Perceptual and Motor Skills, 1970, 30, 295-299. © Perceptual and Motor Skills 1970

PHONETIC SYMBOLISM IN FOUR VOICELESS FRICATIVES[1]

LAWRENCE D. SHRIBERG[2]

University of Kansas Medical Center

Summary.—48 *S*s rated four voiceless fricatives, *f*, *s*, *sh*, and *th* on 12 bipolar scales of a semantic differential. Analysis of variance revealed significant main effects and significant interaction effects for Sound × Dimension ($p <$ .001) and Sound × Scale ($p <$ .001). The greater sensitivity of the presumed kinesthetic scales for some sounds suggests that both the scale and the articulatory characteristics of a sound may determine whether ratings reflect primarily denotative or connotative semantic systems.

Despite the fact that analysis of phonetic symbolism should occur at the "phonemic level" (Heise, 1966), the stimuli for analytic studies have invariably been real or nonsense words, consonant-vowel combinations or CVC trigrams. Taylor and Taylor (1965) have commented on the questionable assumption that the symbolic properties of component phonemes are additive in such stimuli. Research in acoustic phonetics (formant transitions: Peterson & Barney, 1952; duration, fundamental frequency, and intensity: House & Fairbanks, 1953) and notably, recent physiological phonetics studies of coarticulation (Oehman, 1966; Daniloff & Moll, 1968) provide a questionable empirical basis for maintaining this assumption. Although some related studies have used isolated visual or acoustic stimuli (alphabet letters: Knapp & Erlinger, 1968; sonar signals: Solomon, 1959), the use of isolated speech sounds as stimuli for analytic ratings has seemingly gone untried in phonetic symbolism research.

The purpose of the present study was to investigate meanings associated with four phonemes classified as voiceless fricatives: *f*, *s*, *sh*, and *th*. These sounds are similar in manner of articulation but differ as to the place where frication is effected.

METHOD

Forty-eight *S*s, 43 female and 5 male, whose median age was 21 yr., acted as respondents to a semantic differential. All *S*s were physical and occupational therapy students attending a course on communication disorders at the University of Kansas Medical Center.

Twelve bipolar adjective scales which have demonstrated factor loadings on Evaluative, Activity, and Potency dimensions in a cross-linguistic semantic differential study of speech sounds (Miron, 1961) were employed. As in Miron's

[1]This work was supported in part by an American Speech and Hearing Foundation Traineeship, funded by a grant from the Public Health Service, U. S. Department of Health, Education, and Welfare.

[2]The writer would like to thank Frank Bernhart, Computor Services, and Robert Mosteller, Biometry, University of Kansas Medical Center, for their assistance in programming and data analysis.

study and other studies which have used a semantic differential as the dependent variable, some of the 12 adjective scales could be responded to in terms of physiological and/or acoustic phonetic properties of speech sounds.

The 12 scales were randomized as to dimension and left-right marginal positioning and arranged on 7-point scales as suggested by Osgood, Suci, and Tannenbaum (1957, p. 83) on score sheets. At the top of a sheet, one of the four voiceless fricatives was printed in lower case letters. The directions required that *S* "say the *speech sound* made by the letter(s)" to himself before each rating. These procedures would assumedly heighten the sensory-motor components of sound production, whereas an alternative method, oral examiner presentation of each sound, would primarily invoke a rater's auditory perception of a sound.

Eight of the possible 24 orderings of the four sounds were selected to test for order effects in ratings. Booklets were distributed such that the eight experimental orders were distributed equally throughout the room. After all *Ss* had read the instructions, the investigator verbally emphasized that *S* should say each sound quietly to himself before each rating. All *Ss* completed the 48 ratings in 15 min.

Results

Table 1 presents a summary of the analysis of variance. Since both the main effect for Order and a three-way interaction, Sound × Scale × Order, reached statistical significance, the order in which *Ss* rated sounds did make some

TABLE 1

Analysis of Variance: Semantic Differential Ratings for Four Voiceless Fricatives

