Viewer Reaction to Different Captioned Television Speeds

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ABSTRACT

A series of 24 short, 30-second video segments captioned at different speeds were shown to 578 people. The subjects used a five-point scale (Too Fast, Fast, OK, Slow, Too Slow) to make an assessment of each segment's caption speed. The "OK" speed, defined as the speed at which "Caption speed is comfortable to me," was found to be about 145 words per minute (wpm). Most subjects did not seem to have significant trouble with the captions until the rate was at least 170 wpm.

People who could hear wanted slightly slower captions. However, this seemed to relate to how often people watched captioned television. Frequent viewers were comfortable with somewhat faster captions. Age and sex were not related to the caption speeds people were comfortable with. Education had no relation to caption speed except that people who had attended graduate school might prefer slightly faster captions.

INTRODUCTION

Since it first appeared on television broadcasts on March 16, 1980, closed-captioned television has become an important factor in the education and entertainment of people who are deaf or hard of hearing. There are over 500 hours of closed-captioned television programming shown each week and the number is steadily increasing. By the turn of the century, most programs shown on television are expected to be closed- captioned.

This outpouring of televised material for people who are deaf or hard of hearing has raised many questions concerning how well the captions fit their intended audience. One of the major issues is caption speed. When closed captions were first shown, they were usually edited down to 120 wpm or less. Since then, most caption companies have adopted a policy of captioning every word spoken. This change was made partly in response to viewer comments and partly due to the cost of editing. Unfortunately, relatively little is known of the relationship between caption speed and the reading skills and preferences of the viewers. The author of this article has been working for several years to investigate this relationship.

This is the second in a series of research studies related to the speed with which captions are presented on television programs. The first study (Jensema, McCann, and Ramsey, 1996) examined over 200 closed-captioned television programs and calculated the caption presentation speed of each. The mean caption speed among all programs was 141 wpm, with considerable variation for different types of programs.

The second study, the results of which are presented here, measured how comfortable people were with different caption speeds. This was done by showing them a series of captioned video segments and asking them how they liked the caption speed.

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PROCEDURE

Experimental Materials

The materials in this project were a series of 24 short, 30-second video segments, each captioned at a specific speed. Subjects watched each segment and made an assessment of the segment's caption speed. The video segments were developed specifically for this project.

Three topics were selected for the video tape materials: sailing, space, and the nation's capitol. Posters were obtained for each topic, with care being taken to select posters which were relevant to the topic, but did not give information related to the captions. A 30-second video was shot of each poster, with the camera being moved around the poster to give the illusion of a moving picture. The idea was to create interesting video images related to the topic to distract the viewer without duplicating information given in the captions. For example, if the captions talked about the White House, an image of some other Washington building would be shown.

Each topic was introduced with a simple name given on a blank screen and had eight 30-second video segments. Each segment was separated by ten seconds of blank screen on which a printed message was shown telling the subjects to mark their papers. To control for audio information, the tapes were completely silent and had no audio of any kind.

The caption speeds used were 96, 110, 126, 140, 156, 170, 186, and 200 wpm. The order of these speeds was randomly varied for each topic, with care being taken so that extreme speeds did not follow one another. For example, a 96 wpm segment was never followed by a 200 wpm segment. The objective was to avoid sudden extreme changes in caption speed that might artificially influence subject assessment.

The words of the script for each topic were encoded on the tapes as closed captions. A short, two-segment topic on the subject of "art" was created as practice material to be put at the beginning of each tape. Then a total of six different experimental tapes were made--each tape representing a different order of the three topics (123, 132, 213, 231, 312, and 321). Each final version of the experimental tape had the two "art" topic practice sessions followed by the three experimental topics in a particular order.

Data Collection Instrument

All subjects were given a spoken and signed introduction, and then handed a six-page data collection instrument. This instrument contained more introductory material and room for the subjects to record their responses to four things:

1. A background questionnaire.
2. A simple vision test.
3. A practice video.
4. Three captioned videos.

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There were separate background questionnaires for adults and students. Both contained items for age, sex, hearing loss, number of people in household, and television viewing habits. In addition, the adult questionnaire asked for educational background and employment information, while the student questionnaire asked for the student's grade.

