SUBJECT SPEECH RATES AS A FUNCTION OF INTERVIEWER BEHAVIOUR*

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Distinctions have been made between two speech rate measures. Previously these measures have been studied only in naturalistic settings. Also, methodological problems in prior studies generated questionable conclusions. The present study replicated and extended earlier studies. Subjects were interviewed in a Standardized Interview and a Non-Standardized Interview. For both interview situations the following areas were examined for the two speech rate measures: (a) frequency distributions, (b) relative variability, (c) interrelations of the two rate measures, (d) relations of subject's rates to experimenter's rates, (e) relations of the two rates to the lengths of speech units. Interviewer speech rates in the two interview situations were found to influence the subject's speech rates. Marked differences in the variability of the two rate measures were shown. And each rate measure was related to the syllable length of its relevant speech unit. Some implications of the present results for further research are discussed.

Two distinct measures of speech rate are possible, but clear distinctions between these two measures have been made only recently (Martin, 1955; Goldman-Eisler, 1956). Goldman-Eisler pointed out that speech productions are rarely continuous vocal activity, but rather are a series of discrete utterances of short duration, separated by hesitation pauses. One measure of speech rate, *Phonation Rate* or *Rate I,* is the number of syllables (or words) of such an *utterance* divided by the phonation time used to speak that utterance. This is a measure of the absolute rate of speech.

The second measure of speech rate is *Verbal Rate* or *Rate II,* and is the number of syllables (or words) per unit time for the period of speech following the other person's preceding utterance and the end of the last syllable before the other person's subsequent utterance. Thus, Verbal Rate includes both phonation time and pause times, and is based on a different unit of behaviour from Phonation Rate. The speech unit associated with Verbal Rate is labelled an *action,* a unit of behaviour which may be composed of many utterances. These distinctions between the rates and units of speech behaviour are summarized in Table 1.

BACKGROUND

Martin (1955) investigated the interrelations of these two rate measures during one counselling session. He found mean Verbal Rate and mean Phonation Rate to be

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TABLE 1

Rates and Units of Speech Behaviour

utterance	=	number of syllables in an unbroken speech act.
action	=	sum of syllables in the utterances of the action.
t	=	time used in producing an utterance.
P.T.	=	pause times which separate and thus define utterances.
Phonation Rate (Rate I)	=	number of syllables in an utterance / t
Verbal Rate (Rate II)	=	Σ number of syllables in utterances / Σ t + Σ P.T.

significantly different for subjects but not for the experimenter. Further, the experimenter's speech actions having identical Verbal Rate scores showed differences in mean phonation time, total pause time, and proportion of pauses to phonation time. Martin concluded that Verbal Rate and Phonation Rate measured independent speech functions, but that the relation of Verbal Rate to Phonation Rate differed across individuals.

In a naturalistic observation study of speech in diagnostic interviews, Goldman-Eisler (1954a) tested six temporal aspects of conversation, including Rate II, but not Rate I, and found mean Rate II was the most consistent within any one dyad. Further, mean Rate II was the most sensitive aspect when the conversational partner was varied. Her data suggested, though she did not refer to it, that increases in the mean or variance of the experimenter's Rate II were associated with increases in the variance of the subject's Rate II.

In a later study, Goldman-Eisler (1954b) studied Rate II in relation to syllable length of actions. Rate II discriminated significantly between individuals over the entire range of lengths of actions. That is, subjects who were fast talkers in short actions remained so in long actions, and *vice versa*.

Goldman-Eisler (1954b) again demonstrated that although Rate II characterized individuals, it varied with the subject's conversational partner. Within a given conversation, however, subjects tended to maintain a constant Rate II. She concluded that a general level of stimulation was aroused during a given conversation. Even so, high Verbal Rates by one subject either preceded or followed high Verbal Rates by the other subject. Rate II also increased when one subject interjected a remark into a "breathing or thinking" pause of the other subject. The increased rate due to interruption was short-lived, however, and quickly returned to its former level.

In a later investigation, Goldman-Eisler (1956) studied the interrelations of Rates I and II. Subjects' mean Rate II was significantly slower than Rate 1, indicating pause times to be significant in determining Rate II. A close inverse relation was found (rho $= -0.94$, $p < 0.01$) between pause duration and mean Rate II. Rates I and II were independent of each other (rho $= -0.17$), as were Rate I and pause times (rho $= 0.41$).

TABLE 2

Basic Standardization Rules of Standardized Interview (Matarazzo, 1962)

Experimenter introduces the standardized portion of the interview by a five second utterance (following his signal to the observer).

All interviewing must be " non-directive ". No direct questioning, no probing, and no depth interviewing. Experimenter can reflect, ask for clarification, ask for more information, or introduce a new, general topic area. In general, experimenter's comments should be non-challenging and open-ended, and related to subject's past comments or to some new, general topic.

