GAZE DIRECTION AND FLUENCY IN CONVERSATIONAL SPEECH

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RUNNING HEAD: **Gaze Direction and Fluency**

ABSTRACT

In Experiment 1, 114 Chinese-English bilingual undergraduates gave directions to six campus destinations to a bilingual addressee either in Cantonese (their first language) or in English. During two of the descriptions, they were required to gaze fixedly at the addressee, during another two descriptions to gaze fixedly at an inanimate object, and during the remaining two they were allowed to look where they chose. Regardless of the language used, subjects spoke less fluently when required to gaze at their addressee, than when they gazed fixedly at an inanimate object or allowed to gaze where they chose; the latter two conditions did not differ with respect to the frequency of dysfluencies. In Experiment 2, 40 undergraduates performed the same task with the same three gaze conditions speaking Cantonese. Half addressed their directions to another undergraduate, the remainder to a high school student. The effect of gaze condition replicated the results found in Experiment 1. More filled pauses were found in directions addressed to the high school student, especially when speakers were required to fixate their gaze on the listener. The results support a "cognitive interference" explanation of gaze patterns in interpersonal communication.

Gaze Direction and Fluency in Conversational Speech

When people speak, they periodically shift the direction of their gaze toward and away from their listeners, and a variety of kinds of significance have been attributed to both the amount of time participants spend looking at each other, and to the points in the speech stream at which those glances occur. For reviews of the relevant literatures see Fehr and Exline (1987) and Kleinke (1986).

One theoretical interpretation links patterns of gaze direction to the conversational participants' interpersonal relationship Overall, liking and looking covary positively; people tend to look more at people they like than at people they don't like. As a result, other-directed gaze has been interpreted as an "intimacy behavior," which, along with such other nonverbal behaviors as proximity, body-orientation, touching, etc. expresses the social distance between members of a dyad (Argyle & Cook, 1976; Exline, 1972; Exline, Gray, & Schuette, 1985; LaFrance & Mayo, 1976; Maxwell, Cook, & Burr, 1985; Rubin, 1970; Russo, 1975).

Other investigators have emphasized the monitoring functions of gaze, particularly with respect to visible "back-channel" responses. A conversation can be viewed as a collaborative endeavor in which participants' successive contributions to the ongoing discourse must be ratified to ensure that their meanings are mutually understood (Clark & Schaefer, 1987; Clark & Wilkes-Gibbs, 1986). Smiles and head nods are among the behaviors participants use to indicate that such mutual understandings have been achieved (Brunner, 1979; Duncan, 1973; Duncan & Fiske, 1985; Krauss, Fussell, & Chen, 1995; Krauss, Garlock, Bricker, & McMahon, 1977) . Because some of this information must be apprehended visually, speakers will glance frequently at their listeners, particularly at points where information about comprehension would be especially useful.

Another perspective on the functions of gaze in interaction focuses on its role in conversational regulation. Changes in who holds the conversational floor tend to be associated with changes in gaze direction: as speakers complete their turns, they are likely to be looking directly at their listeners, and speakers typically begin their turns with gaze averted. Kendon (1967), among others, has suggested that directed gaze informs the listener the speaker is prepared to relinquish the floor, and averted gaze indicates the opposite. Although microanalyses of the nonverbal behaviors associated with changes of speaker status suggests that the role of gaze in signaling the end of a conversational turn is minimal (Duncan & Fiske, 1977; Duncan, 1972; Duncan & Niederehe, 1974), there is evidence that directed gaze serves as a signal that elicits back-channel responses (Brunner, 1979; Duncan, 1973; Duncan & Fiske, 1977).

