

# Effects of a Question-Answer Format on Visual Perception of Sentences

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Communicators typically receive messages within conversations, using the semantic and topical referents of their own initiating utterances to aid understanding. In this study, 24 hearing-impaired adults attended visually to videotaped sentences (assertions) received in isolation and also following Why-questions. Results, based on key-word scoring, demonstrate superior speech-reading performance when stimulus sentences follow Why-questions than when they are presented alone. This finding supports the need for realistic conversation-based assessment and therapy procedures that incorporate the principles of self-directed interaction.

Most hearing-impaired people depend on visual cues to maintain conversational fluency during face-to-face communication. Because they typically receive reduced perceptual information, hearing-impaired people also exploit available linguistic information to achieve understanding of spoken sentences. The necessary information is provided by semantic, lexical, syntactic, phonological, topical, and pragmatic constraints (Boothroyd, 1988; Summerfield, 1983). The effects of semantic and syntactic redundancy on sentence perception are well known (Fehr & Trotter, 1975; Hutchinson, 1989; Schwartz & Black, 1967). Research and clinical experience typically demonstrate that speakers can enhance sentence intelligibility for hearing-impaired communicators by constructing messages that are short, redundant, and grammatically simple. The topical referents provided by the situation and surroundings also have been shown to increase the accuracy of sentence perception (Connine, 1987; Garstecki, 1979; Lyxell & Ronnberg, 1991).

Sociolinguists have described the rule-based nature of conversation (Brown & Yule, 1983; Levinson, 1983). The concept of "adjacency" or "contingent" pairs suggests a close association between successive utterances in a turn-taking sequence (Clark & Clark, 1977; Jose, 1988). Communicators often can reliably

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predict the form of a response to an initiating utterance: a greeting typically elicits a greeting, a question elicits an answer, a compliment elicits an acknowledgement, and so forth. Moreover, the semantic and topical content of successive turns usually is closely related (Hobbs, 1979). Several studies have shown that preceding contextual information can aid in sentence perception (Bransford & Johnson, 1972; Gagné, Tugby, & Michaud, 1991; Pierce & Wagner, 1985; Tanenhaus & Seidenberg, 1981).

In conversation, a hearing-impaired person usually receives spoken sentences within a cohesive turn-taking sequence. In most instances, the hearing-impaired person speaks just before (and after) his/her partner speaks. Conversation-based procedures employing brief turn-taking sequences have become an accepted component of aural rehabilitation (Binnie, 1976; Erber, 1988; Kaplan, Bally, & Garretson, 1987). In practice, the clinician instructs and encourages the hearing-impaired client to initiate spoken sequences with response-limiting questions that can increase the predictability and thus the correct reception of a partner's responses.

The effects of such client-directed conversation on sentence perception have not been empirically demonstrated, however. The purpose of this study was to compare visual perception of spoken sentences when they are received as answers in question-answer sequences and when they are received in isolation. It was hypothesized that speechreading of sentences would be more accurate when those sentences appeared in a conversation-like context.

## METHOD

### Subjects

Twenty-four adults (16F, 8M) with acquired sensorineural hearing loss participated in the study (see Table 1). They ranged in age from 38 to 79 years (mean = 65.0 years; *SD* = 10.2 years). Their better-ear hearing thresholds for 1000, 2000, and 4000 Hz all exceeded 25 dB HTL as determined by pure-tone screening. Their self-reported degree of hearing impairment ranged from mild to severe, and duration of loss from 2 to 56 years. Nineteen of the subjects regularly wore monaural or binaural BTE/ITE hearing aids. Five did not use hearing aids. All were native speakers of English, demonstrated 20/20 corrected normal vision in the better eye, and were in good health. All were active members of a local organization for hearing-impaired adults, where they regularly received speechreading instruction and practice. All considered themselves to be poor-to-average speechreaders.