All experimenter's actions must be verbal only, or verbal and gestural at the same time, i.e., experimenter cannot use head nods and other gestures alone.

All experimenter's utterances must be five seconds in duration.

After subject finishes a comment or other verbal action, experimenter must respond in less than one second.

From this study, Goldman-Eisler concluded that Rate I was " remarkably invariant " both within and across subjects, and that Rate I contributed little to Rate II. She compared variation coefficients of Rates I and II, but the standard deviations used in her t tests were improper, thus confounding her findings.

An additional reason why Goldman-Eisler found Rate I to be invariant lies in her method of obtaining phonation time scores. Subject's pause times were subtracted from the action time. But actions are composed of many utterances spoken at varying rates. Thus, Goldman-Eisler compared mean Rate I scores with raw scores for Rate II and pause times. Since the variance of means in a distribution is much less than the variance of raw scores in that distribution (Lacey, 1953), more investigation was needed to determine if Rate I was invariant.

Goldman-Eisler's and Martin's studies of speech rates were naturalistic observations with no systematic experimental manipulations involved. It was felt that their findings should be experimentally replicated and extended to clarify the interrelations of Rates I and II.

Chapple (1939, 1940) developed, and Matarazzo and others (summarized in Matarazzo, 1962) refined an experimental approach to non-content speech interactions *via* the Standardized Interview (Table 2).

Specific aspects of the experimenter's behaviour are systematically varied, while other aspects of his behaviour are held constant. Saslow and Matarazzo (1959) have demonstrated significant reliabilities for the interviewer and interviewee, and have shown the subject's interactions with the same experimenter to be significantly stable over long periods. Dinoff, Morris and Hannon (1963) partially replicated Saslow and Matarazzo's reliability study with similar findings. Although many non-content speech variables have been investigated in the Standardized Interview (Matarazzo, 1962), speech rates have not been.

PROBLEM

The present study replicated and extended Goldman-Eisler's (1954a, 1954b, 1956) studies in an experimental rather than a naturalistic observation setting. Procedure differed in that the experimenter's behaviour in half of the interview was controlled *via* the Standardized Interview. In the non-standardized portion of the interview, the experimenter attempted not to standardize his behaviour.

Goldman-Eisler (1954b) put forward three factors as influencing subjects' speech rates: (a) mental processes, i.e., the subject's need for contemplating, integrating and phrasing; (b) perceived allotment of speaking time; and (c) the form and content of the experimenter's speech behaviour. By using the Standardized Interview, more emphasis was placed on the third factor. Since in the Standardized Interview the experimenter spoke only in utterances of five seconds duration, was not allowed to interrupt, and yielded immediately if interrupted, the subject had no time limits for speaking. Likewise, since the experimenter was not allowed to directly question, probe, or " depth interview ", the subject was under less pressure to conceptualize or introspect than in a " typical psychiatric interview " used by Goldman-Eisler (1954b; 1956).

PROCEDURE

Six subjects (4 male and 2 female), between the ages of 18 and 21, with no known history of emotional disturbance, and having an I.Q. of at least 110 were interviewed for fifteen minutes each. Interviews were conducted individually in a sound-damped room overlooked by a one-way vision mirror behind which the observer sat. The onset, half-way point, and end were signalled to the observer by the experimenter through a pre-designated, unobtrusive hand signal. All interviews were tape recorded.

Subjects were divided into two groups, both of which received the two interview conditions, but in a different order. During the standardized part of the interview, the experimenter regulated his behaviour according to the basic standardization rules of Matarazzo (Table 2).

Subjects were told that the experimenter was interested in student attitudes toward the world situation. This topic was vague enough so that all subjects talked with ease for the fifteen minutes required. Tape recordings were transcribed verbatim, including repetitions, false starts, etc., and such vague sounds as " ah " and " eh ". These latter

TABLE 3

Homogeneity of Variance of Subjects' Rates*

	Rate	C-value	*df***	*p*
Standardized Interview	I	0.251	6, 200	< 0.01
	II	0.244	6, 19	n.s.
Non-Standardized Interview	I	0.259	6, 200	< 0.01
	II	0.342	6, 25	< 0.05

*Cochran's test for homogeneity of variance was used (Winer, 1962).
**The first number *df* listed is the number of variances being compared. The second number *df* is the largest N-1 of the variances being compared.

sounds, though not constituting words, were counted as syllables. Rate was measured as syllables per minute.

Scoring of speech and pause times was done with a stop-watch. Tape recordings were played at half-speed for more precise timing. Measurements were made to 0.1 sec. and were taken until at least two consecutive timings agreed. The average error of measurement was found to be less than 0.03 sec.

