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Reductions of Spoken Words in Certain Discourse Contexts

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In discourse, speakers tend to choose lexically short words (e.g., pronouns) when the words' referents are highly accessible to listeners. However, in narrations of a film, a change in episode between references to a character, even one who should otherwise be accessible to a listener, tends to block use of short expressions. In one investigation of spontaneous film narrations and in two follow-up experiments, we found that conditions fostering shortening and lengthening at the lexical level also fostered durational reduction and blocking of reduction of repeated names and of content words more generally. The experiments confirm that episode boundaries tend to block durational shortening, but only when boundaries are marked by "metanarrative statements" (references, e.g., to a scene as such) not by narrative-level discontinuities. © 1997 Academic Press

When an utterance is predictable on the basis of what has been said before, speakers use shorter and less transparent forms than when an utterance is less predictable or new (Givón, 1983). For example, proper names tend to occur in more predictable contexts than do modified full noun phrases, and pronouns occur in even more predictable contexts as in example (1) below from transcripts studied by Levy and McNeill (1992):

(1.1) I guess the *second central character in the film* is named *Sebastian*.

(1.2) OK now Charles doesn't know *Sebastian* at first.

(1.3) He kind of sees *him* around on campus because they go to separate colleges, separate areas of the university.

Vonk, Hustinx and Simons (1992) summarize the literature as suggesting that speakers tend to use the most reduced form that is sufficient to specify the intended referent to the listener.

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Although the general finding of a relation between the opacity or transparency of a form and the greater or lesser predictability of its referent is well-established, its manifestations can be complex, because different aspects of context may affect the speaker's selection of a form in different, perhaps contradictory, ways. This is illustrated in example (2) from Levy and McNeill (1992).

(2.1) and also because *he_i*'s very flamboyant always doing very flamboyant things

(2.2) and um so the next main scene that you see with *Sebastian_i*, is um *Sebastian_i*, and some of his friends are carousing in the courtyard . . .

In (2.2), referent *i* is predictable from the prior reference to the same character in (2.1). This suggests that a shorter form, such as a pronoun, will occur in this context. However, a discourse device ("so the next main scene that you see") intervenes in the utterance's more immediate context and, perhaps therefore, the referent in 2.2 is treated as less predictable; consequently, the referring expression is a fuller, more transparent form, in this case a proper name (see also Vonk et al., 1992). This example suggests that at least two kinds of context can exert different influences on the speaker's selection of a referring expression. In (2), the influence of the more im-

mediate context is stronger. However, in other instances described by Levy and McNeill (1992), more distant context appears to win the competition. Moreover, which contextual variable exerts the strongest influence can differ for different narrators.

Interestingly, the speaker's assessment of the predictability of an utterance for listeners manifests itself elsewhere in a speech event as well. For example, Clark and Wilkes-Gibbs (1986) have found that the number of words that speakers use to refer to initially unfamiliar geometric figures declines as speakers and their listeners refer to them repeatedly. In addition, the acoustic (and therefore articulatory) durations of redundant words are short (Fowler & Housum, 1987), and the words are reduced in other ways as well (for example, spectrally as shown by Moon and Lindblom, 1989) that can affect their intelligibility extracted from their context (Bard, Sotillo, Anderson, Doherty-Sneddon, & Newlands, 1995; Fowler & Housum, 1987; Lieberman, 1963). Third, fundamental frequency increases as a topic shifts and decreases as a topic is discussed (Swerts & Geluykens, 1994). Finally, particular kinds of manual gestures are less likely to occur in more predictable than in less predictable contexts (Levy & McNeill, 1992; McNeill, 1992; McNeill & Levy, 1993). In general, then, the less the speaker believes that the listener knows about what he or she will say, the longer, the more transparent and the more elaborated are the multiple means used to say it; the more the speaker believes that the listener knows about what he or she will say, the shorter, the less transparent and the less elaborated are the multiple means used to say it.

The gross similarity of conditions in which elaborations and reductions occur across levels of description of a speech event is all the more striking in view of their diverse manifestations. Lexical choice is a linguistic variable, whereas fundamental frequency resetting and declination and articulatory elaborations or reductions are not; relatedly, lexical choice is categorical, whereas fundamental frequency

declination and articulatory elaborations or reductions are gradient. The diversity of manifestations of elaborations and reductions hints at a kind of global competition between dispositions of a speaker, on the one hand, to exert him- or herself as little as possible in a communicative exchange, but, on the other hand, to give listeners sufficient information for communication to take place (cf. Grice, 1974; Lindblom, 1990; Vonk et al., 1992). This creates a patterning of elaborations where information is new or unexpected and reductions where it is presupposed.

Our focus here will be on lexical and articulatory reductions and elaborations. Given that the general condition (redundancy or its lack) leading to reductions or elaborations is the same for these different levels of a speech event, possibly the specific conditions leading to reductions or elaboration at different levels of description of a speech event are also the same. This might be the case if a single variable—say, a general estimate of predictability by or accessibility to a listener—had multiple manifestations in utterances, including variation in lexical transparency and word duration. The research that we describe here was designed to begin to explore this idea by focusing on similarities in the conditions leading to lexical and articulatory/acoustic lengthening or shortening. In this study, we investigate whether discourse devices, such as “so the next main scene that you see” in 2.2 above, that dispose speakers to use long referring expressions (Levy & McNeill, 1992; cf. Vonk, et al., 1992) also lead to articulatory lengthening of expressions (or, in Lindblom's terms [1990], use of more “hyper,” less “hypo” speech). In addition, we will look for evidence of the relationship between any such tendency and a tendency to shorten words because they are redundant for other reasons. That is, in example (2.2) above, we might ask whether the first utterance of “Sebastian” is long in duration because a scene change intervenes between references or whether it is short because Sebastian has just been mentioned.

To lay the foundation for these explorations, we review research findings that pro-

vided the most immediate foundation for our research, focusing first on variables affecting the length of lexical referring expressions and next on those affecting acoustic reduction of spoken words.

