde 1979), technical dialogues (Reichman-Adar 1984), and scientific textbooks (Sidner 1983). Testing computational algorithms against multiple genres of natural discourse is important, especially given the universal scope of current frameworks (cf. Grosz and Sidner 1986). We have chosen to systematically examine texts from a broad range of genres, which vary in spoken versus written medium, number of participants, degree of pre-planning, and formality of situation. These genres include informal conversation, partially-spontaneous televised discussion, newspaper articles, and planning and technical documents.

2. REVIEW OF THE LITERATURE

Demonstratives have generally been considered to be one type of deictic expression. Most of the linguistic literature on deixis has concentrated on classifying deictic expressions according to various parameters such as the linguistic or extralinguistic status of the referent. For example, Buhler (1982) distinguishes between *demonstratio ad oculos*, anaphora, and *deixis at phantasma*, whose intended referents are respectively found in the extralinguistic context, the linguistic context, or in memory or imagination. Similarly, Fillmore (1975) distinguishes gestural, anaphoric and symbolic uses of deictic expressions; and Lakoff (1974) distinguishes spatio-temporal, discourse, and emotional deixis. Such distinctions have been useful as a basis for descriptive classification of various uses of demonstrative expressions, but we do not feel that they are relevant for an explanatory account of demonstrative function and so shall not elaborate further on them here. For the same reason we also will not discuss attempts to show that discourse deixis and/or anaphora is derived from or less prototypical than spatio-temporal deixis (cf., Lyons 1977; Fillmore 1982). Our account is more compatible with the

view that deictic expressions signal a change in focus of attention while anaphoric expressions signal focus continuation (cf. Ehlich 1982; Bosch 1983). It is this view which most closely reflects the assumptions underlying computationally explicit models of focus-constrained discourse processing (e.g., Linde 1979; Reichman 1985; Grosz and Sidner 1986).

We turn now to a presentation of specific claims about demonstratives which have been made in the literature.

Focus shift.

- That* but not *it* may be used to refer to an item no longer in focus (Linde 1979). *That* marks the end of a discourse section (Reichman 1984, 1985). *This* but not *that* signals focus movement, except when *this* occurs in the scope of a quantifier or when its head noun is not identical to the head noun of an existing immediate focus (Sidner 1983).
- That* but not *it* may be used to refer to a preceding statement taken as a statement (Linde 1979).
- Stressed *that* must change focus (Isard 1975).

Contrast.

- That* may be used to indicate contrast, even for items currently in focus (Linde 1979). When *this* and *that* are used together contrastively ('copresent' use), *this* specifies the primary, continuing focus and *that* specifies a secondary, temporary focus (Sidner 1983).

Proximity.

- This* is used to denote objects relatively close to the speaker and *that* for objects relatively far from the speaker or relatively close to the hearer. (Fillmore 1975; Halliday and Hasan 1976; Lakoff 1974)
- Both *this* and *that* may corefer with elements in the preceding linguistic context, but only *this* may corefer with elements in the following linguistic context. (Fillmore 1975, 1982; Halliday and Hasan 1976; Lakoff 1974).
- Both *this* and *that* can be used to comment upon a speaker's own prior remarks, with *this* often signalling greater speaker involvement or continued discussion. Only *that* may be used to comment upon the remarks of another speaker (Halliday and Hasan 1976; Lakoff 1974; Sidner 1983).
- The interval denoted by a determiner *this* used with a time expression includes the speech time. (*That* tends to be associated with a past time referent and *this* with one in the present or future. (Fillmore 1975; Halliday and Hasan 1976).

Special effects.

- Demonstratives often have subtle emotional effects such as solidarity, distancing, sympathy, anger, irony, etc. (Lakoff 1974, Fillmore 1982; Halliday and Hasan 1976).
- Unstressed determiner *this* has an indefinite specific use in colloquial narrative speech, (Lakoff 1974); shared attention and experience (Halliday and Hasan 1976); topicality (Prince 1981a)
- Unstressed determiner *that* phrases have a first-mention use for expected shared referents. (Wald 1983).