RESULTS

Shape of frequency distributions of Rates I and II

χ^2 analyses indicated that in neither the standardized (SI) nor non-standardized (NSI) conditions were subjects' distributions of Rates I and II skewed. This contradicted the results of Goldman-Eisler (1954b) which showed Rate II to be positively skewed for all subjects.

Individual differences in subjects' variances were marked for both rate measures, often prohibiting pooling of data. Cochran's test for homogeneity of variance (Winer, 1962) indicated that the variances across subjects were significantly different in the NSI condition for both rate measures.

For Rate II, however, homogeneity of variance was found in the SI condition. Thus although individuals have characteristic Rate II scores, individual differences were less pronounced when the experimenter's behaviour was standardized.

TABLE 4

Subjects' Means, Standard Deviations, Frequency and Variation Coefficients of Verbal Rates and Phonation Rates in Standardized and Non-standardized Interviews

PHONATION RATES (Rate I)

	Standardized				*Non-standardized*			
S	$\bar{X}$	s.d.	N	V.C.	$\bar{X}$	s.d.	N	V.C.
1	328	99	244	30.18	319	102	156	31.98
2	316	79	138	25.00	339	84	95	24.78
3	288	79	120	27.43	295	88	219	29.83
4	274	82	143	29.93	270	74	91	27.41
5	284	60	111	21.13	276	64	117	23.19
6	330	80	196	24.24	326	74	161	22.70
			$\bar{X}_{V.C.}$	= 26.32			$\bar{X}_{V.C.}$	= 26.65
			s.d.	= 3.22			s.d.	= 3.42

VERBAL RATES (Rate II)

	Standardized				*Non-standardized*			
S	$\bar{X}$	s.d.	N	V.C.	$\bar{X}$	s.d.	N	V.C.
1	271	59	19	21.77	204	43	7	21.08
2	266	49	13	18.42	324	40	11	12.35
3	246	42	11	17.07	241	41	26	17.01
4	211	68	20	32.23	212	66	12	31.13
5	261	36	18	13.69	232	32	14	13.79
6	291	74	17	25.43	271	46	12	16.97
			$\bar{X}_{V.C.}$	= 21.44			$\bar{X}_{V.C.}$	= 18.72
			s.d.	= 6.63			s.d.	= 6.79

Variability of Rate I versus Rate II

To compare relative variability of Rates I and II, variation coefficients were computed for each subject (Guilford, 1956). In NSI the mean of subjects' variation coefficients for Rate I was significantly greater than for Rate II($t = 2.56$, $df = 10$, $p < 0.05$). In SI the mean of subjects' variation coefficients for Rate I was greater than for Rate II, though not significantly so ($t = 1.62$, $df = 10$). This finding directly contradicted Goldman-Eisler's (1956) conclusion that Rate I was significantly less variable than Rate II. As pointed out above, this contradication was explained in that Goldman-Eisler used