KINDS OF CONTEXTS THAT AFFECT LEXICAL LENGTH

In a study of the lexical shortening of words in discourse contexts, Levy and McNeill (1992) identified three types of contextual constraints on the length of expressions referring to characters in narrations of a film (for example, pronouns versus proper names). The principle that predictable references are attenuated held at each of the three levels of context. That is, shorter referring expressions, such as pronouns, tended to occur in more predictable contexts at each level. In all four narrations examined, referring expressions were shorter when the targeted expression was "coreferential" than when it was not. (A coreferential context was one in which the last reference to occur in a parallel syntactic position to the target reference was coreferential with it. Coreferential expressions will, in general, be more predictable or redundant than noncoreferential ones. Indeed, it must be the tendency to put references to the same referent in parallel syntactic positions that enables the speaker in 1.3 to refer to both Charles and Sebastian using pronouns.) In three of the narrations, longer referring expressions occurred when the character referred to appeared first as compared to subsequently in an objectively defined episode (defined by the occurrence of such scene markers as "so the next main scene that you see" in 2.2 above). This finding held even in those contexts (such as example (2) above) in which the first type of context, coreferentiality, predicted the occurrence of a less explicit form. Finally, in three of the narrations, shorter expressions occurred in "dense" as compared to "sparse" contexts. (A dense context was an immediately preceding "paragraph" in the discourse in which the targeted character was more frequently men-

tioned than were other characters.) As in the second analysis, this outcome held in those contexts in which the analysis of coreferentiality predicted that a less explicit form would occur.

Overall, Levy and McNeill's study provided evidence for selection of shorter lexical expressions at points of high predictability. The occurrence of several types of context, sometimes exerting their influence in compatible, and sometimes in incompatible, directions, make it possible, however, for speakers to differ in the weight they attach to context of the three different types, and Levy and McNeill did find individual differences of this sort that they argue reflect the speaker's "discourse strategy."

ARTICULATORY/ACOUSTIC REDUCTIONS AND ELABORATIONS OF WORDS IN CONTEXT

Studies of the durational shortening of words have supported the principle that redundant words are attenuated. Bolinger (1963, 1981) reported that words that are unexpected in their contexts are durationally longer than expected words. In his example, "mowed" in "he mowed home" is longer than in "he mowed the lawn." Compatibly, words that are expected in their contexts may be less intelligible extracted from their contexts than unexpected words (Lieberman, 1963; see Hunnicutt, 1985, for some qualifications).

These kinds of effects are found in spontaneous speech as well (Fowler & Housum, 1987; Fowler, 1988). Fowler and Housum reported that words produced for the first time in a monologue are durationally longer, and more intelligible excised, than the same words repeated. Further, consistent with the idea that talkers shorten words when they convey redundant information, Fowler and Housum found, using a cloze procedure, that second occurring words were more predictable in their contexts than were first occurring words. Compatible, too, with an idea that shortening reflects talkers' assessments of listeners' requirements for clarity, Bard, Brew and Cooper

(1991) reported that durational shortening is restricted to repetitions in which the word has the same referent on both occasions.

Lindblom (1990) pointed out, in presenting his "H&H [hyper to hypo speech] theory," that talkers not only reduce forms relative to some baseline, they may also overarticulate, for example in shouting or in speaking to an inexpert (e.g., nonnative) listener. He (1990; Moon & Lindblom, 1989) found both a durational lengthening of vowels produced in "overarticulated" as compared to "citation form" speech, but also a reduction in vowel spectral undershoot.

All of these findings are consistent with a view that talkers calibrate the energy or the deliberateness with which they articulate to their assessment of the listener's requirements to understand.¹ Notice that this conclusion is analogous to that of Vonk et al. (1992) mentioned above with respect to selection of opaque or transparent referring expressions that talkers may use the least transparent expressions that permit identification of a referent by a listener.

STUDY 1: FACTORS AFFECTING WORD DURATION IN SPONTANEOUS NARRATIONS

The purpose of the analyses we report below was to begin to address the question of whether articulatory reductions and lengthenings of words have a pattern that can be explained by the contextual variables influencing lexical length. Specifically, we will ask whether, analogous to findings of Levy and McNeill (1992) for choices of referring expressions, articulatory durations of redundant words are longer than required, given their redundancy, if they are preceded by an episode boundary. Second we will ask whether redundancy fostered by repetition of an expression within an episode leads to shortening.

¹ Possibly the talker's assessment is somewhat or entirely egocentric. Bard et al. (1995) report that speakers produce less intelligible versions of words that they have said recently even if their listener was not present to hear the first production.

Constraints on our ability to detect articulatory reduction or lengthening restrict the comparisons we can make to the literature on lexical choices of referring expressions. To know that a production of a word has been reduced requires a comparison between that production and some other, presumably less reduced, utterance of that same word. (That is, we could only compare utterances of "Sebastian" to other utterances of "Sebastian"; we could not compare "Sebastian" to "he" even if "he" referred to Sebastian.) This constraint made it impossible to look directly at two of the context types that Levy and McNeill had examined, those of coreferentiality and of density of mention, because, in general, when a referent is coreferential or dense, pronouns are used as referring expressions. However, we could examine a variable that relates, as density and coreferentiality do, to the redundancy of a form (Fowler & Housum, 1987), namely the relative position of two occurrences of a word in the narration. We always compared durations of productions of words in the narration that were serially adjacent. That is, for example, we might compare the fourth and fifth productions of "Sebastian," but never the fourth and sixth. Our first variable, then, was whether each form in a pair appeared relatively earlier (the fourth production in the example) or relatively later (the fifth production). Later productions will tend to be more redundant than earlier ones (Fowler and Housum, 1987). In addition, there were sufficient numbers of repeated content words in the narrations for us to look, as Levy and McNeill (1992) had done for length of referring expressions, at the effect of explicit scene changing devices on articulatory duration.

Method

Subjects. Subjects were 16 women from the University of Chicago community, who were paid for their participation in the study. All were native speakers of English. Eight subjects served as narrators and eight as naive listeners to the narrations. For reasons we will describe, we restrict our analyses to six of the eight narrations.

Procedure. The analyses were based on videotaped narrations of the first episode (1 $\frac{3}{4}$ h) of a televised film series, "Brideshead Revisited." These included the four narrations studied by Levy and McNeill and four others. Each encounter in which the film was narrated took place between two strangers, the narrator and a listener who was unfamiliar with the film. In each case, the narrators had viewed the film on the previous day.