A simple vision test was given to all subjects. This was done to assure that they were physically able to see the captions on the television screen. A simple eye chart was placed on the screen and the subjects were asked to copy the letters of the eye chart onto a blank paper form. The smallest characters on the eye chart were considerably smaller than the caption characters, assuring that anyone who could copy the eye chart could see the captions clearly. The results of copying the eye chart were examined before the test videos were shown. Anyone having problems filling out the eye chart was moved closer to the screen.

The third part of the data collection instrument gave a definition of the response categories to be used and a place for the subjects to mark their responses to the two practice video segments. The response categories used in this study and their definitions were:

Category	Definition
Too fast	Captions should be slower. Hard to read the captions. I miss some words.
Fast	Captions should be slightly slower. Captions should be on the screen a little longer.
OK	Caption speed is comfortable to me.
Slow	Captions should be slightly faster. Captions are on the screen a little too long.
Too Slow	Captions should be much faster. I am bored with reading them.

After viewing a video segment, each subject marked a category box corresponding to his or her judgment of the caption speed.

The fourth part of the data collection instrument consisted of forms for the subjects to use in recording their responses to the experimental video segments. The layout of these forms was the same as for the two practice video segments.

Experimental Procedure

All subjects were seated about 10 feet from a 27-inch television set. The experimenter gave a brief introduction to the study and handed out the data collection instrument. The subjects filled out the background questionnaire and copied the eye chart characters from the television screen to their paper form. The experimenter observed them while they copied the eye chart, and anyone having problems was urged to move closer to the screen.

The categories to be used for assessing caption speed were explained and the two practice videos were shown. Any questions the subjects had concerning the caption assessment were answered.

The subjects then viewed all 24 captioned video segments without interruption except to mark their forms. There was a 10-second gap between segments for this purpose. The experimenter observed the

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subjects and paused the tape if the 10-second gap was not enough time for everyone to finish marking their form. Most subjects had enough time, and it was seldom necessary to pause the tape.

After all 24 experimental video segments had been shown, all papers were collected from the subjects, and there was a short discussion during which any questions the subjects had were answered. Finally, each subject was given $5 as an honorarium for taking part in the study.

Data was collected from 578 subjects, coded, and entered into a computer file. Because of careful experimental administration, there was very little missing data. The data file was checked for accuracy, and then subjected to a statistical analysis, the results of which are presented in the next section.

RESULTS

Composite Scores

Each subject's overall score for each topic was calculated by adding up the response for the eight segments of the topic and dividing by eight. The mean for each topic over all subjects was then calculated and the results are given in Table 1. There was no significant difference between the scores on the three topics. Since there was no significant difference between topics, it was decided to create and work with composite scores.

Table 1
Scores for Each Topic
(N=573)

Topic	Mean	Standard Deviation
Washington, D.C.	3.02	0.93
Space Shuttle	3.13	0.93
Sailing	3.09	0.94

The scores on the three topics for each subject were added together and divided by three to get across-topic composite scores for each speed on each subject. Table 2 gives the mean and standard deviation of the composite score for each speed. Adding together the subject's composite scores for each speed and then dividing by eight created an overall composite score. The mean of the overall composite score was 3.09 and the standard deviation was. 39. Figure 1 sows a histogram of the overall composite scores and indicates they form a reasonable approximation of a normal distribution. In the remainder of this study, analysis will focus on the composite scores.

Comfortable Caption Speed

In the score coding used, "3" indicates the caption speed is "OK," as defined as "Caption speed is comfortable to me." A higher score indicates the caption speed is faster than is comfortable, and a lower score indicates the captioning is slower than is comfortable. Table 2 indicates that a mean score of "3"

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would be associated with a caption speed of between 140 and 156 wpm. Using simple interpolation, the "OK" speed is estimated at 145 wpm. Figure 2 shows this graphically.