It is important to recognize, as Butterworth (1978) and others (e.g., Argyle & Cook, 1976; Beattie, 1981b) have pointed out, that speakers in face-to-face interactions are simultaneously performing two cognitively demanding tasks: formulating articulate speech, and determining whether their co-participant's interpretation of what has been said is consistent with the intended meaning. Given limited cognitive capacity, it is argued, the flux of a speaker's gaze may reflect moment-to-moment variations in the demands of these two tasks. When semantic planning draws heavily on cognitive resources, speakers will avert gaze to reduce visual input that would add to the information processing load. Conversely, when the demands of semantic planning are lighter, the speaker may monitor the addressee for visible indications of comprehension, confusion, agreement, etc. Feedback of this sort would be especially informative after the burden of the message has been conveyed, which conveniently corresponds to the time when the demands of speech planning are likely to be lightest. Studies of the speech environments associated with gaze toward and away from the listener yield data that are generally consistent with such a conjecture. Gaze aversion occurs more frequently during the hesitant phase of speech, when speech planning is occurring, than during the fluent phase, when speakers are articulating the previously planned utterance (Beattie, 1978). Speakers are more likely to be looking at their listeners at the ends of sentences than at the beginnings (Cegala, Alexander, & Sokuvitz, 1979; Kendon, 1967). Gaze tends to be averted during filled pauses, which are symptomatic of difficulties in formulating speech (Cegala et., 1979).

If gaze aversion represents an attempt to reduce cognitive load, one might expect that speakers who are unable to avert gaze would experience difficulty producing articulate speech, and it appears that they do. Beattie (1981a) found speech dysfluencies to be more frequent when speakers were compelled to look continuously at their listeners, compared to a condition in which their gaze was unconstrained. Among the explanations for this result considered by Beattie was that requiring the speaker to monitor the listener continuously caused cognitive interference that made it more difficult to produce articulate speech. However, he rejected this explanation, citing as grounds studies of dual task performance (cf. Allport, 1980) "that speakers should be able to manage speech planning and simultaneous visual monitoring" because "as competent conversationalists, we all should have considerable practice at monitoring a human face and planning and producing language since the two do occur simultaneously in conversation for at least some proportion of the time" (Beattie, 1983, p. 44) . We believe that Beattie's rejection of cognitive interference as the factor responsible for his finding was ill-advised. Certainly people are capable of performing two or more cognitively complex tasks simultaneously, but it is quite clear that doing so requires considerable practice. Although people have considerable experience conversing and considerable experience gazing at others, the evidence indicates that they are likely to avert gaze when cognitive demands are heavy, so most speakers have relatively little experience simultaneously planning speech and gazing at their addressees.

Instead of cognitive interference, Beattie attributes his result to the arousing effects of gaze. Second, although it may be the case that being gazed at (at least under certain experimental conditions) results in increased skin conductance (Nichols & Champness, 1971) and cardiac acceleration (Kleinke & Pohlen, 1971), the relation of arousal to fluency is tenuous. For example, as Mahl (1956; 1987) has demonstrated. anxiety increases the rates of virtually all dysfluencies except filled pauses, which happen to have been the most common dysfluency in Beattie's data. Although the evidence is not unequivocal, the rate of filled pauses appears to be unaffected by situational anxiety, and subjects high in predispositional anxiety seem to utter *fewer* filled pauses, compared to nonanxious controls (see Rochester, 1972 and Christenfeld and Creager, 1996 for reviews of the relevant literature). Christenfeld and Creager (1996) contend that anxiety increases the rate of filled pauses only when it causes the speaker to pay attention to his or her speech.

Beattie's experimental design also confounds the effects of fixated gaze with the effects of gaze directed specifically at the face of a conversational partner. Since gaze flux is normal during conversation, it may be that merely compelling a speaker to gaze fixedly while speaking is distracting and results in less fluent speech, irrespective of the object that is fixated. Both of the present experiments replicate Beattie's design, and add a condition in which subjects are required to gaze continuously at an inanimate, neutral object.

In Experiment 1, we also attempt to address what might be called an "Anglophonic bias" in the gaze and dysfluency literatures. The overwhelming majority of the studies reported have been conducted in English, and it is largely a matter of faith that their results generalize to speakers of other languages. In the first experiment we used as subjects Chinese-English bilinguals, speaking either in English or in Cantonese (a Chinese dialect unrelated to English), to ascertain whether the observed regularities reflect particularities of English or the conversational practices of English speakers.

In the second experiment, we attempted to test the cognitive interference explanation directly by manipulating the speaker's cognitive load. If gaze aversion represents an attempt to reduce the cognitive load and it is the inability do this that accounts for the effects of constrained gaze on dysfluency, then increasing the speaker's cognitive load should increase the effects of constrained gaze. We manipulated cognitive load by requiring speakers to adopt the perspective of a person quite different from themselves. It is well established that speakers attempt to take their listeners' perspective into account in formulating messages (Fussell & Krauss, 1989; 1992; Graumann, 1989; Krauss & Fussell, 1991a&b; Krauss, Fussell & Chen, 1995; Schober, 1993; Traxler & Gernsbacher, 1993). The greater the difference between the speaker's and the listener's perspective, the more difficult is the task of message formulation (cf., Schober, 1993; 1995). Subjects should find the task of communicating with a listener who is similar to themselves to be easier than communicating with someone who is different.