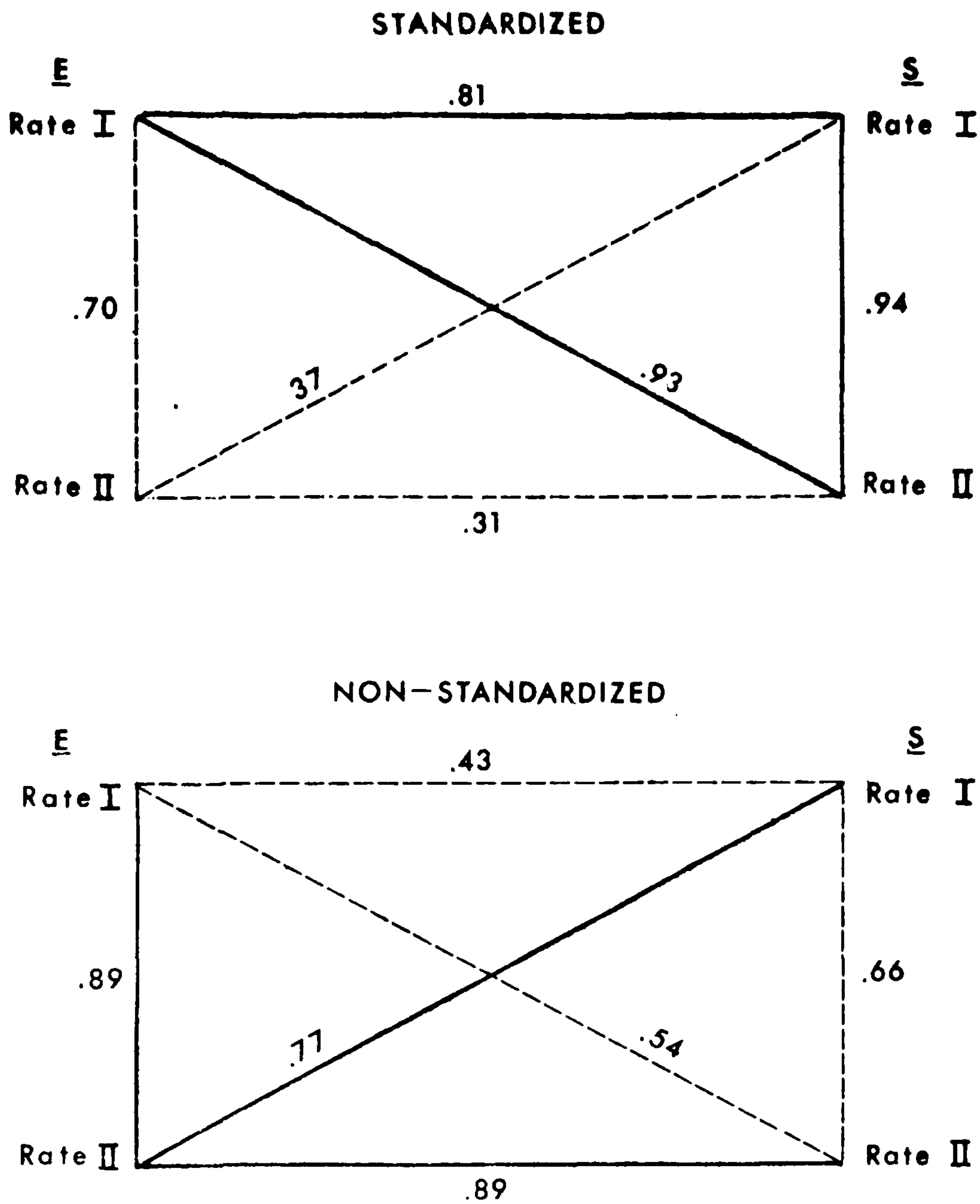

Fig. 1. Rank-order correlations of experimenter's and subject's mean rates.

mean Rate I scores in her variation coefficients, and compared this to the raw scores of Rate II.

Relation of Rate I to Rate II

Mean Rate II was slower than mean Rate I for all subjects in both conditions. Assuming equal likelihood of an increase or decrease, the probability was < 0.02. Thus it was concluded that pause times significantly contributed to the differences between Rates I and II. These results supported Goldman-Eisler's (1956) findings.

Goldman-Eisler's conclusion that Rate I contributed little to Rate II was not supported. Whereas she found a non-significant correlation of -0.17 between subjects' mean Rates I and II, in the present study a rank correlation of 0.94 ($p < 0.01$) was found in the SI condition, and 0.66 (n.s.) in the NSI condition (Fig. 1). This finding

TABLE 5

Differences Between Subjects' $\overline{X}$ Utterances/action Correlated with Amount of Decrease of Subjects' $\overline{X}$ Verbal Rate*

	$\overline{X}$ *Utterances/action*				$\overline{X}$ *Verbal Rate*			
s	SI	NSI	(NSI - SI)	Rank	SI	NSI	(NSI - SI)	Rank
1	12.84	22.29	−9.45	1	271	204	67	1
2	10.62	9.18	1.44	5	266	324	−58	6
3	10.82	8.42	2.40	6	246	241	5	4
4	7.15	7.58	−0.43	4	211	212	−1	5
5	6.17	8.36	−2.19	2	261	232	29	2
6	11.59	13.42	−1.83	3	291	271	20	3

rho = 0.829, $p < 0.05$

* A rank order correlation was used.

modified Martin's (1955) findings. That is, independence of Rates I and II varied with the interview condition rather than, or in addition to, varying with individuals.

The independence of Rates I and II in the NSI condition further indicated that subjects' pause times contributed more to the computation of Rate II in the NSI condition. Difference scores, i.e., NSI minus SI, of mean number of pauses per action were compared with the amount of decrease of each subject's mean Rate II, i.e., NSI minus SI. Pauses per action significantly correlated with the amount of decrease of subjects' Rate II (rho = 0.83, $p < 0.05$), indicating that in NSI, subjects paused significantly more frequently (Table 5).

The length of subjects' actions in NSI and SI were compared also, for length of action could influence the mean number of pauses per action. In no case did t' (Winer, 1962) approach significance. It was concluded that non-standardized interview behaviour was related to increases in subjects' frequency of pausing which significantly contributed to the independence of subjects' Rates I and II in NSI.