### Preparation of Stimuli

A panel of 10 speech pathology students experienced with language-analysis procedures rated a set of 250 prepared sentences (assertions) for "naturalness" (i.e., likely to be spoken/heard in conversation). None of these sentences contained inanimate objects, passive verbs, or inverted word orders. All ranged in

**Table 1**  
 Characteristics of the Subjects who Participated in the Study,  $n = 24$ .

Age	Sex	Hearing Imp.	# Yrs Hrng Imp.	Hearing Aids	Number Key Words Correct	
					No Question	With Question
48	F	moderate	20	mon BTE	32	67
59	F	moderate	52	bin BTE	43	63
68	F	moderate	56	bin BTE	39	59
59	M	moderate	11	bin BTE	7	23
64	M	severe	42	mon BTE	37	46
70	F	moderate	47	bin BTE	23	36
79	F	moderate	11	bin BTE	17	40
66	M	moderate	16	no	16	31
38	F	mild	2	no	22	62
73	F	severe	38	bin BTE	27	23
76	F	moderate	9	no	19	24
52	F	mild	7	bin BTE	11	30
69	M	severe	25	mon BTE	7	33
54	F	mild	3	no	18	44
76	F	moderate	9	no	10	28
62	F	severe	27	mon BTE	50	50
68	M	severe	7	mon BTE	8	44
64	M	moderate	14	mon BTE	11	28
79	F	severe	12	bin BTE	38	40
76	F	moderate	8	mon BTE	15	32
71	M	severe	11	bin BTE	3	14
61	M	severe	7	bin ITE	5	15
71	F	severe	11	bin BTE	17	53
60	F	severe	20	bin BTE	26	55

*Note.* Results are presented as the number of key words correctly identified by the subjects (out of 40 possible key words). Target sentences were either preceded with "No Question" or with a "Question" related to the stimulus.

length from 8-12 syllables and 7-11 words. Forty were selected as stimuli after receiving high naturalness ratings (see Appendix). For each selected stimulus sentence (e.g., "I'm going to my cousin's wedding on Sunday."), a related "Why" question was formed that might logically precede it in conversation (e.g., "Why have you bought a new suit?") (May, 1989). Each of these 40 question-stimulus sentence sequences was rated high in naturalness and cohesion (Halliday & Hasan, 1976; Hobbs, 1979) by a second panel of 10 equally experienced speech pathology students.

The 40 stimulus sentences were ordered such that no sentence (and its associated Why-question) was related to the preceding sentence with regard to topic or content. A speech-language pathology student (F, 22 years) with symmetrical facial features and precise articulation was videotaped speaking the sen-

tences, while diffusely illuminated by overhead fluorescent tubes, and indirectly by a 1000 w floodlight reflected from matte white walls.

The completed tape was presented without sound via a TEAC MV 308 video recorder and General GC 185 video monitor (28 cm × 36 cm screen) to elicit visual identification responses.

### **Testing Procedures**

Two test conditions were created. Twenty items were selected at random from the recorded list and designated to be presented after a Why-question; the remaining 20 items were designated to be presented in isolation. Half the subjects (Group A) received the videotaped sentence stimuli in this order; the other half (Group B) received the 40 stimuli under complementary conditions. That is, where a stimulus sentence was presented to Group A preceded by a Why-question, it was presented to Group B in isolation, and vice-versa. Subjects were randomly assigned to one of the two groups.

Subjects were tested individually. The examiner, a speech-language pathologist, provided each subject with a verbal and written explanation of the procedure prior to testing, as follows:

A videotaped speaker will say 40 unrelated sentences. Before each sentence, I will give you a card. Some cards contain a question. Ask this question aloud to the person on the television, and she will answer it. Tell me what you think she said, and I will write it down. Some cards are blank. A blank card means: don't say anything before the person speaks. Just tell me what you think she said, and I will write it down. The question cards and the blank cards are all mixed up.

The examiner then answered any questions about the procedure. The subjects were instructed to attempt to identify all words within the stimulus sentences. They were encouraged to "guess" if unsure – even to respond with sentence fragments.

Just before viewing each videotaped stimulus sentence, a subject either (a) received a card containing a related Why-question and asked it to the person appearing on the television monitor or (b) received a blank card and said nothing. Following a 2-sec pause, the stimulus sentence was presented without sound. Each subject received 20 different stimulus sentences under each condition.

During testing, the room was distraction-free: quiet, dimly lit without glare, and comfortably warm. Each subject sat on a firm cushioned armchair 2 m directly before the TV monitor screen, at the level of the speaker's life-sized image. A few subjects chose to adjust seating distance to approximately 3 m. Subjects who normally used eyeglasses and hearing aids for conversation wore them during the test session. The duration of the single session ranged from 35 to 55 minutes. Brief rest breaks were provided when requested.