EXPERIMENT 1

Method

Subjects

114 native speakers of Cantonese, recruited from the undergraduate population of the University of Hong Kong, served as subjects. In addition to their native language, all were also fluent in English, a language they had studied

for a minimum of thirteen years.[1]

Design and Procedures

The experiment constituted a 2 (Language: Cantonese vs. English) x 3 (Gaze Condition: Unconstrained vs. Gaze-at-Listener vs. Gaze-at-Object) mixed factorial design. Language was a between-subjects factor and Gaze Condition a within-subjects factor. The subject's task was to give directions that would enable another person to get from one location on campus to another. Each gave six sets of directions (i.e., directions from six starting points to six destinations). Two sets of directions were given normally, without special instructions; for two sets, the speaker was instructed to gaze fixedly at his or her listener; during the remaining two, the speaker was instructed to gaze fixedly at a book lying nearby.

The order in which the six routes were described, and the gaze condition under which the description took place, were randomly determined for each subject. Subjects who were unfamiliar with a particular location were allowed to examine a map of the campus before describing the route. If during a description the subject lost track of the route, the experimenter stopped the description and allowed the subject to examine the map. The entire description was then started over. Subjects were randomly assigned to one of the two language conditions.

During the experiment, the experimenter and the subject were seated facing each other about five feet apart. An audio cassette recorder was positioned so that it could pick up the subject's speech. The experimenter attended to what the subject was saying, nodding and saying "uh-huh" where it

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[1]Because English is the medium of instruction, fluency in English is a requirement for admission to the University.

seemed appropriate, but did not engage in conversation, interrupt, or ask questions. A book was positioned about five feet away from the subject at an angle of about 45 degrees to his or her left. This served as the focus for the subject's gaze in the Gaze-at-Object condition.

Instructions, given in Cantonese or English depending on the language condition, described the experiment as "a study of how people communicate." Subjects were told to formulate directions for a person "who has some familiarity with the Hong Kong University campus, but doesn't know it well—say, a first-year student who has been on campus for six months."

Subjects' directions were transcribed *verbatim.* For each, the total number of words, and the frequency of *filled pauses* (e.g., "ah," "eh," "er," "um"), semantically nonsignificant *repetitions* (e.g., "The next thing you you will see…"), and *false starts* (i.e., incomplete, self-interrupted or subsequently corrected utterances) were counted. Finally, for each direction, the rate for each dysfluency was calculated by dividing its frequency by the total number of words in the direction and multiplying the value by 100.

Results

Overall, the rate of filled pauses was more than twice that of the other types of dysfluencies ($F(2,224)=32.38$, $p<.0001$, $MS_{error}=0.21$). Means for filled pauses, repetitions, and false starts were 4.63 ± 0.34, 2.26 ± 0.19, and 2.12 ± 0.25, respectively. Not surprisingly, dysfluencies were more frequent when subjects spoke English than when they spoke Cantonese (Means: 3.37 ± 0.17 vs. 2.63 ± 0.16; $F(1,112)=4.77$, $p<.05$, $MS_{error}=0.29$), reflecting their less complete mastery of English. The data are shown in Figure 1

