EFFECTS OF SPEECH RATE ON PERSONALITY PERCEPTION

BRUCE L. SMITH, BRUCE L. BROWN, WILLIAM J. STRONG
and ALVIN C. RENCHER
Brigham Young University

Using the voices of six subjects, representing various social and educational backgrounds, fifty-four synthetic voices were generated by computer. Each normal voice was both increased and decreased in rate by 12½, 25, 37½, and 50 per cent. Judges evaluated the fifty-four voices using a series of adjectives representing two major personality factors of " competence " and " benevolence ".

Several statistical analyses were performed, and it was found that the competence factor was much more sensitive to rate manipulations than was the benevolence factor. Ratings of competence were found to increase as rate increases and decrease as rate decreases, in a linear fashion. Benevolence had an inverted U-relationship with speech rate; the highest benevolence ratings occurred with normal speech rate.

The observation that vocal properties of speech seem to convey a certain amount of information concerning emotions and personality has prompted much research directed at determining which particular vocal qualities carry such information and to what extent. Allport and Cantril (1934) conducted numerous experiments to determine correlations between various voice and personality measures. Moses (1942) studied personality from recordings of the voice. Fay and Middleton (1940, 1941) had judges attempt to identify such characteristics as sociability and intelligence from the voice. More recently Hunt and Lin (1971) have obtained experimental results indicating that voice qualities do transmit measurable personality information, independent of any effects of the verbal content of speech.

In comparison to all the other non-verbal qualities of speech that have been studied, speech rate has received relatively little attention. Goldman-Eisler (1956, 1961) has studied how rate of speech correlates with pauses. Black (1961) studied decibel output of speech as it relates to rate. Boomer and Dittman (1964), Henze (1953), and Kanfer (1959) have studied speech rates resulting from moods and emotional arousal.

Studies of the effects of vocal qualities on perception of personality and emotions, then, have primarily been concerned either with identifying whether a given trait can be judged from vocal cues or with obtaining correlations among various vocal characteristics, personality traits and emotional states. Recently there have been some attempts to identify experimentally how various manipulations in vocal qualities will affect personality judgments of voices.

Kjeldergaard (1968) had each of his subjects consciously manipulate his own voice to represent various vocal states, in order to study judged personality types. Brown,

Strong and Rencher (1972) used mechanically altered voices to study separate effects of intonation and rate and in a later study (1973) evaluated the interactive effects of rate, pitch and intonation. Both of their investigations revealed rate to be a better predictor of personality ratings than either of the other two. They found that increasing the rate of a given speaker causes judges to rate him as being less "benevolent", while decreasing the speaker's rate results in a less "competent" rating.

The Brown *et al.* (1973) study used only two voices, each synthesized in twenty-seven combinations of rate, pitch and intonation. Both of the voices used, however, received highly positive ratings on the two personality dimensions. The findings that increased rate decreases benevolence ratings and decreased rate decreases competence ratings may not be true of all voices. It may be, for example, that voices not rated so positively could be increased in competence ratings by an increase in speaking rate. One purpose of this study, therefore, was to increase the generality of the earlier findings concerning rate. This was accomplished by synthesizing and manipulating a variety of voices (in terms of the competence—benevolence ratings they receive) and comparing there results with the results of the earlier studies in which only high competence and high benevolence voices were used.

The two Brown *et al.* studies did not use numerous levels of speech rate, and the information obtained from these studies, therefore, revealed but general observations concerning speech rate. Hence, another factor which precipitated this particular study was a desire to introduce an added number of rate variations, in order to establish more precisely the effects of various individual levels of rate as they relate to personality judgment.