3. CONSTRAINTS ON DEMONSTRATIVE USE

The basic concepts which we take to be crucial for any adequate description of demonstratives are ones which are central to a theory of reference in general. These are concepts such as topic, focus and various types of givenness. Since these concepts concern the cognitive status of a referent, definitions have often been

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rough and intuitive, basically correct but not sufficiently precise for computational implementation. On the other hand, because of the complexity of these concepts, attempts to furnish more precise operational definitions, e.g. on the basis of surface linear order or grammatical relations, have failed to capture their cognitive basis. The result has been a terminological and conceptual confusion in the literature which has led computational linguists to create new constructs such as focus and center, in some cases without relating them to similar linguistic concepts (Hajičová 1987 is a notable exception). Our aim here is to characterize as precisely as possible what the relevant concepts for demonstratives are and how they relate to one another. In a later section we will attempt to show how they relate to more operational constructs proposed in the computational literature.

Definiteness. As has often been pointed out, the basic notion which determines appropriateness of a given referential expression is the status of the referent of that expression vis-a-vis a cognitive state of the addressee (cf. Chafe 1976). In the weakest case, the speaker expects the addressee to understand what type of entity is being described, but not to uniquely identify the entity in question. Such entities are typically referenced with indefinite noun phrases. The most basic distinction in demonstrative function is between the indefinite use of the determiner *this*, as exemplified in (1) and all other uses of both determiner and pronominal demonstratives, which are definite. As has been pointed out by a number of researchers, indefinite *this* occurs only in casual, unplanned discourse. This observation was confirmed by our own study, which found instances of indefinite *this* only in the informal conversations.

- (1) I couldn't sleep last night. My neighbors have **this dog** that kept me awake.

We will be primarily concerned here with definite noun phrases, where the speaker expects the addressee to uniquely identify the referent on the basis of the description in question. The referents of such expressions have often been characterized as 'given'. However, as pointed out by Gundel (1978a, 1978b) and Prince (1981b), givenness is not a unitary concept. There are different senses of givenness each of which is relevant to the form of referring expressions, but in different ways.

Identifiability. In the weakest sense of givenness, the speaker expects the addressee to uniquely identify the referent, but the basis for the identification is irrelevant. Not only can it be linguistic or extralinguistic, based on entities in immediate or long term memory, but it need not be based on any previous shared experience at all (cf. Hawkins 1978). The basis for the identification may be encoded in the form itself, as in (2).

- (2) I couldn't sleep last night. **The neighbor's dog** kept me awake.

This type of givenness, which we refer to as identifiability, is both necessary and sufficient for the use of definite articles.

Shared familiarity. Most identifiable entities are identifiable because of some shared experience between speaker and addressee; again this may be linguistic or extralinguistic, based on local context or long term memory associated with shared cultural or personal experience. It is this status which we claim is necessary for the use of demonstrative expressions (with the exception of indefinite *this*). Thus, (3) unlike (2), is felicitous only if the addressee has prior knowledge of the dog in question.

- (3) I couldn't sleep last night. **That dog next door** kept me awake.

Activation. Entities which are familiar on the basis of presence in the immediate discourse context (either linguistic or extralinguistic) are not only shared but 'in awareness.' This sense of givenness, which we refer to as 'activated,' (cf. Chafe 1976, Gundel 1978b, Hajičová and Vrbová 1982) is necessary for pronominal reference, including pronominal demonstratives. Thus, *that* in (4) could only refer to the barking of a dog if this had been activated by the immediate discourse context:

- (4) I couldn't sleep last night. **That** kept me awake.

Activation is also a necessary condition for determiner *this*. Demonstrative *this*, both pronominal and definite determiner, has the additional condition that it not only be activated but speaker-activated, either linguistically or extralinguistically by virtue of its inclusion in the speaker's context space, as in (5):

- (5) A: Have you seen the neighbors new dog?
B: Yes, and **that dog** kept me awake all night.
B': ??Yes, and **this dog** kept me awake all night.

In focus. Finally, the most highly activated entities are not only in the speaker's and hearer's awareness but are the center of attention at a particular point in the discourse. We refer to this status as 'in focus.' Entities in focus¹ always include at least the topic of the sentence as well as any higher level discourse topics which may not be overtly represented in the sentence itself. Under certain conditions, they may also include other elements such as the reference of the linguistic focus. Thus a shift in focus always entails a shift in topic but not vice versa. The status 'in focus' is a necessary condition for unstressed pronominals and also for zero anaphora (cf. Gundel 1978b).