Source	*df*	*MS*	*F*	*p*
Sounds (A)	3	22.50	5.39	<.01
Dimensions (B)	2	17.65	4.36	<.05
Scales (C)	9	10.82	6.07	<.001
Order (D)	7	10.85	3.20	<.01
A × B	6	31.18	7.79	<.001
A × C	27	9.91	6.60	<.001
A × D	21	5.57	1.34	ns
B × D	14	6.03	1.49	ns
C × D	63	2.38	1.34	ns
A × B × D	42	3.88	1.07	ns
A × C × D	189	1.85	1.23	<.05
Error Terms				
A, A × D	120	4.17		
B, B × D	80	4.05		
C, C × D	360	1.78		
D	40	3.38		
A × B, A × B × D	240	3.60		
A × C, A × C × D	1080	1.50		

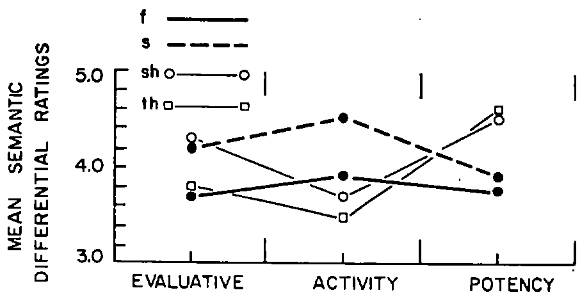

FIG. 1. Mean ratings for *f*, *s*, *sh*, and *th* on the Evaluative, Activity, and Potency dimensions of a semantic differential

difference. In particular, the order of rating the four sounds affected the Sound × Scale interaction term. However, it is the Sound × Scale term summed over all orders, rather than the effects of any one order, which is presently of primary interest, and this effect was significant at the .001 level. The other term of interest, Sound × Dimension, was also significant.

Fig. 1 presents the Sound × Dimension data as the mean ratings for each sound on the three semantic differential dimensions; Fig. 2 shows the Sound × Scale data as the mean sound ratings for the composite adjective scales. It is

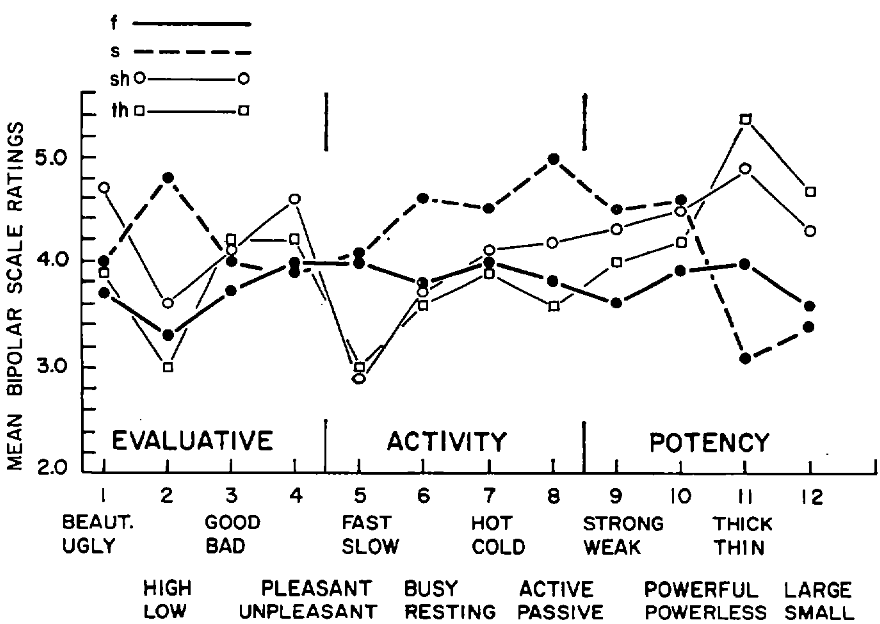

FIG. 2. Mean ratings for *f*, *s*, *sh*, and *th* on the 12 bipolar adjective scales comprising the Evaluative, Activity, and Potency dimensions of a semantic differential

apparent that the differences in the range of mean sound ratings between and within scales (Fig. 2) are wide. For some orientation as to which sound means differ significantly within any of the 12 scales, a q statistic, using the Tukey (a) procedure (Winer, 1962, p. 87) was calculated for those scales having the largest and smallest range of means for the four sounds. For thin-thick and bad-good, interval differences between any two sound means of .87 and .53 respectively, are significant at the .05 level.