### **Scoring**

Four important words in each of the 40 sentences were designated as key

words. The subjects' transcribed sentence-identification responses were scored with regard to key words identified. Contractions/expansions were considered correct (e.g., "They're" identified as "They are"; "television" identified as "TV"). Modifications of verb form were scored as correct if the meaning of the sentence remained essentially unchanged (e.g., "put" identified as "putting"). Pronoun confusions (e.g., "he" identified as "she"), pluralization/singularization ("people" identified as "person"), and noun-verb shifts (the noun "slippers" identified as the verb "slipping") were considered errors.

## RESULTS

The mean number of key words identified in the 20 sentences that were presented alone was 20.9 ( $SD = 13.1$ ). The mean number of key words identified in the 20 sentences that followed a Why-question was 39.2 ( $SD = 15.3$ ) (see Table 1).

The speechreading scores obtained under the two conditions (without/with a preceding Why-question) were compared with one-way within-subjects ANOVA. The effect of stimulus condition was found significant [ $F(1, 23) = 57.99$ ;  $p < .0001$ ], indicating that the subjects were able to speechread key words in sentences more accurately when they received the sentences as answers in a question-answer format.

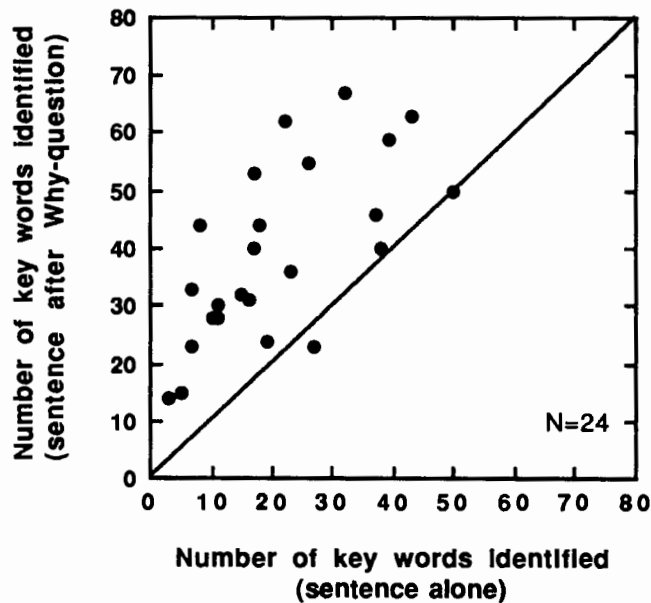


Figure 1. Visual identification of key words in sentences as a function of sentence context.

The results for all subjects are shown in Figure 1. The number of key words identified by each subject in sentences that followed a Why-question is plotted as a function of the number of key words identified by that subject in sentences that were presented alone. For 22 of the 24 subjects, the scores are higher for sentences in question-answer context.

### DISCUSSION

There is a continuing need for realistic assessment procedures that can accurately estimate a hearing-impaired client's communicative performance in daily life. Hearing-impaired people typically receive messages within conversations. The results of this study suggest that most hearing-impaired adults are able to speechread key words in sentences more easily when the communication partner speaks those sentences in response to an initiating utterance (produced in conversation-like context by the hearing-impaired person), than when the partner speaks without such direction. That is, scores are higher when test sentences are presented as in a "conversation" than when they are presented as in a list. Unrelated test sentences presented in lists probably underestimate most clients' communicative potential.

A hearing-impaired person rarely controls all parts of a conversation. In this study, the subjects attempted to identify stimulus sentences as they might have received them in two different conversational situations: (a) a turn-taking sequence initiated by oneself and (b) a turn-taking sequence initiated by one's partner. The subjects who benefitted from "directing" the partner appeared to use the semantic and topical referents of the initiating utterances to aid their understanding. It is likely that many hearing-impaired people can benefit from similar conversation-based aural rehabilitation techniques that provide realistic practice in self-directed interaction (Binnie, 1976; Erber, 1988; Kaplan et al., 1987).

Hearing-impaired adults, of course, cannot be certain that their frequent communication partners will always cooperate in response to initiating utterances as did the recorded talker in this study – with regard to topic maintenance, cohesion, brevity, and clear articulation. In fact, many clients have commented that their partners often produce rambling, marginally relevant answers in response to similar questions. The act of questioning in itself does not guarantee a desired answer (McHoul, 1987).