The relationship between the various (definite) referential statuses and the forms that correlate with them is shown in (6). These statuses are in a unidirectional implication relation such that any status on the hierarchy implies all statuses higher on the hierarchy but not vice-versa:

(6) GIVENNESS HIERARCHY:

in focus	-->	activated	-->	shared	-->	identifiable
it		that, this		that N		the N
		this N				

4. CRITIQUE OF CLAIMS IN THE LITERATURE.

Focus Shift. Observations regarding the focus shift function of demonstratives follow naturally from the theory outlined above given two additional, but uncontroversial assumptions -- that pronominal *it* is necessarily unstressed and that the overwhelming majority of definite noun phrases are not only uniquely identifiable, but shared. As noted above, the primary distinction between demonstrative pronouns and unstressed personal pronouns is that the referents of the latter must not only be activated, but in focus. A pronominal whose referent is not currently in focus is necessarily stressed (cf. Hirschberg and Pierrehumbert 1986). Since *it* is necessarily unstressed, the only third person singular neuter pronominals available for focus shift are the demonstratives *that* and *this*. This accounts for the distribution of *that* versus *it* noted by Linde (1979) as well as the uses of *that* noted by Reichman. Use of *that* in referring to previous statements (also noted by both these authors) is just a special case of focus shift, since the focus of attention at the point after a statement is made is typically not the statement itself. However, our data does not support Sidner's (1983) claim that *this* but not *that* is used for focus movement. Examples illustrating the focus shift function of pronominal *this* and *that* include the following:

- (7) K 1: And..So what he DID was ...came in, set up the tree...
2: and then he made wassail, with rum in it?
3: And..made it in coffee cans and heated it on the stove in the graduate lounge.
A 4: Oh, gee.
K 5: And **this** was the solstice tree.

In (7), the topic and hence the focus of attention in K5 is the tree, which is activated by its mention in K1 thus licensing the

¹There is some confusion in the literature resulting from the fact that the term 'focus' has been used in two distinct and at least partly opposite ways (cf. Hajičová 1987). We use 'in focus' to refer to the psychological notion of focus of attention (Hajičová's focus_{AD}) and 'linguistic focus' to refer to the point of linguistic prominence in the sentence (the comment).

use of a pronominal. However, since it is not in focus in K2, K3, and A4, the reference to it in K5 constitutes a focus shift and thus requires a stressed demonstrative form. Note that since the tree was speaker activated, either *this* or *that* could be used.

- (8) N 1: I like the poor dog who was buried six times in one day!
 K 2: Oh. **That** must, **that** must be a story that comes from the Second Minnesota history,
 3: because **that** didn't appear in the, in the ah diary,
 4: so it must have come from somewhere,

In (8), the topic and hence focus of K2 is the story. Since the story is activated but not in focus in N1 (the focus of attention in N1 is stories that N likes), reference to the story in K2 constitutes a focus shift and thus requires a stressed demonstrative. Note that the story continues to be topic (in focus) in K3 and K4 and that in K3, an unstressed pronominal *it* could have been used instead of *that*.

- (9) N 1: "Bob loves Mary",
 2: and someone else wrote "Mary loves Jim"
 3: and I wrote "Jim loves Bob"! (laughter)
 4: It was three different handwritings, three different people.
 K 5: Yeah, **that's** good.

(9) illustrates the use of *that* to refer to a previous statement or utterance. Since *that* refers to the topic of K5, the story activated in N1-4 (but not in focus), use of *that* constitutes a focus shift.

The focus shift function of determiner *that* (cf. Reichman 1984) can be explained as a consequence of Grice's maxim of quantity, specifically don't be more informative than necessary (cf. Grice, 1975). Since the overwhelming majority of definite noun phrases refer to entities that are shared, use of a demonstrative determiner as opposed to the less restrictive definite article in most instances carries little additional information. Thus a demonstrative determiner is generally used only when the signalling of shared familiarity has some additional communicative function. This is the case when there is a shift in focus, as in (10) and (11), since a focus shift always entails a shift in topic and topics are necessarily shared (cf. Gundel 1985).