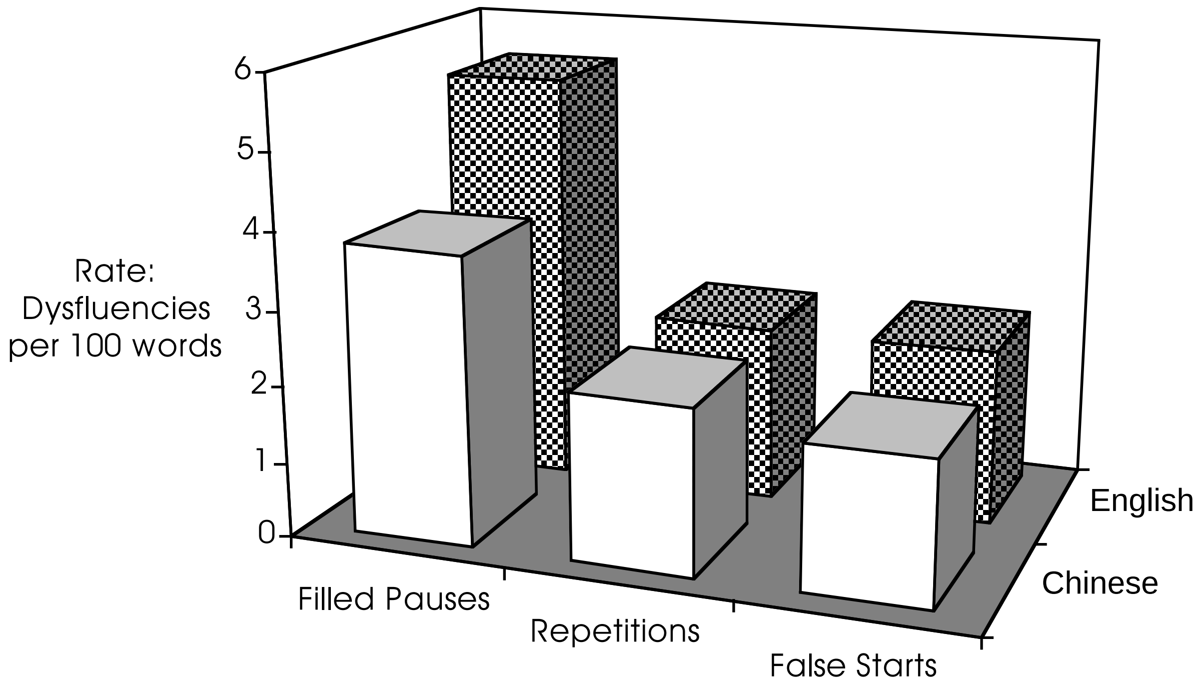

Figure 1. Rates of three filled pauses, repetitions, and false starts as a function of language of description.

Consistent with the cognitive interference hypothesis, gaze condition affected the rate of speech dysfluency ($F(2,224)=5.71$, $p<.005$, $MS_{error}=0.04$). As shown in Figure 2, dysfluency rates were highest when the speaker gaze was fixed on the listener (Mean =3.31$\pm$0.22). Fixating gaze on an inanimate object had no discernible effect on dysfluencies, relative to the unconstrained condition (Means: 2.86$\pm$0.18 vs. 2.84$\pm$0.19, respectively). This pattern of results obtained irrespective of whether directions were given in Cantonese or English; for the Gaze Condition X Language interaction, $F < 0$.