On the first day, each narrator viewed the film and was instructed to return the next day to give her reactions to it. On the second day, she was introduced to the listener, and the two were asked to spend a few minutes getting acquainted. The narrator was then asked to tell the story of the film to the listener. The get-acquainted conversations, in addition to the narrations themselves, were videotaped with the participants' consent.

Two narrations of the original eight were excluded from the present analyses, because they were judged to be too short to yield sufficient word pairs to measure. One of the two rejected narrators had forgotten the second half of the film, and the other, self-described as a poor narrator, told a terse, disjointed story. Data were used from narrators labeled 1, 2, 3, 4, 6, and 7 (numbered in the order that they served in the study).

Coding. The narrations were segmented into episode units. For four of the narrations this was done by Levy (1984); the units were used in the analyses of Levy and McNeill (1992). We used Levy's criteria to segment the remaining two narrations. Clauses were coded as explicit scene changing devices if they met the following criteria: they were (1) explicit mentions of a scene change ("The next scene shows") or phrases containing deictic verbs, such as *he went back into the narrative* and *the next thing you're transported to . . .*; (2) cue words such as *anyway* and *OK so*; and (3) clauses with summarizing deictics, such as *this was hysterical in and of itself* and *I didn't get this part either*. We identified 27 episodes in the narration of talker 1 and, respectively, 19, 35, 18, 35, and 51 in the narrations of talkers 2, 3, 4, 6, and 7. The

number of episodes was roughly correlated with the length of the narration (measured in numbers of sentences: $r = .728$, $p = .11$).

To make our selections of words to be measured, we used copies of the transcripts that had been typed into a computer file. Then we used the "Find" function of a word processing program to locate repeated content words or short phrases. With the following exceptions, we included all occurrences of selected words or phrases in the transcript. We rejected a word and all following occurrences of it if the speaker made a speech error producing it or if a different form of the same word preceded it (for example, if *carousing* appeared before a repetition of *carouse*). (We did use character names even though pronouns referring to the characters may have intervened between repetitions of the name itself.) From these, we selected two categories of repeated word pairs, pairs in which one was first and the other was second in an episode and pairs in which one was last in an episode and the other was first in a following episode. We used 109, 62, 179, 110, 216, and 224 word or phrase pairs respectively in the narrations of talkers 1, 2, 3, 4, 6, and 7. The number of pairs was correlated with the length of the narration ($r = .89$, $p = .03$). In our first analysis, we looked separately at durations of the names of the two main characters, because those were the referring expressions studied by Levy and McNeill (1992). There were 21, 11, 38, 22, 53, and 40 word pairs for talkers 1, 2, 3, 4, 6, and 7, respectively.

Durational measurements. Because the measurements were made by the first author, a procedure was devised to help make the measurer blind with respect to whether she was measuring a first or a subsequently occurring word. The target item names were typed in a list, in which each item was paired with the number of the sentence in the narration in which it occurred. The list of items then was randomized so that first and subsequently occurring instances of the same word or phrase were not typically nearby in the list. The randomized list then provided the approximate order in which target items were mea-

sured. To make the task of measuring the 1800 words or phrases more tractable, however, in each successive set of approximately 20 items in the randomized list, words were measured in their serial order on the videotape, not in their randomized order. This allowed one sequential pass through the videotape for each set of 20 items to be measured. Because target item pairs were rarely within 20 items of each other on the videotape this did not defeat the purpose of the randomizing procedure.

For purposes of acoustic measurement, portions of the recording of each narration that included a target utterance were filtered at 10 KHz and were input to a computer at a 20 KHz sampling rate. Durational measurements were made from waveform displays (using SoundScope, GW Instruments). Both visual and auditory criteria were used to identify the onset and offset of acoustic energy for each target item.

Results

Analysis of repeated character names. Levy and McNeill's analysis (1992) of the patterning of narrators' choices of referring expressions was, of course, limited to examination of referring expressions. In addition, Levy and McNeill focused exclusively on narrators' references to the two main characters in the film. In our first analysis, therefore, to make the closest possible comparison to the study of Levy and McNeill, we restricted our examination to narrators' references by full noun phrase to these two characters.

Most narrators referred to the characters by name. However, one narrator forgot both names, but referred to the characters consistently as "the narrator" and "the blonde." We included her utterances of these noun phrases in our analysis. A second narrator used a name to refer to one of the characters, but did not use a consistent name to refer to the other; for this narrator, we included mention just of the named character.

As described in the Method section, we selected two categories of name pairs: pairs in which one occurrence was first and one second in the same episode and pairs in which one

occurrence was last in an episode and the other was the next occurrence of the same word in the narration (necessarily the first occurrence of the word in another episode). Comparing the durations of pair members in the first category allowed us to look for shortening of repeated words within an episode. Such a finding would extend findings of Fowler and Housum (1987) that shortening of repeated words occurs within a narration. That is, we ask here whether a word (for example, the name "Sebastian") that has already occurred many times in a narration will be longer at the beginning of an episode than when it appears a second time in the same episode. Durations of members of the second category of word pairs allowed us to distinguish a finding that episode boundaries influenced the produced duration of a word from one that earlier occurrences of words tended to be longer than later occurrences, perhaps because they are less redundant than later occurrences, with episode boundaries being irrelevant to that finding.

Figure 1 (top panel) shows the results averaged over talkers. Overall, there was 57 ms of shortening for the later as compared to the earlier occurrence of a word within an episode. There was 28 ms of lengthening between episodes. In an analysis of variance with fixed factors Position in narration (earlier, later), and Episode (within, between), and with random factors Talker and Item, the main effects of Talker ($F(1,173) = 4.08, p < .01$) and the interaction of Episode and Position ($F(1,5) = 6.83, p < .05$) were significant. The former effect suggests that talkers spoke at different rates from one another, and it may reflect the different names given to "Charles" and "Sebastian" ("the narrator" and "the blonde," respectively) by one of the talkers. As for the interaction, subsequent analyses showed that durational shortening was significant within episodes ($F(1,5) = 6.78, p < .05$); the lengthening between episodes was not ($F(1,5) = 3.56, p = .11$). No other factors reached significance.