Table 2 Scores at Each Caption Speed (N=573)		
Speed (wpm)	**Mean**	**Standard Deviation**
96	2.21	0.68
110	2.61	0.54
126	2.79	0.51
140	2.89	0.47
156	3.22	0.48
170	3.49	0.55
186	3.60	0.62
200	3.95	0.66
Combined Speeds	3.09	0.39

Hearing Status

The scores were broken down by whether the subject was deaf, hard of hearing, or hearing. Table 3 gives the mean score for subjects in each hearing category at each caption speed. Figure 3 shows this in a graphic format. The differences between groups were especially noticeable at higher captioning speeds. Overall, the mean score was 3.01 for deaf subject, 3.04 for hard of hearing subjects, and 3.18 for hearing subjects. An analysis of variance indicated a significant difference between the groups on overall scores (F=12.572, df 2/569, p<.0001). The basic conclusion is that the more hearing people had, the slower they wanted the captions to be.

Table 3 Mean Score by Hearing Status (N=573)									
	Words Per Minute **96 110 126 140 156 170 186 200**								**Overall Score**
Deaf	2.32	2.61	2.77	2.86	3.12	3.35	3.35	3.68	3.01
HOH	2.19	2.65	2.68	2.83	3.22	3.44	3.54	3.82	3.04
Hearing	2.12	2.60	2.84	2.93	3.29	3.63	3.81	4.20	3.18
All Subjects	2.21	2.61	2.79	2.89	3.22	3.49	3.60	3.95	3.09

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Viewing Frequency

It was expected that the hearing subjects would want slower captions because they had less experience watching captions and were not used to reading them. An analysis was done of how often people watched captioned television. The categories for this variable were “Daily,” “Weekly,” “Monthly,” “Yearly,” and “Never.” It was found that there was no significant difference between the scores for the “Weekly” and “Monthly” categories, and between the “Yearly” and “Never” categories, so these were combined. The final categories used were “Daily,” “Weekly/Monthly,” and “Yearly/Never.”

Table 4 shows the number of subjects according to their hearing status and the frequency with which they watch captioned television. The frequencies in Table 4 are very significant (chi-square=266.218, df=4, p<.0001). Deaf and hard of hearing people tend to watch captioned television daily and hearing people seldom watch it.

Table 4
How Often Captions are Watched

	Deaf N %		HOH N %		Hearing N %		All Subjects N %	
Daily	169	83	74	68	30	11	273	48
Weekly/Monthly	20	10	19	17	81	31	120	21
Yearly/Never	14	7	16	15	151	58	181	32
All Subjects	203	100	109	100	262	100	574	100

As previously mentioned, comfortable caption speed has a relation to the frequency with which people watch captioned television. Table 5 gives the mean of the overall score for each caption viewing frequency category. Over all subjects, people who seldom watch captions tend to want slightly slower captions (df=2/568, F=14.838, p<.0001).

Table 5
Mean Overall Scores by Caption Viewing Frequency
(N=573)

Viewing Frequency	Mean Overall Score
Daily	3.01
Weekly/Monthly	3.12
Yearly/Never	3.20
All Frequencies	3.09

The questionnaire also asked subjects how many years they had been watching closed captions. Number of years of caption viewing had no relationship to how comfortable different caption speeds were.

Age

It was originally thought that there might be a relationship between age and the caption speeds an individual thought were comfortable. Teenagers might prefer slower captions because they are still in the process of being educated. Subjects over 40 years of age might prefer slower captions because

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eyesight usually begins to deteriorate at about that age. However, examination of a scatter plot between overall score and age showed that there was no relationship between age and comfortable caption speed. The correlation between age and overall score was r=.11, clearly nonsignificant.

Sex

The mean overall scores for males and females were 3.04 and 3.14, respectively. This is significant (df=571, t=3.001, p=.0028), but the difference could be traced to hearing status. When hearing status was controlled, there was no significant difference in caption speed scores between the two sexes.

Education

The adult subjects were asked the highest level of education they had completed. The responses of those who answered (n=402) were coded into "High School or Less," "Trade School or College," and "Graduate School." The mean overall scores for these three categories were 3.15, 3.15, and 3.03. Subjects who had attended graduate school prefer slightly faster captions, but the results were not quite significant (df=2/399, F=2.776, p=.0635). Educational level does not appear to play a meaningful role in caption speed considered comfortable by adults.