Relation between Experimenter's Rates I and II, and Subjects' Rates I and II

A significant correlation (rho = 0.89, $p < 0.05$) was found between experimenter's and subject's Rate II in the NSI condition (Fig. 1), but not in SI (rho = 0.31, n.s.). The relation between experimenter's and subjects' Rate I suggested a trend. Though non-significant, experimenter's and subjects' Rate I correlated 0.81 in SI, while in NSI the correlation was 0.43.

The possibility also existed that the experimenter's Rate II might be related to the subject's Rate I, and vice versa. The correlation between the experimenter's mean

TABLE 6

Experimenter's Means, Standard Deviations, Frequency, and Variation Coefficients of Verbal Rates and Phonation Rates in Standardized and Non-standardized Interviews

PHONATION RATES (Rate I)

	Standardized				*Non-standardized*			
S	$\bar{X}$	s.d.	N	V.C.	$\bar{X}$	s.d.	N	V.C.
1	296	82	27	27.70	309	88	14	28.48
2	296	46	25	15.54	333	77	17	23.12
3	277	40	14	14.44	320	95	38	29.69
4	280	70	29	25.00	300	87	16	29.00
5	292	52	30	17.81	351	83	26	23.65
6	302	52	37	17.22	341	55	14	16.13
			$\bar{X}_{V.C.}$	= 19.62			$\bar{X}_{V.C.}$	= 25.01
			s.d.	= 5.42			s.d.	= 5.18

VERBAL RATES (Rate II)

	Standardized				*Non-standardized*			
S	$\bar{X}$	s.d.	N	V.C.	$\bar{X}$	s.d.	N	V.C.
1	283	64	19	22.97	314	85	7	29.30
2	291	30	13	10.69	341	77	11	23.75
3	276	38	11	14.13	326	99	26	30.98
4	287	52	20	18.40	299	82	12	28.76
5	280	33	19	21.43	332	60	14	18.67
6	288	43	17	15.28	340	52	12	15.88
			$\bar{X}_{V.C.}$	= 17.15			$\bar{X}_{V.C.}$	= 24.56
			s.d.	= 4.65			s.d.	= 6.20

Rate II and subjects' mean Rate I in NSI was 0.77, while in SI the correlation was 0.37. Although neither coefficient was significant, the correlation in NSI suggested a trend. A clearer relation was found between the experimenter's mean Rate I and subjects' mean Rate II. In SI the correlation was 0.93 ($p < 0.05$), while in NSI the correlation was 0.54.

In summary, in the SI condition, the experimenter's Rate I was more closely related to subjects' speed of talking, both Rates I and II. But in NSI the experimenter's Rate I contributed little, while the experimenter's Rate II became more closely related to subjects' Rates I and II. These interrelations are diagrammed in Fig.1, with solid lines representing significant or strongly suggestive correlations.

Relation of Subjects' Variances of Rates I and II to Experimenter's Mean and Variance of Rates I and II

Variance of Rate II decreased in the NSI condition for all subjects (Table 4). The probability of such a consistent decrease is < 0.02. No similar relation was found for the variances of Rate I.

In attempting to relate subjects' constriction of variance in NSI to experimenter's behaviour, it was found that the experimenter's in NSI differed from SI in four ways (Table 6). There were 6 out of 6 increases in NSI for the experimenter's mean Rate I, mean Rate II, variance of Rate I, and variance of Rate II.

The probability of any of these consistent increases occurring by chance was < 0.02. Rank order correlations were computed (a) between these behaviours of the experimenter in NSI and subjects' variance of Rate II in NSI, and (b) between difference scores of the experimenter's behaviour, i.e., NSI minus SI, and subjects' variances of Rate II in NSI. Similar analyses were made between the experimenter's behaviour and the difference scores between subjects' variances, i.e., NSI minus SI. No suggestive trends were found.

Though unrelated to subjects' variances of Rate II, the experimenter's variances were related to subjects' variances of Rate I in both the SI and NSI conditions. Variances of the experimenter's Rate II correlated 0.90 with subjects' variances of Rate I in SI, and 0.76 in NSI. Although the latter correlation did not reach significance, the correlation seemed suggestive. Variances of the experimenter's Rate I correlated with subjects' variances of Rate I 0.74. This correlation also seemed suggestive. The interrelations between the experimenter's variances and subjects' variances are diagrammed in Fig. 2.

In summary, the experimenter's variances of Rate II showed the closest relations to subjects' variances of Rate I in both interview conditions. Thus, variations in the amount and/or duration of the experimenter's pauses influenced subjects' behaviour, but the influence was not so much on subjects' pauses as on subjects' phonation rates.

Discussion

The Standardized Interview appears to be a valid basic technique for studying speech rates. But additional controls are obviously necessary if one is to achieve a standardization of subjects' speech rates.

