

GENDER DIFFERENCES IN VISUAL INTELLIGIBILITY

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Abstract

Results from three studies investigating gender differences in the visual intelligibility of talkers indicated that the gender difference in speech variables used by talkers was not sufficient to explain the gender difference in talker intelligibility. Thus the difference may¹ have been partly due to gender stereotypic expectations. Results showed three main findings: (1) Female talkers were easier to speech-read than male talkers; (2) Female talkers spoke in a different way to male talkers; (3) Female talkers were expected to use clearer speech than male talkers. These results are discussed with respect to the 'stereotype hypothesis', the 'gender-dialect hypothesis', and the 'self-fulfilling prophecy'. It is proposed that stereotypes play a role in the development and use of gender-appropriate visual speech.

1. Introduction

This paper presents results from three studies which investigated gender differences in the visual intelligibility of talkers. Study 1 investigated whether speechreaders found female talkers easier to speech-read than male talkers; Study 2 examined gender differences in the visual speech of talkers (i.e., the existence of a gender dialect); and Study 3 investigated the effect of gender stereotypes on the relationship between visual intelligibility and interpersonal impressions. Results showed that: female talkers were easier to speech-read than male talkers; the visual speech of female talkers differed moderately from that of male talkers; and that female talkers were expected to use clearer speech than male talkers. Because the visual speech of male and female talkers differed only moderately, gender stereotypes may be contributing to the visual speech perception of the speech-reading participants as well as the development of gender differentiated visual speech. Thus, a circular relationship between expectation, performance and perception in visual speech is proposed.

2. Definition of Terms

The speech-reading (lip-reading) process has been defined as the visual perception of speech (Boothroyd 1988:77). Speech-reading is often assumed to be a skill used only by individuals with a hearing impairment. However, people with normal hearing also use visual cues in speech perception (Dodd 1987). Thus, speech perception skills consist of both auditory and visual elements. In this paper, the sender of the message is referred to as the *talker* and the receiver of the message as the *speechreader*. *Visual speech* describes the production of speech by a talker who can be seen and not heard

3. Methodology

3.1 Participants

Twenty four talkers (12 male and 12 female) were video-recorded each presenting 16 simple English sentences (*BKB/A* sentences, Bench & Doyle 1979). Talkers were asked to speak in their natural speaking style, a little slower than usual, as if giving a lecture or telling a story. The video camera was adjusted to include the talker's head and shoulders in the frame. The 12 male talkers presented the same sentences as the 12 female talkers. All talkers were second generation Anglo-Australian, monolingual speakers of English. All wore standard blue

¹ The authors wish to thank the talkers and speechreaders who participated in this study, and to acknowledge the technical assistance of John Yelland.

sweatshirts, no *makeup*, and male talkers were clean shaven. Female talkers were aged between 26 and 52 (mean 38.1) years, and male talkers were aged from 23 to 57 (mean 37.7) years.

The 48 speechreaders (24 female and 24 male) were Australian-born monolingual speakers of English with normal hearing and eyesight (wearing corrective lenses where necessary). Speechreaders were aged between 18 and 50 years (females, mean 23.0 years; males, mean 26.0 years).

3.2 Procedure

The speechreaders viewed the talkers over two 45 minute sessions in a softly-lit, sound-treated room. The videotapes were shown without sound on a 55 cm screen at a distance of two metres from the speechreader. There was a pause after each sentence which allowed speechreaders to repeat what they had perceived. Speechreaders were encouraged to guess if unsure. Their responses were recorded manually by a person sitting beside them (ND). Fourteen semantic differential scale items were completed by speechreaders immediately after speech-reading each talker.

To avoid practice and fatigue effects, half the speechreaders saw female talkers in the first session, and male talkers in the second session, and the other half of the speechreaders saw the reverse order.

3.3 Scoring Speech-reading Accuracy

There were 318 key words (words carrying the main semantic content) in the sentences. Thus, for each speechreader a score out of 318 was calculated for the female talkers and another score out of 318 for the male talkers. Scores were calculated using the loose keyword method in which a word is scored correct if the root of the word is given correctly (Bench & Bamford 1979). Speech-reading scores for male and female talkers were used in all three studies reviewed in this paper.

3.4 Semantic Differential Items

Fourteen semantic differential items were used to investigate interpersonal attraction in Study 3. These were based on the Status and Solidarity factors used in language attitude research (see Bradac 1990, for a review). Items included to measure Status were *self-confident*, *successful*, *authoritative*, and *educated*; those included to measure Solidarity were *pleasant*, *attractive*, *friendly*, and *trustworthy*. A third factor called Performance was included based on comments made by experienced speechreaders when reporting why talkers on videotape were easy or difficult to speech-read (Daly, Lind, Doyle & Bench 1996). This factor included *natural*, *interested*, *expressive*, and *relaxed*. The final two items were statements not associated with the three factors: 'I would like to meet this person', and 'I would like to continue speech-reading this person'. The poles of each item were separated by a seven-point scale, and the positive and negative poles were alternated to the left and right to overcome position bias.