A total of 120 students indicated the school grade they were in. No significant difference in overall caption speed score was found between grades.

School-Aged Deaf and Hard of Hearing Subjects

In this study we were especially interested in the caption speed scores of school-aged deaf and hard of hearing people because of the potential educational impact of captioning. The study had 160 deaf and hard of hearing subjects under the age of 20. All but 13 of these students were teenagers. The mean age was 15.2 years, with a standard deviation of 2.2 years. There were 94 male and 66 female subjects, with 106 being deaf and 54 being hard of hearing.

The means of the scores at each speed and the overall score are given in Table 6. These means are very close to those given in Table 2 for all subjects in the study and the overall comfortable speed is estimated to be around 147 wpm. This indicates that deaf and hard of hearing teenagers are most comfortable at approximately the same caption speeds as the overall viewing population.

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Table 6 Scores for Deaf and Hard of Hearing Teenagers (N=160)		
Words Per Minute	**Mean**	**Standard Deviation**
96	2.21	0.77
110	2.60	0.63
126	2.72	0.53
140	2.89	0.57
156	3.15	0.49
170	3.38	0.61
186	3.39	0.65
200	3.73	0.74
All Speeds	3.01	0.41

Table 7 gives the frequency with which the students reported watching captioned television. The results are extremely interesting, with 12 percent of the students reporting that they watched captioned television "Yearly/Never." These responses were noted during data collection and some of the subjects were questioned about them. Many of the respondents who report that they seldom watch captioned television were day students who came from poor inner-city homes with old (pre-July 1993) television sets which did not have caption decoders built in. These students had little access to captioned materials, a major educational disadvantage for them. They did watch some captioned television as part of their schoolwork, but they consider this "work." To them, "watching captioned television" means recreational viewing at home.

Table 7 Frequency of Caption Viewing by Deaf and Hard of Hearing Teenagers		
	N	**%**
Daily	112	71
Weekly/Monthly	26	17
Yearly/Never	19	12
All D/HOH Teens	157	100

Deaf students and hard of hearing students did not differ significantly in frequency of captioned television viewing. There was also no significant relationship between viewing frequency and caption speed comfort.

DISCUSSION

A previous study by Jensema, et. al. (1996) indicated that the overall mean speed of captioned television programs is 141 wpm, with a standard deviation of 21 wpm. A major goal of the study reported here was to determine how this compared with the caption speeds with which people were most comfortable. The data indicated that the mean caption speed that "is comfortable to me" is about 145 wpm, very close to the 141 wpm mean rate actually found in television programs. This study used 30-

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second video segments, and watching these is obviously not directly comparable to watching a full-length television program. However, the results are suggestive and indicate that the caption speed rates used today are comfortable for most viewers.

Of particular interest in this study was the adaptability exhibited by the respondents. As caption speed increased, the respondents recognized this, but most seemed able to adjust and did not appear to consider the captions unacceptable. Table 2 showed that at 170 wpm, the mean score was 3.49, about halfway between "Caption speed is comfortable to me" and "Captions should be slightly slower. Caption should be on the screen a little longer." This suggests that most viewers are able to adjust to higher captioning rates and will not object to verbatim captions when the audio rate picks up.

It was expected that hearing people would not depend on captions and would have less practice in reading captions. Because of this, hearing people were expected to want slower captions. Table 3 showed that the more hearing people had, the slower they wanted captions to be. Table 5 showed that the less subjects viewed captions, the slower they wanted the captions to be.

The experimental tapes in this study had no audio, and hearing people became effectively "deaf" for purposes of the experiment. The score differences in Tables 3 and 5 are not large, and the findings suggest that a newly deafened person needs relatively little practice to adjust to reading television captions. This conclusion was also supported by the finding that number of years of caption viewing had no relation to the scores. People apparently adjust to caption reading quickly, and practice beyond this makes little difference.