Although mental processes of the subject, e.g., contemplating, and the perceived allotment of speaking time may influence subjects' speech rates (Goldman-Eisler, 1954b), the present study indicated that the experimenter's speech rates, *per se*, influence subjects' mean and variance of speech rates. But which of the experimenter's rates,

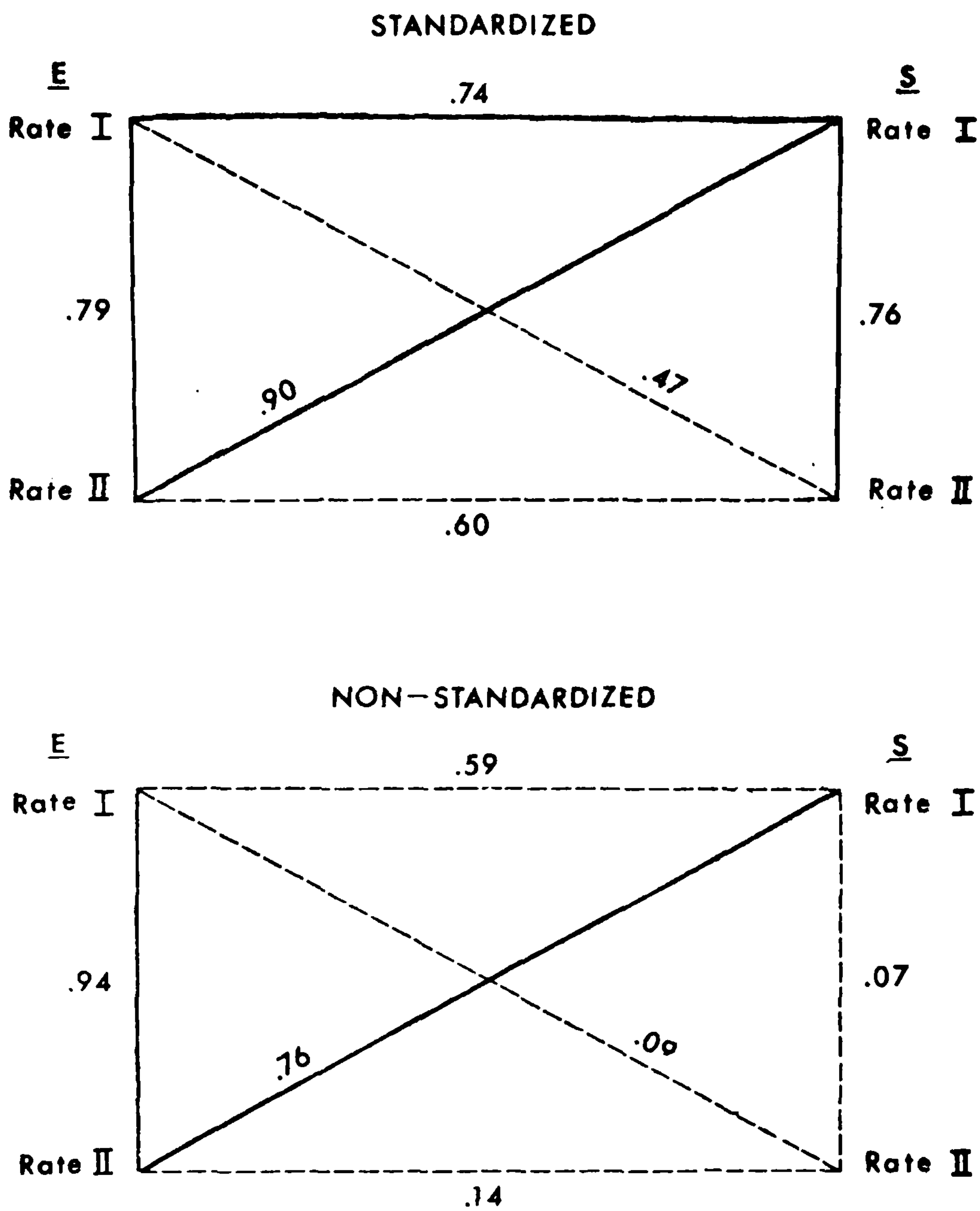

Fig. 2 Rank-order correlations of experimenter's and subject's variances.

i.e., Verbal or Phonation Rate, is more salient in influencing subjects' speech behaviour is complex and unclear at this point.

Standardized Interview behaviour by the experimenter, as opposed to non-standardized behaviour, appeared to have definite effects on subjects' speech rates. Across subjects, variance was homogeneous only in the Standardized Interview; and the independence of Rates I and II strongly differed for the two interview types.