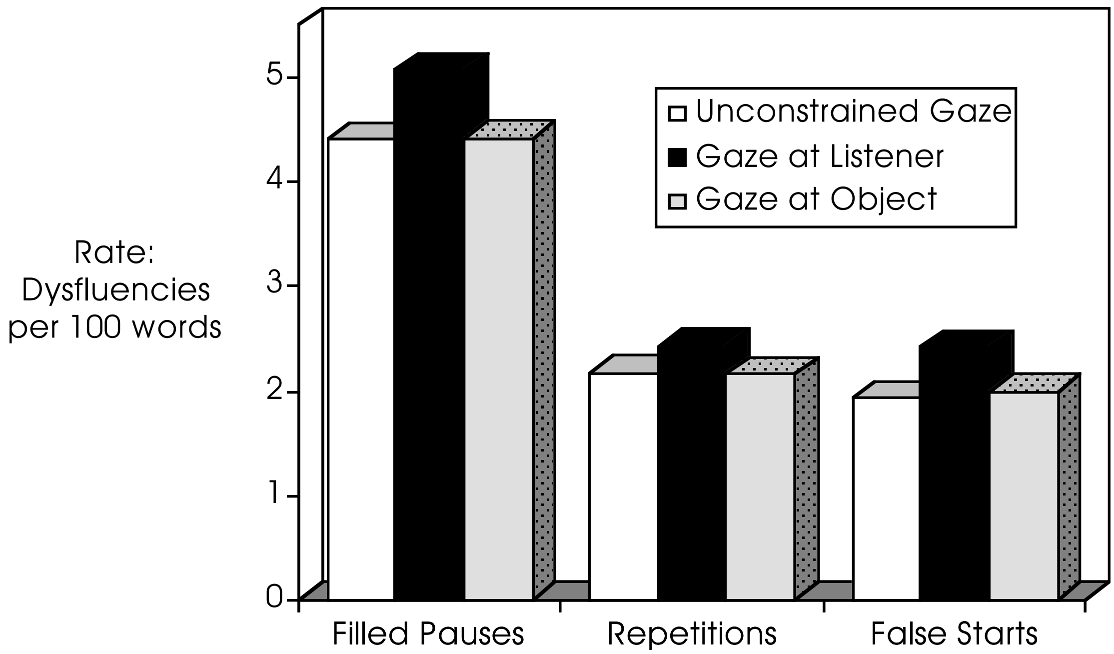

Figure 2. Rates of three speech dysfluencies as a function of gaze condition.

EXPERIMENT 2

If speakers avert gaze in order to reduce cognitive interference, and as a result have difficulty producing fluent speech when they cannot avert gaze, increasing the cognitive load should potentiate the effects of the inability to avert gaze. Increasing a speaker's cognitive load can be accomplished in a number of ways. One is to require the subject to perform another task concurrent with the main task. Although performance in the so-called "dual task paradigm" has been well studied, it raises a number of problems that make it unsuitable for our purposes (Allport, 1980; Pashler 1992; 1994).

Instead, we decided to increase cognitive load with a manipulation that was part of the communication task. A common problem in producing informative messages for others derives from differences in speaker's and listener's perspectives. People experience the world differently, and such differences will affect the way messages are comprehended and interpreted (Krauss & Fussell, in press). As Roger Brown observed: "Effective coding requires that the point of view of the auditor be realistically imagined" (Brown, 1965. To communicate effectively, speakers attempt to take their addressees' perspectives into account when they formulate messages (Graumann, 1989; Krauss & Fussell, 1991b; Krauss, et al,, 1995). However, imagining another person's perspective may be difficult, especially when that person is quite different from oneself, and even when the other's point of view can accurately be taken, it is not always obvious how to construct a message that will be readily comprehensible. We decided to manipulate cognitive load by varying the properties of the addressees for whom the directions were intended.

Method

Subjects

Twenty male and twenty female undergraduates from two local universities in Hong Kong were recruited as subjects. All were native speakers of Cantonese. Because in Experiment 1 the effects of gaze condition on speech dysfluency were independent of language, the experiment was conducted in Cantonese.

Design and Procedures

As in Experiment 1, subjects were instructed to give directions that would enable another person to get from one location on campus to another. Each subject gave three sets of directions. One set of directions was given normally, without special instructions (Unconstrained Gaze); one was given while the subject gazed fixedly at the experimenter (Gaze-at-Listener) and one was given while the subject gazed fixedly at a book. The order in which the three routes were described, and the gaze condition under which the description took place, were randomly determined for each subject. Except for the fact that the experiment was conducted in Cantonese only, the procedures were identical to those in Experiment 1.

Subjects were randomly assigned to one of two perspective conditions. Half of the subjects were asked to give directions to a high school student who was not familiar with the campus, and the remaining subjects to another undergraduate student. Our assumption was that formulating a message for an audience who had little knowledge of the campus would be relatively effortful and would require more cognitive resources.

In sum, the experiment constituted a 3 (Gaze Condition: Unconstrained vs. Gaze-at-Listener vs. Gaze-at-Object) X 2 (Perspective: Undergraduate vs. High School Student) mixed design. Gaze Condition was a within-subject factor and Perspective was a between-subject factor.

Subjects' directions were transcribed verbatim. Only the rate of filled pauses was calculated because, in comparison with repetitions and false starts, they could be coded more reliably, and because results from Experiment 1 revealed that more than two-thirds of the dysfluencies were filled pauses.

Results

A 2 (Perspective) X 3 (Gaze) ANOVA with gaze as a within-subject factor was performed on filled pause rate (number of filled pauses/number of characters) in each direction. Filled pauses were more frequent in the Fixated at Listener Condition than in the other two conditions ($F(2,76)=7.86$, $p=.001$, $MS_{error}=0.00065$). The mean percentage of filled pauses for the fixed on listener, fixed on object and unconstrained conditions were 2.3, 1.75, and 1.51, respectively. A significant listener main effect was also found ($F(1,38)=4.22$, $p<.05$, $MS_{error}=0.00043$). Filled pauses were more frequent when the intended listener was a high school student (*M*=2.25) than a university undergraduate (*M*=1.47).