Four of the six talkers showed the numerical pattern of the overall analysis. Talker 2 showed shortening both within (47 ms) and

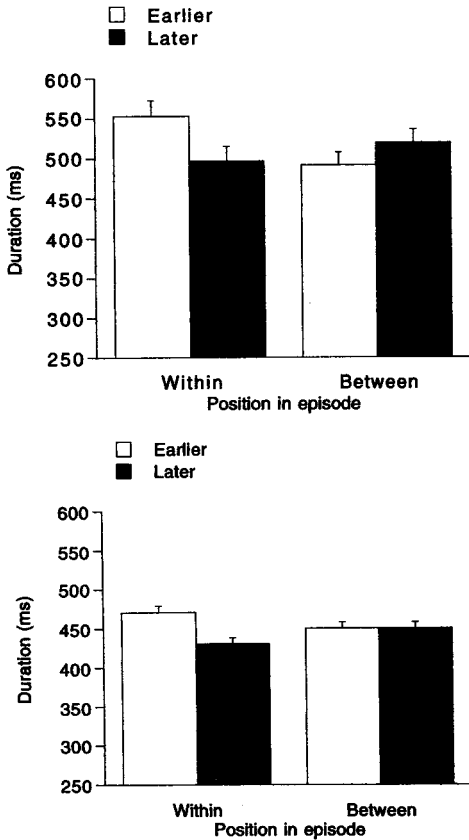


FIG. 1. Mean durations of character names (top panel) and of content words (bottom panel) that occur earlier or later in the narrations of Study 1, with or without an intervening scene marker. Bars above the means indicate standard errors. Data are unweighted averages of the word pairs for the six talkers.

between (34 ms) episodes; Talker 3 showed no shortening or lengthening anywhere. However, the interaction between Position and Episode was statistically significant only for Talkers 6 and 7, the narrators who provided the most data.

Analysis of repeated content words. Research by Fowler and Housum (1987) and others on durational shortening of redundant words was not restricted to references to individuals. In our next analysis, we examined durations of all of the repeated content words or phrases we had measured.

Figure 1 (bottom panel) shows the results averaged over the talkers. Overall, there was

41 ms of shortening for the later as compared to the earlier occurrence of a word within an episode. There was 0 ms of shortening between episodes. Accordingly, the outcome was qualitatively similar to the analysis restricted to character names. In an analysis of variance like that performed on character name durations, the main effects of Talker ($F(1,888) = 25.34, p < .0001$) and Position ($F(1,5) = 12.76, p = .016$) were significant. The Position effect indicated that, independent of their location within or between episodes, earlier occurrences of words tended to be longer than later occurrences. Despite the substantial shortening within episodes and the 0 ms of shortening between, the interaction of Episode and Position was not significant in this analysis ($F(1,5) = 2.80, p = .15$).

We found individual differences in outcome. In separate analyses on durations of each narrator, three talkers (2, 4, and 7) showed main effects of Position such that earlier occurrences were durationally longer than later ones. This outcome is similar to that of Fowler and Housum (1987) in suggesting a general tendency for earlier occurrences of words to be shorter than later occurrences. It extends the finding, however, in looking at additional mentions beyond the first and second in the narratives. Two talkers, 6 and 7, showed a significant interaction between episode and position.

Discussion

In the introduction, we pointed out that two kinds of context, redundancy and the presence or absence of scene markers, may influence a speaker's selection of referring expressions. In particular, pronouns are more likely to mark more redundant than less redundant references to a film character; however, if an episode boundary intervenes between mentions, the second mention tends to be marked by a full noun phrase. An aim of our research was to examine whether the same kinds of contextual variables exerted comparable influences on the articulatory durations of spoken content words. Overall our findings suggest that they may. When our analysis is restricted to names

referring to the two main characters examined by Levy and McNeill, we find the interaction we predicted. Repeated mentions of a name are shortened, but only if they are successive occurrences within an episode. An episode boundary blocks shortening.² Results are qualitatively quite similar, but statistically weaker when we include a wider variety of content words in the analysis.

In the present study, we chose to look at a database of spontaneous narrations because the narrations provided a measure of durational shortening in a fairly natural communicative context. However, in some respects, the database was not optimal for our purposes. Most importantly, we had no control over the distance between repeated words. Generally, between episode occurrences of words were farther apart than within episode occurrences. This, rather than the episode boundaries might have explained the findings for Talkers 6 and 7 who reliably showed blocking of shortening between episodes.³ Further, the acoustic recordings were somewhat noisy, because tapes had been made for purposes of transcription, but not for purposes of acoustic analysis. Accordingly, in two following experiments, we examine durational shortening as a function of redundancy and of location with respect to episode boundaries in a less natural communicative setting, but with better-controlled materials and superior acoustic recordings.

Earlier research comparing shortening of repeated words in spontaneous and comparable read speech (that is, readings of the spontaneous speech transcribed; Fowler, 1988)

² Here and elsewhere we will refer to the effect of an episode boundary as one of blocking shortening, rather than using the terser, less awkward term, *lengthening*, because we never find significant lengthening at episode boundaries.

³ Following our analysis of repeated content words, we used a regression analysis to partial out effects of distance on shortening for these talkers and then did an analysis of variance on the residuals. For Talker 7, evidence for blocking of shortening by episode boundaries was still statistically significant; for Talker 6, it was not ($p = .12$).

showed significant shortening in the read speech, but significantly less shortening there than in the spontaneous speech. Fowler ascribed the difference to either or both of two sources. First, the spontaneous speech had been produced in answer to some questions posed by an experimenter, and hence it was produced in order to communicate answers to another individual. In contrast, the same speakers, as readers, were reading transcripts of their spontaneous speech in the presence of the same listener, who, they knew, was already aware of what they were going to be reading. Accordingly, the reading event was considerably less genuinely communicative than the spontaneous question answering event. (A second experiment showed that utterly uncommunicative speech—words and nonwords repeated in a read list—showed no shortening at all.) Second, the read speech was produced at a significantly faster rate than the spontaneous speech, and, therefore, was less compressible.

We may ask, of course why *any* shortening occurs in read speech of this sort. It may occur because, although reductions in word durations do reflect the accessibility of the events, objects or attributes of objects referred to by the words, they do not reflect the speakers' estimates of their listeners' access to these things, but rather the speaker's own access. There is some evidence for this in research by Bard, et al. (1995). Accessibility will undergo transient changes for readers whether or not they are attempting to communicate what they are comprehending to a listener, and this may drive durational shortening.