A few subjects did not speechread sentences more easily when viewing them after asking related Why-questions. Such results probably reflect differences in linguistic competence (Stoker & French-St. George, 1984). Informal discussion with these subjects and examination of their responses suggest that the following factors may have contributed. (a) They did not speak their own initiating utterances in personally relevant situations. They seemed to have difficulty role-playing, and perceived the spoken question-answer sequences as external to their own communicative needs and interests. (b) Having asked an initiating Why-

question (e.g., "Why does the old woman look so happy?"), they developed a strong expectation for a particular response (e.g., "because her daughter was getting married!"). When this utterance was not forthcoming, they could not assign meaning to the unexpected stimulus pattern that the talker actually produced ("We found her gold ring behind the bookshelf."). Repeated experiences of this sort may have led to distrust of contextual cues and reliance on more analytical perception of the spoken sentences.

One may speculate that speechreading results based on perception of stimulus sentences received under conversation-like conditions closely reflect a person's communicative performance in daily life. If so, it is suggested that future assessment and therapy procedures incorporate such a context-rich approach. Further, more detailed studies incorporating this paradigm are recommended.

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## APPENDIX

### LIST OF STIMULUS SENTENCES AND ASSOCIATED WHY-QUESTIONS

Scored key words are underlined.

1. Why were you awake so early this morning?  
I always get up at 6:30 for breakfast.
2. Why are there four pigeons in the back yard?  
We put out some stale bread for the birds.
3. Why are they friends again?  
She admitted that she made a mistake.
4. Why can't I find my letters to the City Council?  
I put the papers in your briefcase.
5. Why is your auntie so relaxed tonight?  
She had a glass of wine before dinner.
6. Why did you think that the wedding had started?  
We heard organ music as we entered the church.
7. Why are they all muddy again?  
The children love to play in puddles!
8. Why do you like her?  
I think she has a great sense of humour.
9. Why did it take so long to send the announcements?  
We addressed all the envelopes by hand.
10. Why did you run outside so fast?  
We heard someone scream in the house next door.
11. Why are you so bored?  
He told us those stories about the war again.



12. Why does the old woman look so happy?  
We found her gold ring behind the bookshelf.
13. Why is there sawdust everywhere?  
I sanded the table in the kitchen.
14. Why are the tourists so exhausted?  
They climbed all the way to the top of the tower.
15. Why did you leave before it was over?  
We didn't enjoy the film very much.
16. Why isn't the boss in his office?  
He's having a three-hour lunch break.
17. Why have you been cooking all day?  
We're expecting eight people for dinner tonight.
18. Why weren't you home on Saturday afternoon?  
I took my nephew to a football match.
19. Why have you nearly finished eating?  
They served our meals earlier than we expected.
20. Why is the hospital so busy this weekend?  
Many people have been hurt in car accidents.
21. Why is your uncle still at home?  
We didn't want to take him with us.
22. Why do you have a kennel?  
We bought a dog for the children.
23. Why is your friend always moaning about something?  
She loves to complain about her husband.
24. Why have you bought a new suit?  
I'm going to my cousin's wedding on Sunday.
25. Why is it so dark in here?  
She drew the curtains to block out the sun.
26. Why has he lost his driver's license?  
The police pulled him over for speeding again.
27. Why weren't you at your flat on Friday night?  
My friends and I went camping on the weekend.
28. Why is your cousin such a good babysitter?  
She grew up in a home with 8 children.
29. Why are you in your bare feet?  
I can't find my new slippers anywhere.
30. Why is no one in the lounge this evening?  
They're serving drinks in the entrance hall.
31. Why do you know a lot about current events?  
I always watch the news when I get home.
32. Why have you climbed out of the pool already?  
I get tired after swimming about five laps.

33. Why didn't you see any bats?  
They don't let people in the caves any more.
34. Why is he so cross?  
His mother told him not to play with the toys.
35. Why aren't your sisters on the verandah with the others?  
They're in the kitchen washing all the dishes.
36. Why are those flies buzzing around again?  
We forgot to cover all the sausages.
37. Why is everyone talking about the World Cup?  
They all watched the match on television last night.
38. Why was his wife so embarrassed?  
He was so loud they heard him in the next room.
39. Why did your cousin become a fashion model?  
She always liked to dress-up as a child.
40. Why can't I hear any more barking?  
They took the dog for a walk in the park.