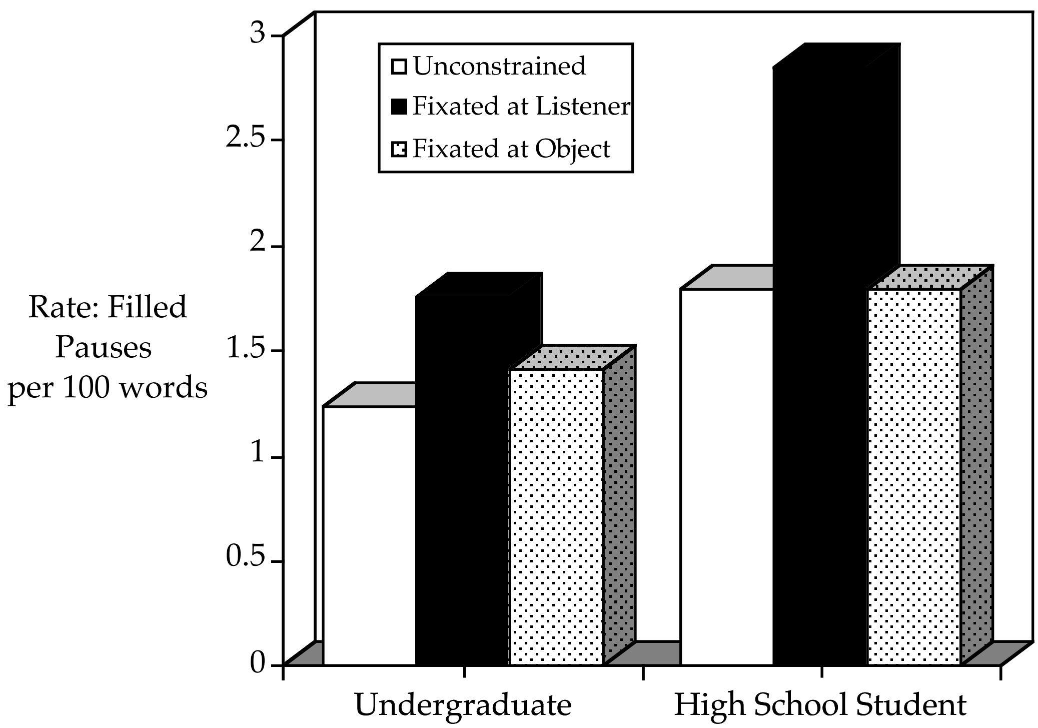

Figure 3. Filled pause rates in the three gaze conditions for directions addressed to undergraduate or high school student listener.

The mean filled pause rate in each of the six experimental conditions is shown in Figure 3 . In both perspective conditions, the filled pause rates in the Unconstrained Condition and the Fixated at Object Condition were almost identical, and the filled pause rate in the Fixated at Listener Condition was discernibly higher, replicating the results of Experiment 1. Requiring speakers to fixate gaze on the listener appeared to have a greater effect on filled pauses in the High School Student Condition than in the Undergraduate Condition. However, because the direction of the gaze effect in the two perspective conditions were the same, the ANOVA test was not sensitive enough to detect this difference, and the predicted Perspective X Listener interaction was not significant($F(2,76)=0.96$, *ns)*. Planned effect size analyses revealed that the effect of gaze on filled pause rate was greater in the High School Student Condition, $F(2,38)=6.38$, $p<.01$, $\eta^2=.25$, than in the Undergraduate Condition, $F(2,38)=1.92$, $p=.16$, $\eta^2=.09$. Paired comparisons of the perspective effect in the three gaze conditions also indicated that the perspective effect was reliable only in the Fixated at Listener Condition, $F(1,38)=4.37$, $p<.05$, $MS_{error}=0.00027$, but not in the Unconstrained Gaze Condition $F(1,38)=2.80$, *ns*., or the Fixated at Object Condition, $F(1,38)=2.20$, *ns*.