In the particular case of (10), there is not enough information encoded in the noun phrase itself to allow the addressee to uniquely identify the referent. Thus a demonstrative (as opposed to a definite article) is required in order to link the referent up with entities shared as a result of immediate discourse context. In (11b) on the other hand, the demonstrative functions simply to signal a focus shift and therefore a definite article would be equally appropriate.

- (10) a. John, this speech was a magnificent triumph for the President. He showed he could stay awake for twelve whole minutes. He showed that he could speak every word off of his teleprompter, even the long ones. But the speech doesn't have any chance of putting the scandal behind him, because the scandal is not about mistakes, as he said, and it's not about mismanagement, as the Tower Commission said. It is about a betrayal of principles, it's about lying, and it's about breaking the law.
 b. And **those** issues remain. [McLaughlin 3/6/87].
 (11) a. These incredibly small magnetic bubbles are the vanguard of a new generation of ultradense memory-storage systems.
 b. **These** systems are extremely rugged;
 c. they are resistant to radiation and are nonvolatile.

Contrast. The contrastive function of demonstratives, like the focus shift function, is related to the fact that contrast is marked by stress and pronominal *it* cannot carry stress. Moreover, contrast may be just a special case of focus shift. since a contrastive noun phrase always brings into focus other entities with which it is being contrasted, as illustrated in (12):

- (12) a. In both cycle steal mode and DPC, the attachment feature...responds with a **condition code**.
 b. For commands that do not require interrupts (that is, commands executed under DPC), the **condition code** provides current device status information.
 c. For commands that require execution in cycle steal mode followed by an interrupt request, **this first condition code** provides information concerning acceptance of the command by the attachment feature.
 d. Upon interrupt servicing by the processor, the attachment feature provides a **second condition code** and an interrupt word.

Thus, the referent of *this first condition code* in (12c) is already in focus since it is also the topic of (12b). However, since the use of this noun phrase brings into focus contrasting condition codes (cf. *a second condition code* in (12d)) it is not only contrastive, but constitutes an implicit focus shift as well

Proximity. The speaker-activated condition on *this* predicts correctly that both *this* and *that* can comment upon a speaker's own prior remark as in examples (7) and (10) respectively, but only *that* can be used to comment upon the remarks of another speaker, as illustrated by example (9).

The same condition also explains why *this* is used for extralinguistic objects relatively close to the speaker and *that* for those relatively further away as in (13), and why the interval denoted by determiner *this* includes speech time, while *that* tends to be associated with some time prior to speech time as in (14). This is so because speaker-activated means not only linguistically activated but activated within the speaker's context space.

- (13) N: **This** tastes like water. **This** tastes like **THAT**!
 Wait a minute--the stuff that's \$1.99 for two quarts tastes a- the same as one that's \$2.07 for a fifth.
 (14) K: There he was **that hairy hound from Budapest**/Never leaving us alone./Never have I ever known/a ruder pest

Special Effects. As seen in the diagram in (6), each of the referential statuses is also correlated as a necessary condition for a different type of definite reference. Since the statuses are implicationaly related, reference with a particular form will generally imply appropriateness of reference with all forms associated with a status higher on the hierarchy, but not vice-versa. Thus, pronominal *that* in (13) may be replaced with *that wine* and *these systems* in (11b) can be replaced with *the systems*. However, not all cases of *the N* are replaceable with *that N*, as illustrated in (2) and (3); and not all cases of *that N* are replaceable with *that.*, as illustrated in (3) and (4).

The maxim of quantity would dictate that speakers will use the strongest possible form, i.e. will signal the most information as is relevant regarding the givenness status of the entity in question. The same maxim predicts that speakers would not use a stronger form than necessary in a given situation, i.e. they will not signal more information than is appropriate. Violation in either direction will often result in a special effect or implicature, as in (15), where the use of *this* as opposed to the equally appropriate *the* conveys an effect of solidarity:

- (15) Gov. D (from videotape): I've got the energy to run **this** marathon, the strength to run **this** country, the experience to manage our government, and the values to lead our people. [McLaughlin, 3/20/87]

We already noted that use of a demonstrative determiner often has a special effect, such as signalling a topic shift, because virtually all definite NPs are also shared, and thus demonstrative determiners do not normally convey much more information than would be conveyed by the definite article. Similarly, in cases where the referent is not activated, determiner *that* acts as an overt signal to the addressee to search long term memory for the referent, as in (16):

(16) A: You can get those little magic finger jobbies that tell you when to water it. They're only \$10 or something.