A very important issue, one that was not covered in this study, is the age at which caption speed begins to matter. The study had only a few subjects under the age of 13. Certainly, most children are reading captions at a much younger age, but how young and how fast can they read? Further work is needed to determine the age at which children start to read captions and the speeds they can handle as their caption reading skills improve.

References

Jesema, C., McCann, R., and Ramsey, S. (1996). "Closed-Captioned Television Presentation Speed and Vocabulary." *American Annals of the Deaf*. 141(4), 284-292.

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Figure 1. Histogram of Overall Scores

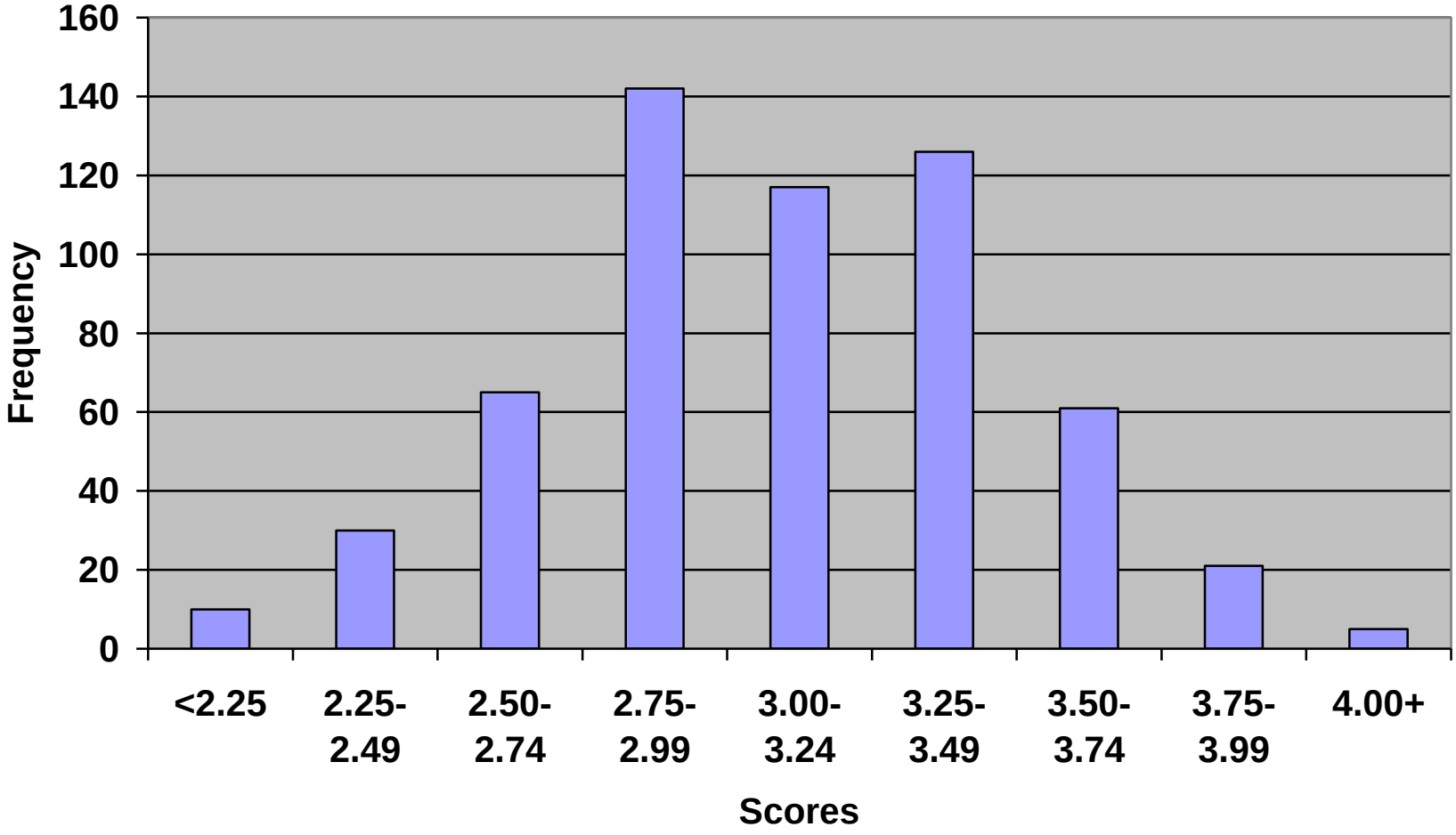

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Figure 2. Evaluation of Caption Speed