Method

The voices of twenty-eight male subjects, representing various social and educational backgrounds, were recorded as each subject read through a list of four test sentences. The list consisted of two statements, one question and one exclamation. The tape, which included the two voices used in the 1973 Brown *et al.* study, was played for a group of four judges. The judges rated each of the twenty-eight voices on a scale of fifteen paired-opposite adjectives. These adjectives were the same ones used by Brown *et al.* (1973) for their personality measurements. The ratings were factor analysed by the principal factors method with a varimax rotation (Harman, 1967). Fig. 1 shows the factor pattern, i.e., the relationship of the two factors ("competence" and "benevolence") with the fifteen adjectives. Fig. 2 is a plotting of each of the twenty-eight speakers in terms of their factor scores on competence and benevolence, derived from their ratings on the fifteen adjectives.

The results of the voice selection process were used as the basis for selecting six speakers representative of the four quadrants shown in Fig. 2. Those dots circled

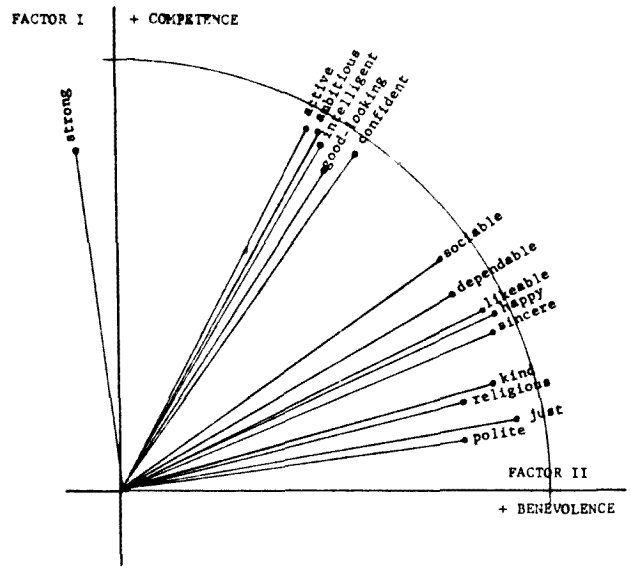

Fig. 1. Factor pattern for the adjective ratings of voices with rate manipulated.

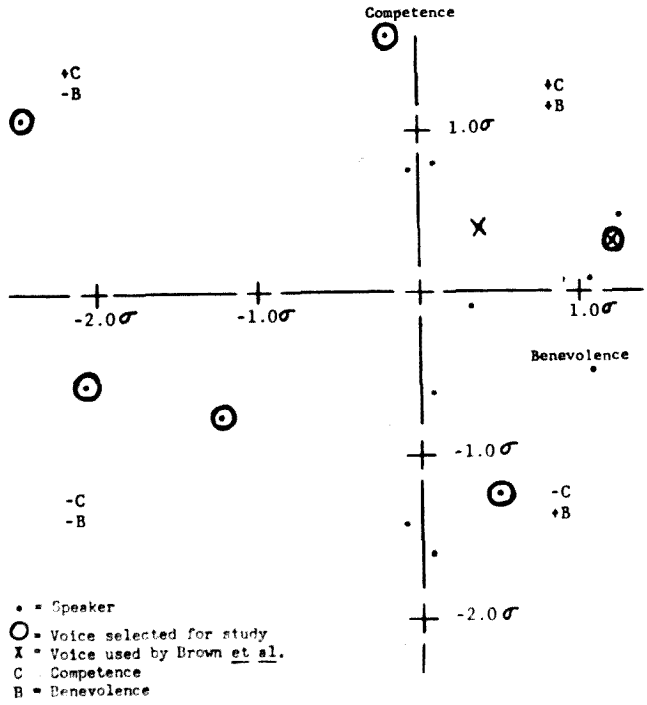

Fig. 2. Factor scores of adjective ratings for the 28 speakers of the voice selection process.

in Fig. 2 indicate the speakers chosen for the present study. One of the six speakers was one of those used by Brown *et al.* (1973); this was done to compare the ratings assigned to that particular voice in the Brown *et al.* study with the ratings of that same voice in this study.