5. GENRE DIFFERENCES

The distribution of demonstrative types differs according to genre, as seen in Table 1. (See Hedberg, forthcoming, for more on these genres.) Thus, for example, the relative percentage of pronominal *that* appears to be greater in multi-participant oral communication than in written communication. The casual conversations and electronic specification documents represent the respective extremes on this scale:

	that	that N	this	this N	Total
SPOKEN GENRES					
Casual Conversations	49 %	15 %	17 %	19 %	316
Televised Discussion	39 %	15 %	12 %	34 %	122
WRITTEN GENRES					
Newspaper Articles	14 %	21 %	7 %	58 %	83
Planning Document	11 %	29 %	7 %	53 %	83
Specification Document	1 %	5 %	4 %	90 %	102

Table 1. Demonstrative distribution in five genres

The distribution of demonstrative forms and functions for each genre will be individually presented and discussed below.

5.1 **Casual conversations.** The casual conversations were taped for purposes unrelated to linguistic analysis; participants are family members reunited for holiday gatherings:

	that	that N	this	this N	Total
Same speaker	67	18	7	9	101
Other speaker	58	3	5	---	66
Extralinguistic	26	4	36	5	71
Reminder	---	17	---	---	17
Indefinite	---	---	---	36	36
Time	---	---	2	10	12
Forward	---	---	4	---	4
Other	4	4	1	---	9
Total	155	46	55	60	316

Table 2. Demonstratives in casual conversations

Other Speaker's Remarks. A large proportion of pronominal *that* in the casual conversations is due to its use for reference to an immediately preceding contribution of another conversational participant. For an example see (9) above.

As noted above, pronominal and determiner *this* require that the referent be speaker-activated. Thus we would expect to find *that* used extensively in any multiple-participant discourse, such as casual conversation. While, we do have five exceptions to this generalization, where *this* is used to refer to an entity activated by the addressee, all of these are clarification questions requesting referent identification, perhaps conveying polite intention to not interrupt, as in (17):

(17) N: So yesterday I finished up the day's work and put it in gear and nothing happened. The cable for the transmission. . . .

M: Is *this* your car?

N: No. Truck. The old, beat up, lousy van I have to drive.

Extralinguistic reference. While the linguistic or extralinguistic status of the referent is irrelevant for predicting the form of a referring expression, this status does differ across genres. For obvious reasons, extralinguistic reference occurs primarily in face-to-face interaction. (18) is an example showing the use of *that* for shifting the focus onto an extralinguistic entity, followed by subsequent reference using *it*. Note that activation is accomplished here by a gesture:

(18) K: What is *that*, Beethoven what, on *that* teeshirt.
N: I think *it's* the Ninth, isn't it.

K: Number Three. [after reading it]
N: Oh it is.

Reminder that. Since determiner *that* does not require activation of the referent, but only that it be shared, it can be used to refer to entities that are not present in the immediate discourse context, as in (19).

(19) K: I realized something that seems significant to me about George. . . that in the, in the fall, he . . . as everyone else, he wears. . . .
N: [Clothes.
A: [Loafers.
K: No. [Those kind of tennis shoes that are expensive=
A: [Boots.
N: Adidas.
A: [Adidas.
K: [Adidas, ok.

As noted above, *that* N is sometimes used as an explicit signal to the hearer to search memory for the referent. One would expect such signals to be most common in interactions between individuals with shared personal experiences, so it is not surprising that they would occur frequently in casual conversations between family members. Typically such phrases include a relative clause specifying additional information to aid in the search and are often embedded in a request for confirmation that the referent has indeed been located. Since the referent is shared but not activated, it frequently occurs in left-dislocated constructions which have the function of introducing or reintroducing a topic into the discourse. (cf. Keenan and Schieffelin, 1976)