Likewise complex was the finding that although subjects' means and variances of Rate I did not change in any consistent pattern in the non-standardized interview, changes in the experimenter's Rates I and II were closely associated with changes in

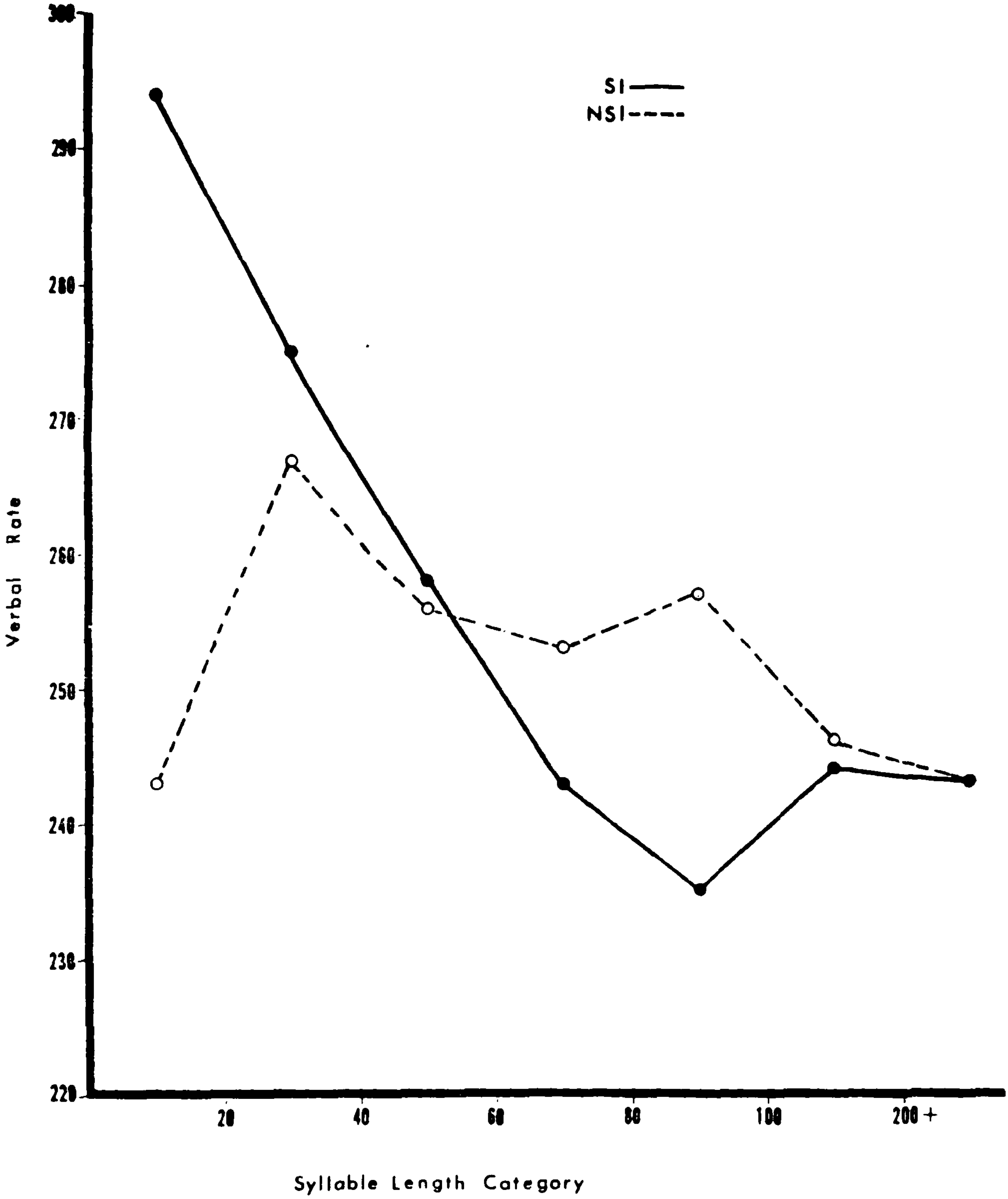

Fig. 3. Subjects' mean verbal rate for actions of different syllable lengths.

subjects' Rate I. This may have resulted from the experimenter's behaviour changes not having been consistent across subjects. Although the experimenter's behaviour in the NSI condition was always different from SI in the same direction, the magnitude of these changes was not consistent across subjects. Likewise, the possibility must be considered that subjects' speech rates mutually influenced the experimenter's speech rates.