From the four sentences used in the voice selection process, the two statements were arbitrarily selected for each speaker to use in this part of the study. From the six speakers, each repeating the two sentences, fifty-four synthetic voices were generated using a homomorphic speech analysis-synthesis system similar to one described by Oppenheim (1969). The system was run on a Digital Equipment Corporation (DEC) PDP-15 computer. The normal rate of speech was both increased and decreased by percentages of $12\frac{1}{2}$, 25, $37\frac{1}{2}$, and 50 for each of the six speakers.

The fifty-four synthetic voices resulting from this process were recorded in random order, with the constraint that two manipulated voices from the same speaker had to be separated by at least four other voices of different speakers. This was done in order to minimize the possibility of the judges recognizing the repetition of the various speakers. Two practice voices were placed at the beginning of the tape to allow ratings to stabilize somewhat before presenting the fifty-four voices of interest. (It was found in the Brown *et al.* 1972 study that ratings of this kind stabilize fairly well after one practice voice and very well after two.)

The tape was played for a group of twenty-eight judges that had been recruited on a voluntary basis from two introductory psychology classes at Brigham Young University. The fifteen paired-opposite adjectives were again used for rating purposes.

Results and discussion

The ratings of each of the fifty-four voices, averaged over the twenty-eight judges, were factor analysed. In order to present the results more clearly, the ratings given to the fifty-four synthetic voices are presented in a series of two figures. Figs. 3 and 4 are factor plottings comparing the normal synthesized voice with the eight manipulations for each speaker.

From merely observing the factor plottings, an obvious trend resulting from the rate manipulations can be detected. In general, it appears that increasing the speaking rate caused ratings to move in a + competent, − benevolent direction, benevolence being appreciably more affected. On the other hand, decreased rate of speech appears to result in a move toward the − competent, − benevolent quadrant.

A multivariate analysis of variance (Cooley and Lohnes, 1971) was computed to test the rate manipulations for significance. The resultant Wilk's Lamda value was 0.03481, accounting for 97 per cent of the variance (biased estimate). Since the required Lamda value at the 0.01 level (for eight degrees of freedom for the treatment term and forty degrees of freedom for the error term) is 0.4695, rate seems to be an extremely significant variable. This, however, seemed quite obvious from even a cursory glance at the factor plottings of the factor analysis.

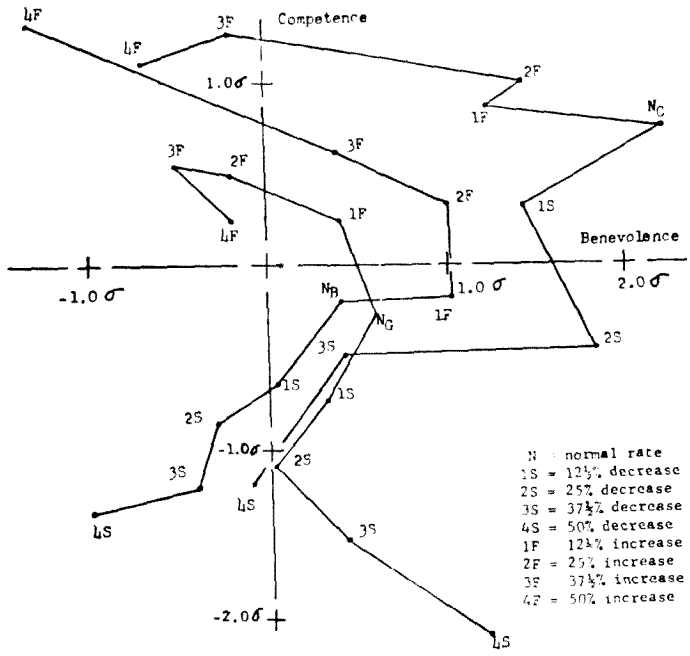

Fig. 3. Factor scores of adjective ratings for speakers A, D and E at 9 rate levels.