Uncertainty aside about why shortening occurs in read speech, the literature does suggest that, in the next study, we may expect to find durational shortening, but less shortening than in Study 1.

STUDY 2A: FACTORS AFFECTING WORD DURATION IN READ SPEECH

The experiment had two aims. The first was to vary redundancy and the presence or absence of an episode boundary in materials that were better controlled than our spontaneous

narrations to determine whether the patterning of durational shortening and blocking of shortening that we had seen in the spontaneous narrations would replicate. The second was to distinguish two sources of the blocking of shortening that we expected to see after episode boundaries. In the spontaneous narrations, following Levy and McNeill (1992), we identified episode boundaries at points where narrators had used kinds of statements that McNeill (1992) refers to as "metanarrative." Most statements in a narrative are narrative-level statements; that is they recount the story itself. Other statements, however, may refer to the vehicle by which the narrator learned the story (e.g., "the next scene showed . . ."). These are metanarrative, and they represent a change in perspective that the narrator adopts on the story-telling event. The blocking of shortening that we observed across these metanarrative statements, then, might reflect the narrator's sensitivity to this momentary shift in statement level.

There is another possibility, however. A statement such as "the next scene showed . . ." implies a different kind of shift that takes place within the narrative level itself. That is, it implies a discontinuity in the events of the story. Events that occur in a next scene need not occur immediately after those of the preceding scene and need not take place in the same location. These implied time and/or location discontinuities may underlie blocking of shortening by rendering characters, other entities and events in a previous scene less accessible, due to the implied passage of time or shift in location (cf. Anderson et al., 1983).

To distinguish these possible sources of blocking of shortening, we had subjects read paragraphs that represented three conditions. In one condition the paragraph made explicit reference to a scene change, most often denoted by *in another scene* or *in a later scene*. In a second condition, the paragraph referred to a time and/or location change, using such markers as *two weeks later* or *the next night at dinner in a restaurant*. The final condition was a control condition in which the scene,

time and location remained the same throughout the paragraph.

Method

Subjects. Subjects were 12 undergraduates in an introductory psychology class at the University of Connecticut who participated in the experiment for course credit. All were native speakers of English.

Materials. The seven paragraph triads used in this experiment were based loosely on parts of the videotaped narrations investigated above. Each paragraph triad included target words that were repeated. One version of a triad mentioned no change in scene, time or location. A second version mentioned a time change or a time and location change between repetitions of target items. A final version marked an episode boundary between the first and second occurrence of target words with a metanarrative statement. The version of each paragraph that the subjects read was counter-balanced across readers. Target items were content words; 16 of the 38 were references to characters. Table 1 provides a sample triad of paragraphs with target items in bold.

Each paragraph contained three to six target words (38 in all) that were repeated once. Just under half were proper names such as *Sebastian* or other references to characters. The remaining words all were content words such as *blankets* and *eccentric*. The repeated words occurred in approximately the same position in the three versions with the same or nearly the same number of words intervening between them. In the two versions that contained episode boundaries, the first mention of the word occurred before, and the second mention after, the time/location or scene change. The paragraphs ranged from approximately 50 words to 190 words, and the number of intervening items between first and second occurrences ranged from 12 to 137 words.

Three packets of materials were created for different readers, with one version of each paragraph in each packet. Each packet included paragraphs from all three conditions and approximately the same number (either 12 or 13) of critical word pairs in each condition.

TABLE 1
ONE SET OF THE PARAGRAPHS USED IN STUDY 2a

Control
Aloysius lived in a huge mansion called Maidenhead . One day, he took his friend Martin home from college to meet his nanny who still lived in the family home. The old woman was very happy to see the boys and she asked them to stay for tea. They stayed for tea and the nanny regaled Martin with stories about Aloysius when he was a little boy at Maidenhead .
Time/Location
Aloysius lived in a huge mansion called Maidenhead . One day, he took his friend Martin home from college to meet his nanny who still lived in the family home. The old woman was very happy to see the boys and she asked them to stay for tea. They couldn't stay, but weeks later, the nanny visited them and regaled Martin with stories about Aloysius when he was a little boy at Maidenhead .
Scene change
Aloysius lived in a huge mansion called Maidenhead . One day, he took his friend Martin home from college to meet his nanny who still lived in the family home. The old woman was very happy to see the boys and she asked them to stay for tea. They couldn't stay, but in another scene, you see the nanny regaling Martin with stories about Aloysius when he was a little boy at Maidenhead .

Note. Target words are in bold.

Procedure. Subjects were instructed to read the seven short paragraphs into a microphone as if they were telling stories to someone. The readings were recorded, and an experimenter stood by to serve as audience. Subjects were tested individually, and the experimental session took no more than 15 min. Durations of target words were measured by the third author from waveform displays of the recordings in SoundScope (GW Instruments) on a Macintosh computer.

Results

Main analysis. Due to misreadings of one or both members of a repeated pair, 5.3% of the target pairs were not measured. Figure 2 shows the results of durational measurements of the remaining target words. Repeated words were shorter than first mentions by 17 ms in the control condition and by 23 ms in the time condition. The durations of repeated words were longer by 9 ms in the scene condition. Subject and item analyses of variance with factors Condition (control, time, scene) and Position (earlier, later) revealed no main effect of Condition, but an effect of Position

($F(1,11) = 4.81, p = .05$; $F(2,37) = 4.56, p < .05$) with earlier mentions overall longer than later mentions, and a significant interaction ($F(2,22) = 8.54, p < .01$; $F(2,74) = 3.18, p < .05$). Planned comparisons showed that shortening occurred in the control and time conditions (control: $F(1,11) = 8.91, p <$

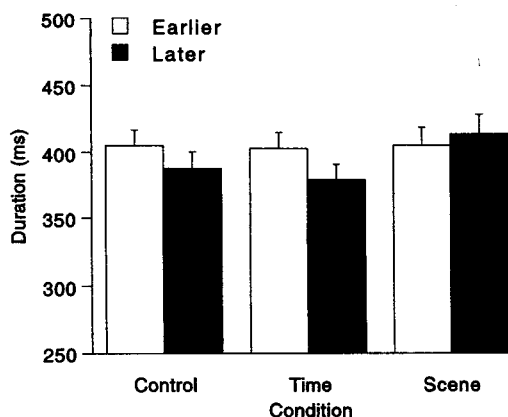


FIG. 2. Mean durations of words in paragraphs of Study 2a with earlier and later occurrences separated by mention of a scene change, by mention of a time/location change or by neither ("control").