5.2 **Televised Discussions.** The televised discussion was a videotaped episode of The McLaughlin Group (initial transcript obtained from the Federal News Service). This genre is similar to the casual conversations in being spoken and multi-participant, but differs in degree of formality and spontaneity and in awareness of an audience. Four journalists participate in a structured discussion about current affairs under the control of a moderator. As shown in Table 3, most of demonstratives are pronominal *that*, as expected in interactive discourse.

	that	that N	this	this N	Total
Same Speaker	21	6	---	4	31
Other Speaker	26	2	---	---	28
Discourse Topic ¹	1	6	7	22	36
Extralinguistic	---	1	---	---	1
Reminder	---	2	---	---	2
Indefinite	---	---	---	3	3
Time-Person-Place	---	---	---	11	11
Forward	---	---	5	---	5
Other	---	1	2	2	5
Total	48	18	14	42	122

Table 3. Demonstratives in televised discussions

Discourse topic *this*. The televised discussions are distinguished from the casual conversations by the frequent use of *this* to refer to non-speaker activated entities. Such uses contradict our claim that *this* must be speaker-activated. To account for such examples, we suggest that a distinction be made between inclusive and exclusive speaker space. In the case of local discourse segments, speaker space often excludes the addressee, but with higher-level discourse topics, which are often shared, speaker space includes the addressee. In such cases, which are characteristic of highly structured interactions, *this* may be used for something which was not initially activated by the speaker. In (20), reference is made to the explicit discourse topic of the segment, Gorbachev's decision not to cancel the summit:

¹The categories Same Speaker and Other Speaker include only referents which are locally activated in the immediately preceding utterance. Thus, they are mutually exclusive with the category of discourse topic.

- (20) G: The business of trying to play Kremlinologist on **this decision**, I think it's simpler than that. I really think that Reagan looked very, very vulnerable at that time. It was the thing for Gorbachev to do, and he just misread it. [McLaughlin, 10/30/87, 21]

5.3 **Planned, non-interactive genres.** Tables 4-6 show the distribution of demonstratives in newspaper stories (New York Times "Week in Review" section, 6-11/87); a University of Minnesota administrative planning document; and an electronic specification document supplied by Control Data Corporation.

A characteristic of these non-interactive, written genres is a relatively high percentage of determiner *this*. This may be partly attributable to the fact that everything that is activated is speaker activated. In addition, there are many time expressions with *this* in the newspaper articles and metadiscourse references such as *this document* in the planning document. Unlike the discourse-topic use in the televised discussions, referents of determiner *this* in the written genres are typically activated in the immediately preceding sentence and constitute a focus shift.

	that	that N	this	this N	Total
n-0 ¹	3	1	1	3	8
n-1	9	11	3	12	35
n-2+	--	2	1	15	18
Time-Person-Place	--	2	1	17	20
Forward	--	--	--	1	1
Reminder	--	1	--	--	1
Total	12	17	6	48	83

Table 4. Demonstratives in newspaper stories

	that	that N	this	this N	Total
n-0	9	9	--	--	18
n-1	--	13	6	20	39
n-2+	--	2	--	9	11
Time	--	--	--	4	4
Metadiscourse	--	--	--	11	11
Total	9	24	6	44	83

Table 5. Demonstratives in planning document

	that	that N	this	this N	Total
n-0	1	5	--	3	9
n-1	--	--	4	78	82
n-2+	--	--	--	8	8
Metadiscourse	--	--	--	3	3
Total	1	5	4	92	102

Table 6. Demonstratives in specification document

Informative this. A use of determiner *this* expressions which is found exclusively in the non-interactive genres is to informatively redescribe a referent. In the newspaper stories, these are typically redescrptions of topical referents (already in focus) which would have been specifiable with an unstressed pronoun if the extra material had not been included, as in (22). Although speakers generally use the strongest possible form of referring expression, here a weaker form is being used for a special reason, namely to introduce new information in the noun part.

- (22) Nearly lost in the polemic was Judge Kennedy himself. That was ironic, because in many ways **this former small-city lawyer with the stable marriage and three attractive children and the fine reputation** appears to personify just those values that made the image of Ronald Reagan so attractive after the convulsions of the 1960's and 1970's. [New York Times, 11/15/87, 4:1]

Informative *this* is used in the electronic specification document for obligatory demonstrative reference to the referent of a heading which is activated but not yet in focus, as in (24). Note that here an unstressed pronoun would not be possible.