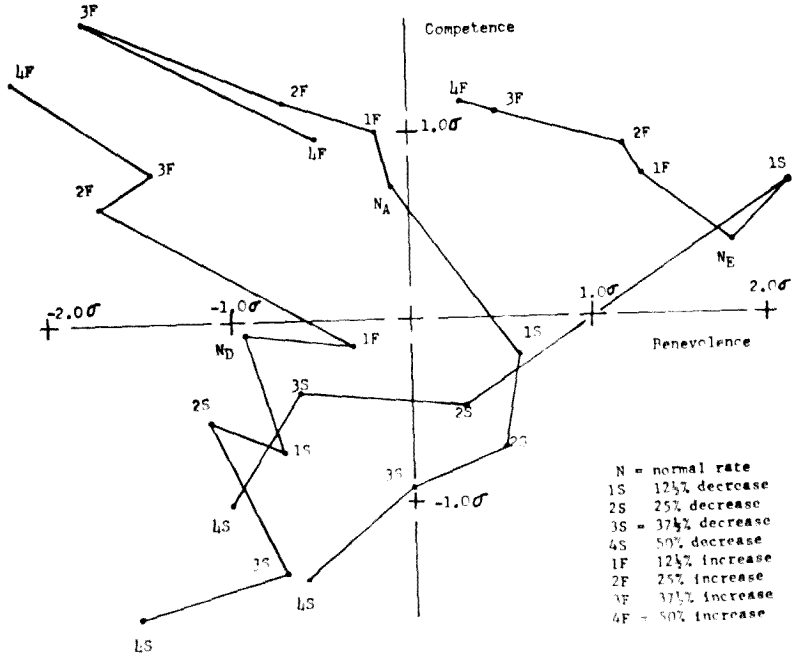

Fig. 4. Factor scores of adjective ratings for speakers B, C and G at 9 rate levels.

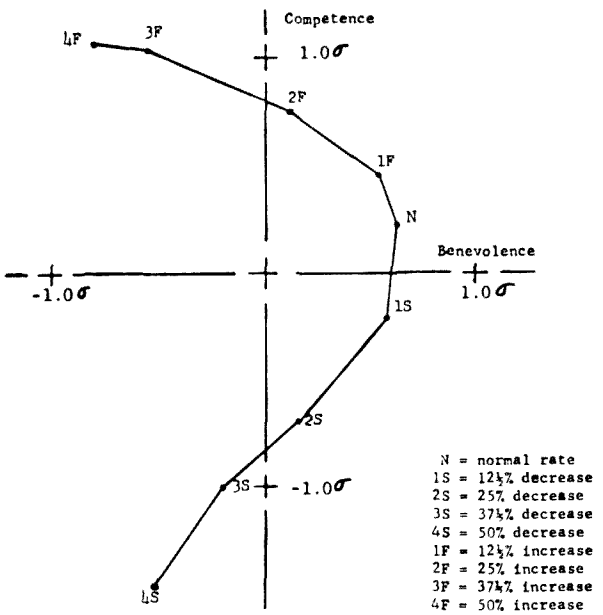

Fig. 5. Grand centroids of factor scores for each of 9 rate levels.

To more accurately determine the specific effects of the various rate alterations, means were computed for each of the nine manipulations, averaging over all six of the speakers. Fig. 5 shows the centroids for each of the rates. It appears that these results are quite consistent with the Brown *et al.* (1972, 1973) studies, but they do offer some additional information not detected by those studies.

Brown and his associates concluded that a decrease in the rate of speech causes subjects to sound less competent. The present findings substantiate that particular claim, but also indicate a considerable reduction in benevolence ratings when rate is decreased. Also consistent with the Brown *et al.* studies is the finding that an increase in speaking rate was associated with a decrease in benevolence.

However, one finding of the present study contradicts a claim made in the 1972 Brown *et al.* paper, Study III, i.e., that "since slowing the voice makes it sound less competent, one might expect speeding it to make it sound more competent, but it seems from these results that such is not the case." It can be seen from Fig. 5, however, that competence was *substantially* increased by increasing the rate of speaking.