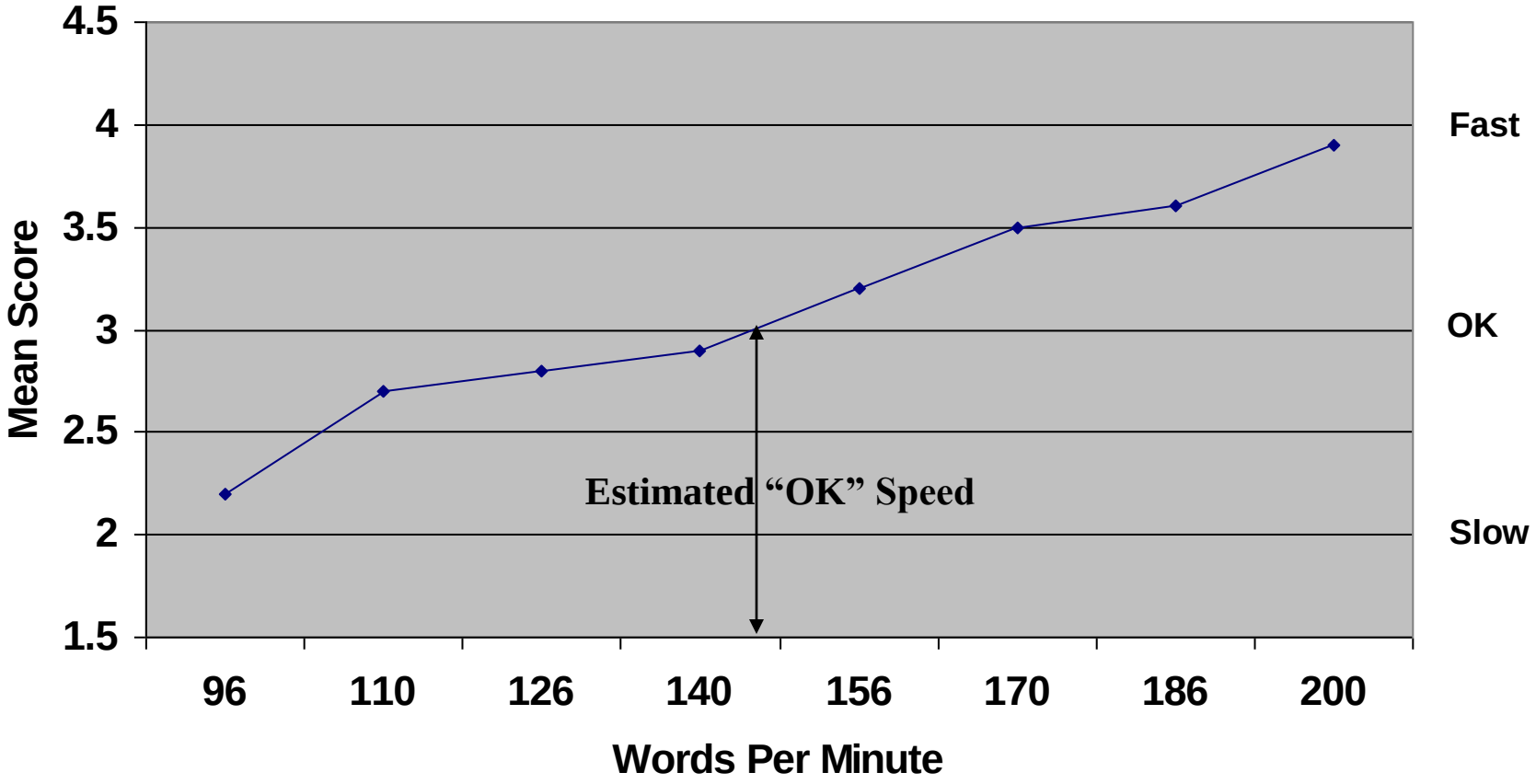

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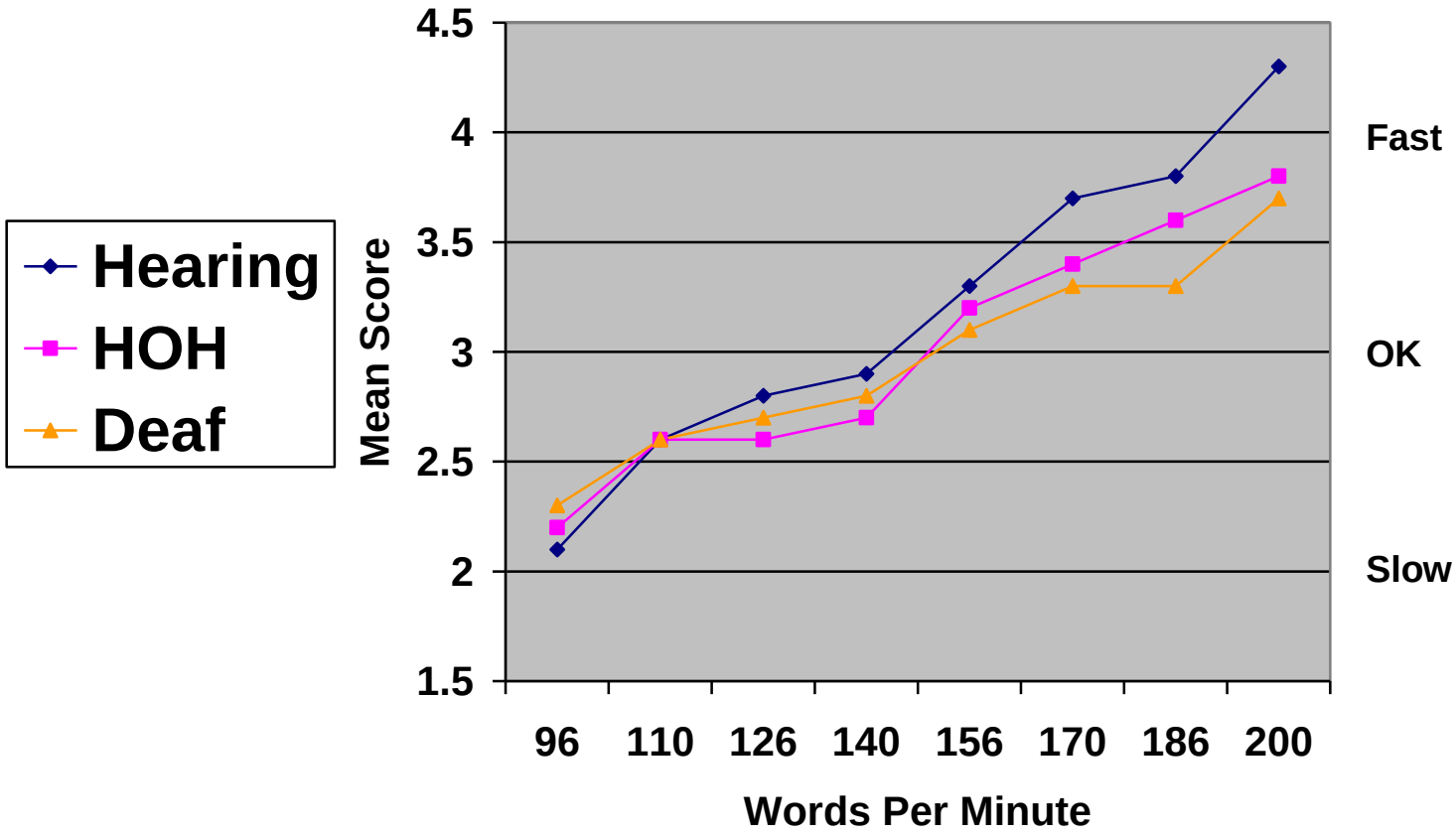
Figure 3. Evaluation of Caption Speed by Hearing Status



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