General Discussion

The effects of fixated gaze on speech fluency depends on the contents of the speaker's visual field. Fixating on an inanimate object such as a book has no discernible effect, but requiring speakers to gaze fixedly at their listeners markedly reduces their ability to produce fluent speech. Our findings replicate and extend Beattie's results in two ways. First, it is clear that the increase in the rate of dysfluency that accompanies fixated gaze is not due simply to the effortfulness of maintaining gaze fixation. Secondly, the effects of fixated gaze are not restricted to conversations conducted in English. Mean dysfluency rates were higher when subjects spoke English rather than Cantonese, but that is probably attributable their incomplete mastery of English rather than an intrinsic difference between the languages. Morphological differences between Cantonese and English make it difficult to calculate rates (e.g., words per minute) that are comparable, so that comparisons across the two languages are problematic, but within the two languages the effects of fixating gaze on the listener are identical.

Why did gazing fixedly at their listeners' faces affect speakers' ability to speak fluently? One possibility is that the results reflect an intramodal interference effect—that fixating visually caused difficulties at the conceptualizing level of speech production by interfering with the speaker's ability to visualize the route to be described. Certainly our subjects' task required a considerable amount of spatial visualization, but the evidence suggests that difficulty in visualizing does not account for our results. In the first place, it is not clear why gazing fixedly at a face should interfere more with visualization than gazing at some other object. Yet when speakers were required to gaze fixedly at a book, they spoke as fluently as they did when they were free to gaze where they chose. Secondly, in Beattie's (1981a experiment, subjects spoke on either a "spatial" topic (the route to a destination) or a "verbal" topic (the arguments for and against capital punishment). The effects of gazing fixedly at a listener's face on speech dysfluency did not differ for the two kinds of contents. So intramodal interference with spatial visualization is not an adequate explanation for our results.

A second possibility is the one favored by Beattie—that being the object of another's gaze is physiologically arousing, and, since speakers who were gazing at their listeners could see that their listeners were gazing at them, their difficulties in the Gaze-at-Listener condition reflect the effects of this arousal. In the absence of direct measures of arousal we cannot reject this explanation out of hand, but such indirect evidence as we have argues against it. To begin with, as was noted earlier, the literature provides little support for the notion that increased arousal produces an elevated rate of hesitations. Secondly, one would expect to find more rapid speech as a consequence of higher levels of arousal, but in fact no differences in speech rate among the three gaze conditions were found.

Finally, our second experiment found that making the task cognitively more demanding, by requiring the speaker to assume the perspective of a high school student in describing routes, caused an elevation of the filled pause rate that was especially large in the Gaze at Listener condition. If gaze aversion reflects an attempt to reduce visual input when the burden of information processing is great, we would expect that preventing speakers from averting gaze would have particularly deleterious effects when the cognitive demands of the communication task are high.

Considering our results and what we know about the factors that produce dysfluent speech, it seems reasonable to conclude that gaze patterns are at least in part constrained by cognitive capacity and reflect the process by which the speaker regulates the information processing load. By averting gaze at moments when the demands of speech production are great, a speaker can reduce the amount of input requiring processing. In our experiments, subjects were not allowed to avert gaze in the Gaze at Listener, and apparently could not ignore the facially-expressed information. We believe that the capacity required to process that information reduced the resources available for speech production, resulting in less fluent speech.

Why couldn't subjects simply ignore the visual input, as presumably they did when the fixated object was inanimate? On this issue we can only speculate. Three obvious possibilities occur to us. One is that the listener's face was animate, whereas the book was not, and inanimate stimuli are easier to ignore. A second is that faces have a special status perceptually (cf. Bruce, Doyle, Dench & Burton, 1991; Kemp, McManus & Pigott, 1990) and are intrinsically difficult to ignore. A third possibility, and the one we favor, is that the particular face on which subjects' gaze was fixated was that of the person they were addressing, and what it expressed was potentially relevant to the speech they were planning. There is considerable evidence that speakers use such visible information as facial expressions and head nods to help them formulate speech that is well-suited to the informational needs of their addressees (Brunner, 1979; Krauss, Fussell, & Chen, 1995). We believe it is the relevance of such information to the speakers in our experiment that mediates the effects we observed. That is, we do not believe our results were due simply to the fact that subjects were gazing at another person's face, but rather to the fact that it was the face of the person to whom their directions were addressed. At present we have no data specifically relevant to this issue, but it clearly is a question that can be answered by relatively straightforward experiments.

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