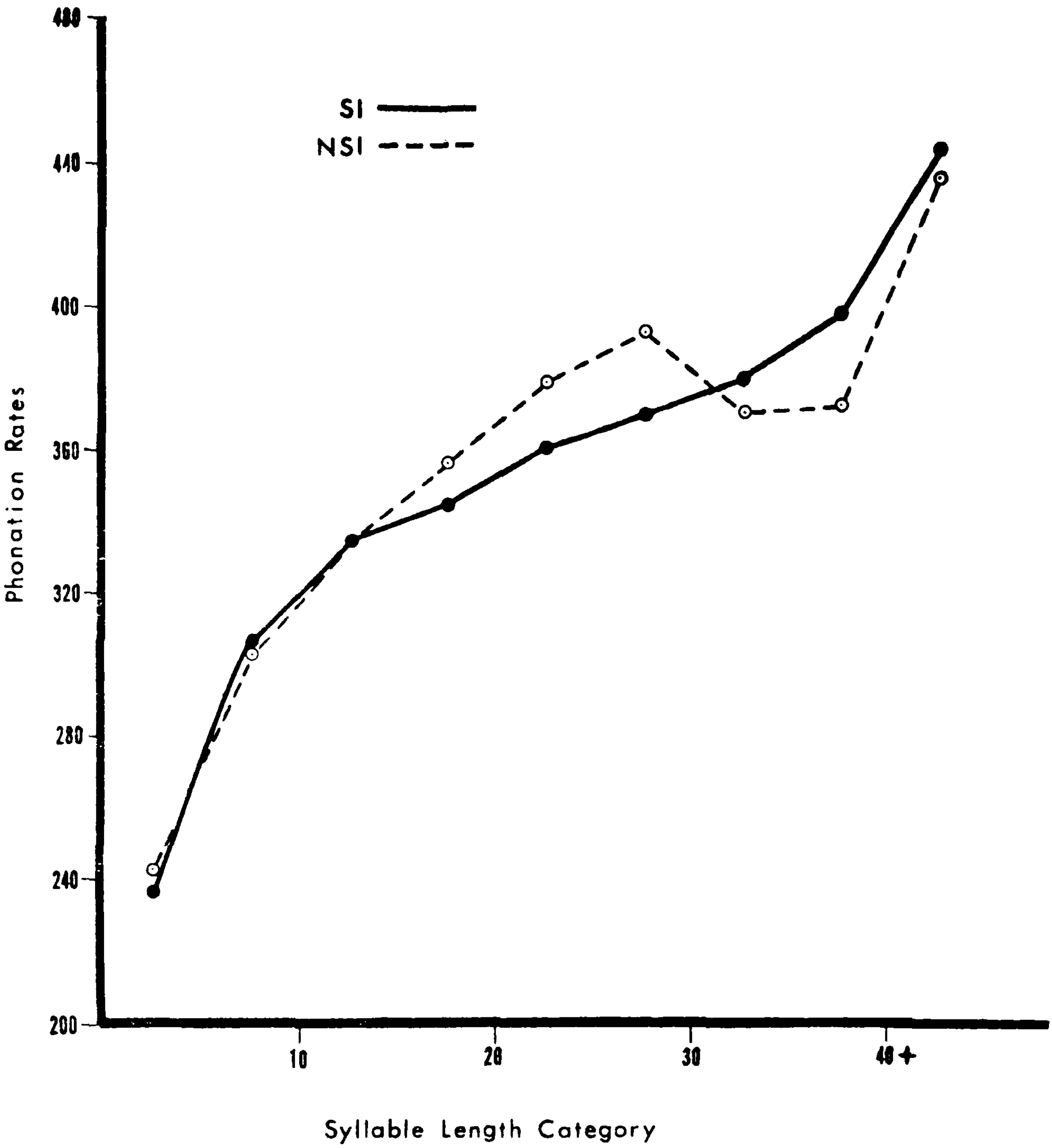

Fig. 4. Subjects' mean phonation rate for utterances of different syllable lengths.

Further investigation with speech rates is necessary, not only to clarify the relevant parameters of speech rates in interviews, but also to determine whether speech rates interact with other non-content speech variables, such as utterance duration, which have been shown to be meaningful in the Standardized Interview. There is evidence that such an interaction exists between speech rate and speech duration. Goldman-Eisler (1954b) found that Rate II decreased in a linear fashion for all subjects as the number of syllables comprising an action increased. In the present study, such an inverse relation was found between Rate II and syllable length of action, but only in the Standardized Interview portion. Furthermore, the curve was more reverse J-shaped than linear (Fig. 3). For the non-standardized interview, no relation existed between Rate II and syllable length of action.

Much clearer, and regardless of the type of interview behaviour the experimenter exhibited, was a direct relation between subjects' Rate I and syllable length of utterances. For all subjects in both interview conditions, as the syllable length of utterance increased, Phonation Rate increased in a roughly linear fashion (Fig. 4).

Such relations between the rates and durations of speech segments should be considered in future non-content speech research.

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