Discussion

Although the mean differences between sounds on both dimensions and scales are of modest absolute value, it is the pattern of differences across scales which warrants close inspection. Osgood (1962) makes the following statement about the use of a semantic differential:

> I think the semantic differential is subject to what might be called *denotative contamination.* Most adjectival scale terms have variable denotative meanings as well as their affective connotation. Particular concepts exert a selective limitation upon scale meanings, drawing forth a denotative usage of some and the connotation of others (p. 27).

In the present context, the sound patterns across scales suggest that 'denotative' use of some scales may be mediated by the kinesthetic and tactile feedback from tongue postures required for articulation of a sound. These denotative scales appear to be the most discriminant of subject ratings. Consider the tongue posture needed for articulation of the *s* sound versus that needed for the *th* sound, in relation to how these sounds are rated on the low-high versus the thin-thick and small-large scales. Note how these trends compare with presumedly non-kinesthetic or connotative scales within the Evaluative and Potency dimensions. Note also the relatively flat configuration across scales for the *f* sound, the only sound which does not require articulation of the tongue.

An alternate interpretation would consider the acoustic characteristics of these four sounds as mediating denotative ratings, assuming that *S*s were monitoring some auditory feedback from rehearsal of a sound. Heinz and Stevens (1961), using listener perception of synthesized speech, have found the acoustic spectra of the four fricatives here to rank from highest to lowest, *th*, *f*, *s*, and *sh*. Inspection of Fig. 2 suggests no correspondence between any ratings and these acoustic data. The rank order of intensity for these sounds (Strevins, 1960) is, from highest to lowest, *sh*, *s*, *f*, *th*; correspondence with these data is also not apparent.

The present study indicates that both denotative and connotative symbolism can be demonstrated in speech sounds using isolated phonemes as stimuli. Methodologically, these data also suggest that derivation of a semantic differential from a composite of scales exercising both phonetic (denotative) and non-phonetic (connotative) meanings requires data analysis of scales as well as dimensions. Compare, for example, how scores on the low-high scale (Fig. 2), considered a denotative scale in the present study, affect the means for *s* and *sh* on the composite Evaluative dimension (Fig. 1). The 1.2-point difference between these sounds on this denotative scale obscures the higher ratings given *sh* on ugly-beautiful and unpleasant-pleasant, two scales which would appear to tap connotative symbolism within the Evaluative dimension.

REFERENCES

DANILOFF, R., & MOLL, K. Coarticulation of lip rounding. *Journal of Speech and Hearing Research*, 1968, 11, 707-721.

HEINZ, J. M., & STEVENS, K. N. On the properties of voiceless fricative consonants. *Journal of the Acoustic Society of America*, 1961, 33, 589-596.

HEISE, D. R. Sound-meaning correlations among 1,000 English words. *Language and Speech*, 1966, 9, 14-27.

HOUSE, A. A., & FAIRBANKS, G. The influence of consonant environment upon the secondary acoustical characteristics of vowels. *Journal of the Acoustic Society of America*, 1953, 25, 105-113.

KNAPP, R. H., & ERLINGER, H. J. Study of semantic associations to the alphabet. *Perceptual and Motor Skills*, 1968, 26, 939-942.

MIRON, M. S. A cross-linguistic investigation of phonetic symbolism. *Journal of Abnormal and Social Psychology*, 1961, 62, 623-630.

OEHMAN, S. E. G. Coarticulation in VCV utterances: spectrographic measurements. *Journal of the Acoustic Society of America*, 1966, 39, 151-168.

OSGOOD, C. E. Studies on the generality of affective meaning systems. *American Psychologist*, 1962, 17, 10-28.

OSGOOD, C. E., SUCI, G. J., & TANNENBAUM, P. H. *The measurement of meaning.* Urbana: Univer. of Illinois Press, 1957.

PETERSON, G. E., & BARNEY, H. L. Control methods used in a study of the vowels. *Journal of the Acoustic Society of America*, 1952, 24, 175-184.

SOLOMON, L. N. Search for physical correlates to psychological dimensions of sounds. *Journal of the Acoustic Society of America*, 1959, 31, 492-497.

STREVINS, P. Spectra of fricative noise in human speech. *Language and Speech*, 1960, 3, 32-49.

TAYLOR, I. K., & TAYLOR, M. M. Another look at phonetic symbolism. *Psychological Bulletin*, 1965, 64, 413-427.

WINER, B. J. *Statistical principles in experimental design.* New York: McGraw-Hill, 1962.

Accepted December 29, 1969.