¹The rows n-0, n-1 and n-2+ refer to the distance between the demonstrative expression and its antecedent.

- (24) Poll Return The attachment feature sends **this inbound tag** to the Series/1 channel controls to indicate a poll capture for interrupt servicing or non-burst cycle steal servicing. It is not used to signal a burst transfer.

6. IMPLICATIONS FOR ALGORITHMS

The previous sections proposed constraints on demonstratives and discussed their use in different genres. This section outlines components of a natural language system that would capture the relevant notions of shared familiarity, activation and focus and explores possibilities for incorporating these into current discourse-processing algorithms.¹

Shared familiarity. At minimum, a computational model of shared familiarity requires maintenance of a user discourse history in which a record is maintained of all entities referenced in conversations with a particular user. Thus, for any entity in its knowledge base, the natural language system knows whether that entity has been discussed before (shared familiarity) or not (familiarity unknown). Only in the former case can a definite demonstrative expression be used. The recognition of discourse units (e.g. speech acts of Allen 1983) and the relations between them, e.g. conversational moves (Reichman 1985), rhetorical predicates (McKeown 1985, Mann and Thompson 1986) are also important in demonstrative resolution. These require a sophisticated user model which keeps a record of beliefs and intentions of discourse participants. While such a model could be incorporated into existing discourse structure frameworks (e.g. Grosz and Sidner 1986), no specific proposals to account for shared familiarity have yet been advanced (but see Sparck Jones 1986).

Activation. An adequate model of activation must isolate that subset of shared entities which is activated at any given point in the discourse. This subset includes entities referenced in the immediately preceding sentence, entities present in the immediate spatio-temporal context of the discourse, and beliefs and intentions relevant to the current discourse segment. Many current discourse algorithms which function at the local level of discourse structure can be used to model activation due to the immediately preceding sentence. For example, Hajičová (1987) points out that elements in McKeown's (1985) potential focus list can be equated with activated elements. Similarly, in the current centering paradigm (Grosz, Joshi and Weinstein 1986, Brennan, Friedman and Pollard 1987) elements in the set of forward looking centers can also be considered activated. At the global level, Sidner and Grosz (1986) describe a model of discourse structure which indicates currently activated beliefs and intentions at any given point in a discourse.

In Focus. Elements in focus are those which are most highly activated.² These always include at least the topic of the sentence, any high-level topics (including those not overtly represented in the sentence), and under certain as yet poorly understood conditions, the referent of the linguistic focus. In the current centering paradigm, the topic of the sentence is equated to the backward looking center (cf. Joshi and Weinstein 1981). In this

¹ Kryk (1987) presents an algorithm for demonstrative interpretation in Polish and English based on Sidner's 1983 algorithms. Kryk's algorithm, however, does not appear to be explicit enough to serve as a basis for implementation. Moreover, some of the algorithm's predictions, for example that the demonstrative *that* is never used for non-copresent extralinguistic reference whereas non-copresent *this* is used only for extralinguistic reference, are inaccurate.

²Although our notion of activation is similar to Hajičová (1987), it differs in that she considers the linguistic focus to be more highly activated than the topic. We feel that our assumptions about degrees of activation are more compatible with the fact, noted also by Hajičová, that topic maintains its activation longer than does the referents of the linguistic focus.

paradigm unstressed pronouns are viewed as preferring an existing backwards-looking center as antecedent. We have suggested that use of a demonstrative expression or stressed pronoun signals that the option to shift the backwards-looking center has been selected over the otherwise-preferred option of continuing an existing backwards-looking center. Brennan, Friedman and Pollard (1987), in fact, mention in passing that stressed pronouns in oral discourse could be used to unambiguously signal one such type of center shift. (cf. Sgall (1984), who remarks that demonstratives can be used to unambiguously specify reference to the linguistic focus of the immediately preceding sentence.)

Genre differences. A final application of our constraints is in the area of discourse genre variation. We have shown that both the form and function of demonstrative expressions varies between different spoken and written discourse genres. Our final suggestion is that these and other genre differences should be further explored, so that it will eventually be possible to design maximally-efficient discourse-processing algorithms which differentially exploit such genre distinctions.

7. REFERENCES

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