.01; $F_2(1,37) = 7.53, p < .01$; time/location: $F_1(1,11) = 15.70, p < .001$; $F_2(1,37) = 10.88, p < .01$), but the lengthening was not significant in the scene change condition.

Comparison of character references to other content words. In our earlier analysis of the spontaneous narrations, we found a suggestion that the effect of an episode boundary was stronger on mentions of the two main characters in the narrated story than on other content words. We looked for an analogous effect here under two construals of *analogous*. First, we distinguished character names from other content words and added a factor Name/Other to the items analysis reported above. Second, we distinguished any reference to a character, whether by name or other means (e.g., "nanny," "father") from other content words. In neither analysis did our critical Condition by Position interaction participate in a three way interaction with the new factor (Name analysis: $F_2(2,72) = 1.23, p = .30$; Character analysis: $F_2(2,72) = 1.11, p = .33$). Nor was there a numerical tendency for either names or character references more generally to show a stronger effect of episode boundaries on the blocking of shortening.

Shortening as specific loss of accessibility or as a global slowing in speech rate. A reviewer of an earlier version of our paper suggested an interpretation of our shortening findings that we had not anticipated. We had interpreted the blocking of shortening of repeated content words in the scene condition of this experiment and at episode boundaries in our analysis of the spontaneous-speech narrations as evidence that these boundaries rendered otherwise redundant, and hence accessible events, objects or attributes of objects less accessible. As the reviewer pointed out, however, an equally viable interpretation is that talkers slow their speech rate globally after episode boundaries with a consequence, for example, that, had we measured them, nonrepeated words produced after mention of a scene change would also have been especially long in duration.

To address this interpretation post hoc, we found content words that occurred for the first

time after the boundary manipulation in the paragraphs used in the experiment and that occurred in all three versions of the paragraph in approximately the same location in each. If talkers slow down globally after mentions of a scene change, these words should be durationally longer in the scene versions of each paragraph than in the other two versions.

We found 17 items to measure; these included 10 nouns, five verbs, and two adjectives. (None of the nouns were names, because these had all been used as experimental items that occurred twice in the paragraphs.) The mean duration of these items collapsed across conditions was 399 ms, quite comparable to the 396 ms mean duration for repeated experimental items. Across conditions, means were 389 ms in the control condition, 398 ms in the scene condition, and 412 ms in the time/location condition, a range also comparable to that observed among the experimental items. However, the means did not order as predicted for the global slowing hypothesis (or as repeated experimental words had ordered in the original analysis). The global slowing hypothesis predicted in accordance with findings in our original analysis that durations would be similar and relatively short in the control and time/location condition and relatively long in the scene condition. In analyses with condition as a factor, the differences among conditions did not reach significance although they were marginal in the items analysis ($F_1(2, 22) = 1.13, p = .34$; $F_2(2,32) = 2.57, p = .09$).

Discussion

As anticipated, our shortening was modest in absolute magnitude in comparison to the shortening we saw in the analyses of spontaneous narrations. Following Fowler (1988), we ascribe this to one or possibly two factors. First, we did not present our readers with a setting in which they believed that real communication would be taking place. Although we asked our subjects to read the paragraphs as if they were telling stories, our impression was that most did not or could not follow those directions. Their readings sounded quite lifeless to us. Sec-

ond, and perhaps relatedly, we believe that our subjects may have read the paragraphs at a faster speech rate than the narrators had used to summarize the film. For example, averaged across the narrated productions of the referring expressions (items produced both by our narrators and our readers) "Sebastian," "Aloysius," and "nanny," the word duration of first productions was 597 ms; averaged across the 12 readers of Study 2a, first productions of the same referring expressions averaged 545 ms. Repeated productions by our readers may have been less compressible than second productions by narrators.

Despite the modest amount of shortening, the experiment revealed an interesting patterning of durational variation. Compatible with findings on the narrations, repeated word shortening that occurred in our control condition (with no intervening scene change) was blocked by explicit mention of a scene change. However, shortening was not blocked by our time/location manipulation. The blocking that occurred in the scene condition could not be ascribed to a global slowing of speech rate, as revealed by an analysis of nonrepeated words following the experimental manipulation in each paragraph. Accordingly, we ascribe the blocking to a loss of ready access to events, objects or object attributes referred to by words in the paragraphs that was caused by the mention of a scene change. In contrast to a hint in Study 1 that blocking of shortening was more marked on character names than on other content words, we found no corresponding difference in the present study.

As for the blocking of shortening that occurred after mention of a scene change, but not after mention of a time or time and location change, the findings might favor an account of the shortening that focuses on special effects of "metanarrative" statements (such as "in the next scene"; McNeill, 1992). However, before concluding that they do, we might ask whether the time or time and location shifts we used were large enough to affect accessibility. In post hoc analyses, we looked separately at durations of repeated target

words separated by a time shift only (22 ms of shortening) from those separated by both a time and location shift (23 ms of shortening); the 1 ms difference in shortening did not approach significance. In a second analysis, we looked separately at repeated words associated with smaller (2 days or less; 30 ms of shortening) or larger time shifts (18 ms of shortening); this difference, although larger than the first, and in the expected direction, did not approach significance either ($t(36) = .72, p = .48$). These analyses, however, were based on small amounts of data. Accordingly, Study 2b was designed as a replication of Study 2a in which time/location shifts were made larger.

STUDY 2B: REPLICATION WITH NEW BOUNDARY MARKERS

We expected to find that manipulations that should render characters, things or events less accessible to an ostensible listener to a story would block repeated word shortening. In findings by Levy and McNeill on narrators' choices of referring expressions, one such variable was an explicit scene marker. Our Study 2a and the investigation of spontaneous narrations in Study 1 suggest that this variable can be effective also in blocking repeated word shortening.