Fig. 6 is beneficial in recognizing the various effects of speech rate on the two factors; both competence and benevolence (averaged over all six speakers) are plotted separately against the average number of phonemes per second for all six speakers. The benevolence/rate plot reveals an inverted-U relationship, with the mean for normal voices (N) being rated most benevolent; this indicates that a speaker cannot be made to sound more benevolent by altering his rate of speech. Any rate manipulation only causes him to sound less benevolent than normal. The competence/rate plotting

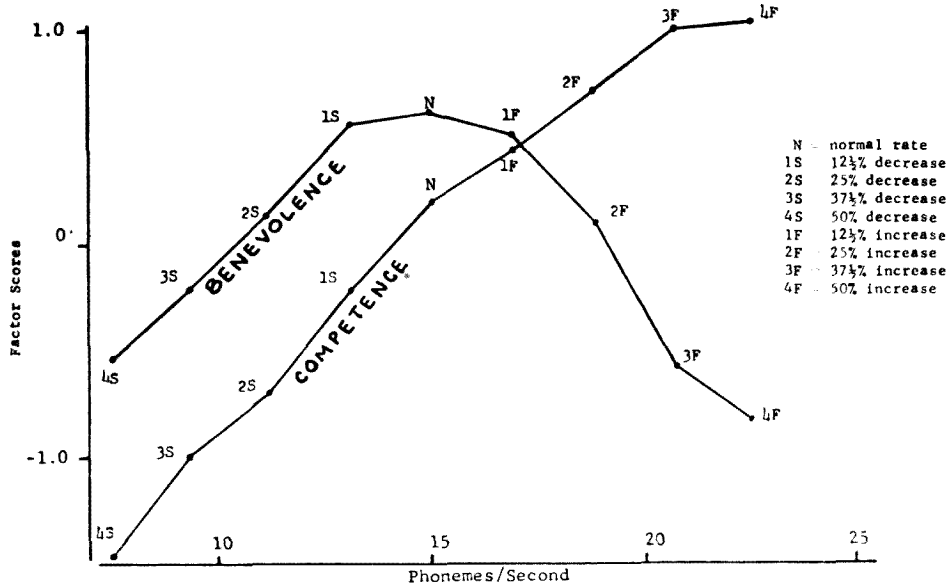

Fig. 6. Grand centroids of factor scores for competence and benevolence at 9 rate levels.

reveals a nearly linear relationship, indicating that a normal voice can be made to sound either more competent or less competent by either increasing or decreasing (respectively) the rate of speech. The conflict with the earlier statement from the Brown *et al.* (1972) paper is very clearly portrayed in this figure.

In order to compare the effects of various percentages of rate manipulation upon each of the personality rating factors, a multiple comparison of each of the nine rates with one another was made using a Newman-Keuls Sequential Range Test (Winer, 1962). The results of these comparisons indicate that both increasing and decreasing the rate of speech by 25 per cent or more had significant effects on competence at the 0.01 level. A rate decrease of $12\frac{1}{2}$ per cent had significant effects on the same factor at the 0.05 level, whereas the same percentage of rate increase produced no significant effect on competence.

The benevolence factor was found to be affected less by the rate manipulations; a rate increase of 50 per cent was significant at the 0.05 level, but all other manipulations were statistically insignificant in their effects. (This is somewhat related to Hart's (1971) findings, which suggest that competence judgments of a speaker are based on vocal qualities as well as verbal content, whereas benevolence judgments are based primarily on verbal content with vocal qualities having much less effect.)

Thus, the earlier observation that judged competence increases or decreases with appropriate rate manipulations was shown to be valid from a statistical point of view. Although the rate of speaking appears to affect judged benevolence, the effects were not statistically significant (except for a 50 per cent increase) for the sample size of this study.

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