3.5 Measurement of Speech Variables

Measurements of dynamic and static speech variables used in Study 2 were made from the videotapes of the talkers speaking. The dynamic measurements were based on incidences of speech variables from the running videotape (visible tongue movement, lip rounding, teeth visibility, eyebrow movement, and speed of speech). Static measurements were made of the height, width and area of mouth apertures from still frames using a computer measurement program (NIH Image 1.52, Rasband 1995).²

² For details concerning these measurements, refer to Daly, Bench & Chappell 1996a.

4. Results and Discussion

4.1 Study 1

In Study 1, the speech-reading scores for female and male talkers were compared using analysis of variance. The mean speech-reading score for female talkers was 55.83 key words correct (kwc) and for male talkers it was 43.52 kwc. This difference was significant ($F_{1, 40} = p < .0001$), and indicated that the speechreaders could speech-read female talkers significantly more accurately than they could male talkers (Daly, Bench & Chappell 1996b).

Why did speechreaders find female talkers easier to speech-read than male talkers? A key to the answer to this question comes from a study of gender differences in interpersonal impressions from voices on audiotape (Lawrence, Stucky & Hopper 1990). They proposed two hypotheses to explain these gender differences: the 'stereotype hypothesis', whereby men and women are judged differently because of gender stereotypes (hereafter called the 'gender—stereotype hypothesis'); and the 'sex-dialect hypothesis' whereby men and women are judged differently due to gender-linked speech patterns (hereafter called the 'gender—dialect hypothesis'). These same theories appear relevant to the gender difference in visual intelligibility. More precisely, it is possible that the gender difference in visual intelligibility of talkers (shown in Study 1) was due to actual differences in the visual speech variables used by male and female talkers (gender dialect hypothesis) or stereotypic expectations concerning male and female communication (gender—stereotype hypothesis), or a combination of both.

A study of interpersonal impressions by Mulac, Incontro and James (1985) suggested that the gender dialect-effect and the gender-stereotype effect operated independently. Transcripts of six adult male and six adult female spontaneous descriptions of landscape photographs were rated by 264 university students and 239 older non-students using a standardised 12-item attitudinal scale using semantic differentials. Transcripts were presented with and without naturally occurring gender dialect (such as tag questions etc.) to examine the effect of the 'gender-dialect hypothesis', and with the gender of talkers correctly or incorrectly identified to examine the effect of the 'gender—stereotype hypothesis'.

Results from the 12 semantic differential items used in the Mulac *et al.* (1985) study showed that women and men were rated significantly differently (females scored higher on dimensions of aesthetic quality, and males higher on dynamism) when naturally occurring gender-dialect was left in the transcripts (gender dialect effect), and also when the gender of the talkers was correctly identified (stereotype effect). However, the results suggested that the gender- dialect effect was stronger than the stereotype effect. The authors suggested that this may be due to gender-dialect differences being apparent throughout the transcript, whereas when the gender of talkers was identified for the stereotype effect, this information was presented only once at the beginning of the passage.

In the present study, due to visual cues, the gender of the talker was apparent at all times, regardless of whether the talkers were using gender dialects. The question of whether male and female talkers were using gender dialects is difficult to assess without measurement. While male and female talkers presented the same sentences, it is possible that there was a gender difference in articulation or other movements of the face. It is also possible that both gender dialect and gender stereotypes were at play simultaneously.

4.2 Study 2

Study 2 investigated the gender—dialect hypothesis: did male and female talkers differ in their visual speech? For this study, measurements of eight speech variables were made from the videotapes of the talkers: eyebrow movement, lip rounding, mouth area, mouth height, mouth width, speed of speech, teeth visibility, and visible tongue movement. Female talkers

used more teeth visibility, more lip rounding, larger mouth height, larger mouth area, and slower speed of speech than male, all of which have been shown to improve visual intelligibility talkers (Daly, Bench & Chappell 1996a). Thus, these trends could contribute to the superior visual intelligibility of the female talkers in Study 1. These trends also provide some evidence of a visual gender dialect.

The eight speech variable measurements for male and female talkers were compared using unpaired t-tests. Results showed that the only significant difference in the speech variables used by male and female talkers was lip rounding ($p < .01$), which was used significantly more by female talkers than by male talkers. This finding could explain why female talkers were easier to speech-read than male talkers (Daly, Bench & Chappell 1996c). If this were the case, we would expect that lip rounding would explain a larger amount of variation in mean speech-reading scores for female talkers than for male talkers. However, when correlations between lip rounding and mean speech-reading scores were compared, lip rounding accounted for 22% of the variance in mean speech-reading scores for female talkers, and 24% of the variance in mean speech-reading scores for male talkers. Thus, although female talkers used significantly more lip rounding than male talkers, lip rounding did not contribute more to their visual intelligibility. So, while there is some suggestion of a gender dialect explanation for the gender difference in visual intelligibility, it is also worthwhile investigating the impact of gender stereotypes on speech-reading.