We have proposed that those markers may be looked at in two ways. On the one hand, they may imply a time and/or location change, and these changes can serve to make characters in a story inaccessible. On the other hand, they promote a shift in the story teller's and comprehender's perspective from a focus on the events in the narrated story itself to a focus on the vehicle (here, a film composed of scenes) that conveyed the story to the narrator. Our findings suggest that the latter aspect of mentions of scene shifts is important in blocking repeated word shortening. That is, only explicit mention of a scene change blocked durational shortening; mention of time and location shifts did not.

Because these results are somewhat counterintuitive and because we wanted to ascertain that our time/location shifts were sufficient to affect accessibility, we modified our

materials and ran a replication of Study 2a. First, we increased the magnitude of time and location changes in that condition of the experiment to strengthen the manipulation. Second we replaced mention of scene changes with explicit references to a film. The film mentions, in contrast to the explicit mentions of a scene change, need not themselves signal an episode change. By these two changes in the materials, we hoped to distinguish our experimental conditions more clearly and provide a second opportunity to distinguish effects of a decrease in accessibility of referents due to time or time and location changes from effects of a shift in narrative statement level.

Method

Subjects. Subjects were 12 students in an introductory psychology class at the University of Connecticut who participated for course credit. All were native speakers of English.

Materials. The paragraphs were those of Study 2a with several modifications. First, we increased time shifts in that condition of the experiment. Whereas in Study 2a, time shifts ranged from "the next night" to "weeks later," in Study 2b, they ranged from "weeks later" to "10 years later." Second, in the scene change condition, we substituted phrases such as "the film also showed" for "in another scene." Third, we eliminated the no change versions of each paragraph assuming that results would be the same as those in Study 2a. Finally, we replaced some target character names (e.g., "Aloysius" in Table 1) that subjects had frequently mispronounced. An error was made in one paragraph so that, in the time/location condition, a target word ("summer") appeared in the mention of the time shift as well as before that and after that. Durations of that target word were excluded, so that measures are based on one less target word than in Study 2a.

Procedure. The procedure was the same as in Study 2a. Durations were measured by the first author.

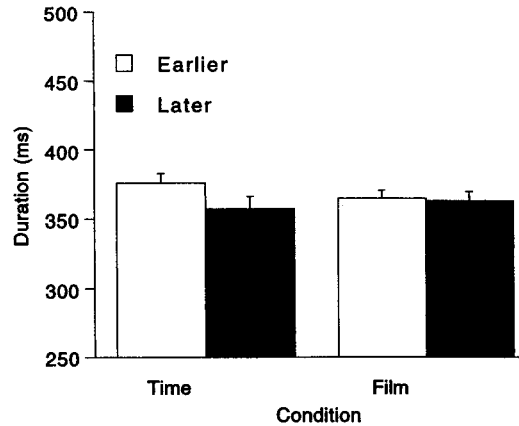


FIG. 3. Mean durations of words in paragraphs of Study 2b with earlier and later occurrences separated either by mention of the film or by a time or time and location shift.

Results and Discussion

Main analysis. Due to misreadings, 3.8% of target pairs were not measured. Figure 3 shows the results of durational measurements of the remaining target words. Repeated words were shorter than first occurrences by 19 ms in the time shift condition and by 2 ms in the film condition. In an analysis of variance with factors Condition (time, film) and Position (earlier, later), the main effect of occurrence was significant ($F(1,11) = 10.53, p < .01$; $F(1,36) = 5.13, p < .05$) with earlier mentions overall longer than later ones. However, the interaction was also significant ($F(1,11) = 8.59, p = .01$; $F(1,36) = 5.57, p < .05$), because the shortening was restricted to the time shift condition. In analyses on shortening in the time shift condition only, shortening was significant ($F(1,11) = 24.37, p < .001$; $F(1,36) = 8.37, p < .01$).

These findings replicate those of Study 2a very closely. We conclude, therefore, that the blocking of durational shortening that occurs across episode boundaries marks a shift in the speaker's focus away from the narrated story itself to the vehicle by which the narrated events were conveyed to the narrator.

Comparison of character references to other content words. As in Study 2a, we per-

formed two further items analyses contrasting the shortening patterns shown by names or by references more generally to characters to the patterning shown by other content words. In the analysis of names, the three way interaction of Condition, Position and Name/Other did not approach significance ($F_2 < 1$). In the analysis of references to characters, it was marginal ($F_2(1,35) = 2.82, p = .10$). In both analyses, the numerical trend was for references to characters to show a larger difference between the film and the time/location condition than other content words. For example, in the analysis in which the three way interaction was marginal, references to characters showed 4 ms of lengthening in the film condition and 31 ms of shortening in the time/location condition; analogous values for other content words were 14 ms and 21 ms of shortening, respectively. Here, as in Study 1, but not in Study 2a, we have a weak indication that shortening and blocking of shortening may be stronger in references to characters than in productions of other content words. Further research is required to determine whether this difference is reliable.

GENERAL DISCUSSION

The question with which we began our research was whether conditions that promote use of lexically shorter or longer referring expressions also promote use of durationally shorter or longer words. In general, we can answer the question affirmatively. Levy and McNeill (1992) found that two measures of the redundancy of a referent in a narration, its coreferentiality and its density of mention, predicted use of pronouns or of full noun phrases. In our investigation of their narrations (but necessarily a different measure of redundancy), we found an overall tendency for talkers to shorten repeated words. Levy and McNeill had also found that use of pronouns in redundant contexts can be blocked if an explicit episode boundary occurs before mention of a referent. In our investigation of their narrations, we found blocking of durational shortening by an episode boundary.

In two follow-up experiments, we con-

firmed the general patterning of durational shortening and blocking of shortening that our investigation of the narrations had revealed. That is, we found repeated word shortening that was blocked by explicit mention of a scene or of the film being narrated. In one experiment (Study 2b), but not the other, we found weak evidence as in Study 1 that blocking of shortening was more marked in references to characters than in other content words. Because this effect was weak in both instances in which it occurred numerically, we are not yet convinced that it is real. In any case, our findings overall lead us to conclude that general discourse variables promoting use of shorter, less transparent referring expressions also promote use of durationally short versions of words quite generally.