4.3 Study 3

Study 3 examined the effect of gender stereotype on speech-reading and was conducted with the mean speech-reading scores for talkers and the results of 14 semantic differential items used to measure interpersonal impressions. These were completed by each speechreader immediately after speech-reading, using a similar methodology to the research in language attitude literature (see Bradac 1990, for a review). It was hypothesised that the relationship between speech-reading and interpersonal impressions would be stronger for female talkers than for male talkers. This hypothesis was based on language—attitude and gender—stereotype literature. An underlying assumption of language-attitude research is that people distinguish between valued and non-valued linguistic forms when making interpersonal judgements from auditory recordings, and this assessment of value is affected by the communication context (Bradac 1990). In Study 3 it was hypothesised that in a speech-reading context, visual intelligibility would be valued, and a relationship between visual intelligibility and interpersonal impressions would be found. A large body of literature shows that in Western culture, women are expected to be clearer communicators than men (e.g. Kramarae 1982; Giles, Scholes & Young 1983). Thus, it was hypothesised that the visual intelligibility of female talkers would be more strongly correlated with interpersonal impressions than that of the male talkers.

Correlations between the speech-reading scores for the talkers and interpersonal impression scores on the three factors Status, Solidarity, and Performance were conducted. When the correlation coefficients were compared by talker gender, analysis of variance showed that correlations for female talkers were significantly higher than for male talkers ($F(1, 6) = 18.53, p = .0005$). Thus, the results of this third study showed that gender stereotypes are in evidence during the speech-reading process (Daly, Bench, & Chappell 1996d).

5. Final Discussion

In summary, the results of Studies 2 and 3 demonstrate the effect of both gender dialect and gender stereotype in speech-reading. It seems likely that both phenomena contributed to the gender difference in the visual intelligibility of talkers shown in the first study. Results of the study by Mulac *et al.* (1985), described above, indicate that the effect on interpersonal

impressions of gender stereotype is very similar to the effect of gender dialect. It was speculated that, given the similarity in strength and effect of gender dialect and stereotype, the two phenomena may well operate in a mutually reinforcing way. Language choices of talkers are likely to be affected by stereotypes and these stereotypes are probably reinforced by the use of gender dialects by others. This theory has particular relevance to the current paper which has shown both an expectation for female talkers to be more visually intelligible than male talkers, and also evidence of female talkers being more visually intelligible than male talkers. It is plausible that these two phenomena are interrelated. It is also likely that the effect of the intelligibility of female talkers' speech on the interpersonal impressions that others form represents a strong motivation for female talkers to use clear visual speech.

5.1 The Self Fulfilling Prophecy

Several studies have shown that expectation alone can affect behaviour (Snyder 1984). The relationship between stereotypes and actual behaviour (in this case, visual speech for talkers, and the speech-reading skill for speechreaders) has been called the *self-fulfilling prophecy*. This relationship has been more strictly defined as 'the notion that beliefs and expectations can and do create their own social reality' (Snyder 1984:247). According to this theory, because female talkers are expected to be more visually intelligible than male talkers, this expectation will eventually be fulfilled.

One study concerning the self fulfilling prophecy with particular relevance to gender expectations was conducted by Skrypnik & Snyder (1982). Their results showed that expectations concerning gender appropriate behaviour can result in behaviour which confirms these beliefs. Male—female pairs of previously unacquainted students were located in separate rooms so they could neither see, nor hear each other. Their task was to decide who would perform a number of tasks with different gender connotations (e.g. 'cleaning a gun' was associated with males and 'polishing silver' was associated with females). Results showed that gender stereotypes affected the choice of tasks made by the pairs.

In the context of the current study, it is possible that gender-stereotypic expectations of both speechreaders and talkers resulted in the higher visual intelligibility of female talkers demonstrated in the first study. The speechreader expectations for female talkers to be clearer talkers than male talkers (shown in Study 3) could not have affected the visual speech of the talkers in real time, because video-recordings of talkers were shown to speechreaders at a later date.

However, it is possible that expectations for female talkers to be clearer than male talkers may have resulted in female talkers becoming clearer talkers than male talkers in their everyday lives prior to video-recording. Talkers themselves would hold the same expectations concerning others' and their own speech. Therefore, it is plausible that the speech of talkers was developed by external stereotypic expectations, but at the time of recording was shaped by stereotypes held by the talkers concerning what is expected of someone of their gender.