In our follow-up experiments, we obtained two additional new findings. First, an analysis ruled out global slowing of speech rate as a reason why shortening of repeated words is blocked after an episode boundary. Nonrepeated words were not longer after episode boundaries than the same words in comparable locations in the control versions of our paragraphs. Accordingly, we can conclude that blocking occurs specifically on repeated, otherwise redundant words that presumably have been rendered less redundant or accessible by the episode boundary. Second, we did not see blocking of shortening across explicit mentions of time shifts or of time and location shifts. Levy and McNeill did not identify episode boundaries based on these narrative-level discontinuities; accordingly, we do not know whether these led their narrators to shift to use of long referring expressions where shorter ones, such as pronouns, would have been unambiguous. However, as we will point out shortly, there is suggestive evidence in the literature that they might have.

In respect to the difference in outcome in our "scene" and "film" as compared to our time/location conditions in Studies 2a and 2b, our findings appear to reflect McNeill's (1992) taxonomy of narrative statement levels described earlier. That is, we find blocking of shortening following metanarrative state-

ments, but not following narrative-level discontinuities. Possibly this is because metanarrative statements mark a more major perspective shift on the part of the narrator than do narrative-level discontinuities, and blocking of shortening is only sensitive to these more marked perspective shifts. If this is the case, however, it suggests a difference in patterning between the variables articulatory duration and lexical length. With regard to lexical length variation, that is, there is evidence that narrative-level discontinuities can serve to render referents inaccessible (e.g., Anderson et al., 1983), and some kinds of narrative-level discontinuities can foster use of lexically transparent referring expressions (Vonk et al., 1992). However, marked differences between the research designs of these studies and ours preclude our determining whether these reflect real differences in the sensitivity of lexical length variation and durational length variation to narrative-level discontinuities or whether the apparent differences in outcome might be reconciled.

For example, Vonk et al. (1992) presented subjects with series of comic-strip like pictures that suggested a story. The subjects' task was to write a story to fit the series of pictures. In some cases, a final picture in a series was meant to promote a topic or theme shift in the story. Vonk et al. were interested in writers' use either of full noun phrases or of pronouns to refer to characters after the theme shift as compared to references in stories in which no theme shift occurred. Statistically, findings were as expected. For subjects who introduced a theme shift, full noun phrases outnumbered pronouns in references to characters. For subjects who did not, pronouns predominated.

In a closer analysis of their data, Vonk et al. found that the predominance of full noun phrase use following a theme shift only held for sentences that were not introduced by phrases mentioning a time or location shift. Where a time or location shift was mentioned, in fact, pronouns predominated in reference to characters. Vonk et al. suggested that, if the theme shift is marked by mention of a time or location shift, then it is not further marked

by use of a full noun phrase. If the theme shift is not otherwise marked, it is marked by use of full noun phrases. If these findings have relevance to our own, then a different reason why we failed to find blocking of shortening following time and location shifts may be analogous to the reason why Vonk et al. found that pronouns were used in these contexts. With the time and location shifts explicitly marked, speakers did not mark them redundantly by blocking shortening.

For two reasons, however, we doubt that this interpretation of our findings is realistic, and we speculate that, in respect to the strategic versus automatic character of their deployment, lexical length variation and articulatory durational variation may turn out to differ. One reason for doubting that our speakers used blocking of shortening as an optional or alternative marker of a discontinuity in a narrative is simply that it is not obvious why references to a film or scene should not have served the same purpose as the time/location markers. That is, if our speakers failed to block shortening in the time/location condition because the time/location markers already were present to mark a discontinuity in the narrative, why did they not fail to block shortening in the scene and film conditions for the same reason? Our second reason is more fundamental. It is that some recent findings of our own and of other researchers lead us to doubt that durational shortening and blocking of shortening are markers provided deliberately for listeners by speakers.

In a replication and extension of research by Clark and Wilkes-Gibbs (Clark & Wilkes-Gibbs, 1986; Wilkes-Gibbs & Clark, 1992), Nohara, Brown, Fowler, and Levy (in preparation) asked speakers to describe sets of complex geometric forms (Tangram figures) to their listener, who could hear but not see the speaker or the speaker's set of forms. The listeners' task was to use each description to pick out the appropriate form from their own set of forms. Over trials, speakers described the same forms multiple times. We found, as Clark and Wilkes-Gibbs had, that speakers used progressively briefer descriptions of each

form over trials, often settling eventually on a one- or two-word description (e.g., "the ice-skater"). We also found that the descriptions, when repeated, were durationally reduced by the speakers over trials. After five successive trials, half of our speakers continued for five more trials with the same listener, whereas the remaining speakers had to describe the forms to a new listener for five trials (cf. Wilkes-Gibbs & Clark, 1992). As Wilkes-Gibbs and Clark had found, speakers describing the forms to new listeners were sensitive to their listeners' naive knowledge state, and they reverted back to use of long descriptions of the geometric forms. In contrast, in our study, speakers in the new-listener condition did not lengthen the articulatory durations of descriptive words that they had used in the presence of the original listener, but that were first occurrences for the new listener. Indeed, these durations were as short as those of the speakers describing forms to experienced listeners on trials 6 through 10.

These findings on durational shortening are compatible with two others of which we are aware. As we have already noted, Bard et al. (1995) found that talkers reduced the intelligibility of words they were repeating whether or not their listeners had heard their first utterance of the words. Fisher and Tokura (1995) found that mothers reduced the durations of repeated expressions ("pig," "tiger") used to refer to animal puppets in speech directed to their 14-month-old infants even though, on average, the mothers estimated that their infant knew less than a quarter of these expressions. All of these findings suggest that talkers reduce the durations of expressions that are redundant to them, but are not necessarily well-known to their listener. This leads us to doubt that shortening and blocking of shortening are used strategically as markers in the way the subjects in the research by Vonk et al. (1992) may have used pronouns and full noun phrases.

In respect to our study as a whole, we draw two conclusions that may be significant for understanding discourse production. First, two factors that foster use of lexically reduced or

elaborated forms also foster use of durationally shorter or longer forms. Redundancy fosters use of lexically short referring expressions and durationally reduced forms. Metanarrative statements foster use of lexically longer and more transparent referring expressions and durationally unreduced forms. This suggests that something like Grice's maxim of quantity is observed at more than one level of description of a talker's utterances. Second, however, we do not expect length variation at these two levels always to pattern in the same way. Rather, we expect that further research will reveal differences in the patterning of lexical length variation and articulatory durational variation that may reflect the different degrees of consciousness or deliberateness with which these sources of variation are deployed by talkers.

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