There is evidence that people adhere to norms more in the presence of an audience (Eagly & Wood 1991). Although for this study the person making the video-recording (ND) was the only person present at the recording sessions, all talkers were aware that the tapes were to be speech-read by an audience. Thus, there was an anticipated audience present during video-recordings, which very probably had a similar effect on the speech of the talkers as having an actual audience present (Bell 1984). That speechreaders were able to perceive the visual speech of female talkers more accurately than that of male talkers may have been due to female talkers being able to anticipate the needs of their addressees more accurately than their male counterparts.

It is also possible that the stereotypic expectations of speechreaders result in female talkers appearing to be more visually intelligible than they are. That is, stereotypes may have been affecting the salience of the behaviours of male and female talkers to speechreaders. For example, although no gender difference was shown in visible tongue movement, it may have been perceived and used more readily in female talkers than in male talkers because female talkers were expected to be more visually intelligible than male talkers.

6. Conclusion

The studies presented here show evidence of gender differences in the visual intelligibility of Anglo-Australian talkers. Female talkers were found to be easier to speech-read than male talkers. It is possible that these gender differences in visual intelligibility are due in part to differences in the actual visual speech variables used (shown in Study 2), and in part to the expectation for female talkers to produce clear speech (shown in Study 3). It is proposed that there is a strong relationship between the expectation of clear speech by both talkers and speechreaders, and the use of clearer speech by female talkers. Although it is difficult to separate the effect of stereotype and gender-dialect in visual speech (as was done in transcripts by Mulac *et al.*, 1985), it is possible that the expectation for clear speech may inflate the perceived visual clarity of female talkers.

REFERENCES

- Bell, A. 1984. Language style and audience design. *Language in Society* **13**: 145-204.
- Bench, J. & J. Bamford. 1979. *Speech-hearing tests and the spoken language of hearing-impaired children*. London: Academic Press.
- Bench, J. & J. Doyle. 1979. *The BKB/A (Bamford-Kowal-Bench/Australian Version) sentence lists for hearing-impaired children*. Melbourne: Lincoln School of Health Sciences.
- Boothroyd, A. 1988. Linguistic factors in speechreading. *Volta Review* 90: 77- 87.
- Bradac, J. J. 1990. Language attitudes and impression formation. In W. P. Ryan & H. Giles (eds.), *Handbook of language and social psychology*, 387-412. New York: John Wiley and Sons.
- Daly, N., R. J. Bench & H. Chappell. 1996a. What constitutes visual intelligibility for spoken sentences. Unpublished manuscript, Melbourne: La Trobe University.
- Daly, N., R. J. Bench & H. Chappell. 1996b. Gender differences in speechreadability. *Journal of the Academy of Rehabilitative Audiology* 29: 27-40.
- Daly, N., R. I. Bench & H. Chappell. 1996c. Gender differences in visual speech variables. Unpublished manuscript. Melbourne: La Trobe University.
- Daly, N., R. J. Bench & H. Chappell. 1996d. Interpersonal impressions, gender stereotypes and visual speech. *Journal of Language and Social Psychology* 15: 468-478.
- Daly, N., C. Lind, J. Doyle & R. J. Bench. 1996. Speechreaders' perceptions of visual intelligibility. Unpublished manuscript. Melbourne: La Trobe University.
- Dodd, B. 1987. The acquisition of lip-reading skills by normally hearing children. In B. Dodd & R. Campbell, (eds) *Hearing by eye*, 163-175.
- Hillsdale, NJ: Lawrence Erlbaum. Eagly, A. Fl. & W. Wood. 1991. Explaining sex differences in social behaviour: A meta-analytic perspective. *Personality and Social Psychology Bulletin* 17: 306-3 15.
- Giles, H., J. Scholes & L. Young. 1983. Stereotypes of male and female speech: A British study. *Central states speech journal* 34: 255-256.
- Kramarae, C. 1982. Gender: How she speaks. In E. B. Ryan & H. Giles (eds.) *Attitudes towards language variation: Social and applied contexts*, 84-98. London: Edward Arnold.
- Lawrence, S. G., N. P. Stucky & R. Hopper. 1990. The effects of sex dialects and sex stereotypes on speech evaluations. *Journal of Language and Social Psychology* **9**: 209-224.
- Mulac, A., C. R. Incontro & M. R. James. 1985. Comparison of the gender-linked language effect and sex role stereotypes. *Journal of Personality and Social Psychology* **49**: 1098-1109.
- Rasband, W. 1995. *NIH Image: National Institute of Health* [Computer program].
- Skrypnek, B. J. & M. Snyder. 1982. On the self-perpetuating nature of stereotypes about women and men. *Journal of Experimental Social Psychology* **18**: 277-291.
- Snyder, M. 1984. When belief creates reality. *Advances in Experimental Social Psychology* **18**: 247-305.