amount of information (bits/stimulus) contained in a stimulus sequence accounts for a significant portion of the variance in GSR level.

The ineffectiveness of the ITI variable was unexpected and is probably attributable to the small range of values (100 sec vs 200 sec). More data are needed before any firm conclusions are drawn concerning this variable.

These data further serve to call into question the wisdom of research which disregards the pattern of the stimulus complex and chooses to deal only with simple contiguity relationships. This does not suggest that it is inappropriate to research the "associational moment," but that one can ignore neither the distribution in which that moment is embedded nor the cortical representation of the stimulus distribution which S develops.

REFERENCES

- BERLYNE, D. E. Collative stimulus properties and the orientation reaction. *International Congress of Psychology*, 1966, 18, 84-102.
- CHAMPION, R. A., & JONES, J. E. Forward, backward, and pseudoconditioning of the GSR. *Journal of Experimental Psychology*, 1961, 62, 58-61.
- COOK, R. F. Pseudoconditioning of the GSR. Unpublished Masters thesis, Kansas State University, 1966.
- GARNER, W. R. *Uncertainty and structure as psychological concepts*. New York: John Wiley, 1962.

- PROKASY, W. F., & EBEL, H. C. Three components of the classically conditioned GSR in human subject. *Journal of Experimental Psychology*, 1967, 73, 247-256.
- RESCORLA, R. A. Pavlovian conditioning and its proper control procedures. *Psychological Review*, 1967, 74, 71-80.
- SOKOLOV, E. N. *Perception and the conditioned reflex*. New York: Pergamon Press, 1963.
- STEWART, M. A., STERN, J. A., WINOKUR, G., & FREDMAN, S. An analysis of GSR conditioning. *Psychological Review*, 1961, 68, 60-67.
- THOMPSON, R. F., & SPENCER, W. A. Habituation: A model phenomenon for the study of neuronal substrates of behavior. *Psychological Review*, 1966, 73, 16-43.
- TURSKY, B., & WATSON, P. D. Controlled physical and subjective intensities of electric shock. *Psychophysiology*, 1964, 1, 151-162.
- UNGER, S. M. Habituation of the vasoconstrictive orienting reaction. *Journal of Experimental Psychology*, 1964, 67, 11-18.
- ZIMNY, G. H., STERN, J. A., & FJELD, S. P. Effects of CS and UCS relationships on electrodermal response and heart rate. *Journal of Experimental Psychology*, 1966, 72, 177-181.

NOTES

1. This report is based on the author's doctoral dissertation (Cook, 1968) where additional information may be found. The research was performed while the author was a USPHS Predoctoral Fellow. The author would like to thank Merrill E. Noble for his assistance and guidance through all phases of the research.
2. Now at the American Institutes for Research, Washington office.
3. "Nonassociative" does not imply a complete lack of association between two types of stimuli but that the stimulus distributions are such that the one could not serve as a cue for the occurrence of the other.

Some properties of the verbal transformation (VT) effect¹

GEORGE B. KISH and MARGARET E. BALL, *Veterans Administration Hospital, Fort Meade, S. D. 57741*

Using a group method of testing, the verbal transformations (VTs) of the repeated word "distress" were studied in 85 Ss who had also taken the Sensation-Seeking Scale (SSS). Number of VTs occurred according to a negatively accelerated growth function during 4 min of listening. Disclosing the repetitive nature of the tape reduced the number of VTs produced when compared to a nondisclosure group. The results did not support a satiation analysis of the VT effect.

When a single tape-recorded word is repeatedly presented to an S at fairly high

rates, he reports spontaneous changes in the words he perceives, often hearing words which are markedly different from the actual recorded word (Warren & Gregory, 1958).

Warren (1968) has recently reviewed the findings and some of the theoretical attempts to explain this "verbal transformation" (VT) phenomenon. One possible explanatory attempt which he discusses may be derived by considering the VT effect and perceptual reversal illusions (e.g., the Necker cube) as analogous phenomena. Accordingly, the VT effect may be considered to reflect semantic satiation to a particular auditory stimulus, with resulting perceptual reorganization producing a new percept.

The present experiment was planned within the context of a satiation analysis. It was reasoned that people who varied in

stimulus-seeking tendencies as measured by the Sensation-Seeking Scale (SSS) (Zuckerman et al, 1964) might also positively co-vary in their rate of adaptation to stimulation. According to Quay (1965), this may constitute one basis for differing needs for stimulatory variety. If adaptation (satiation) were the process underlying both the VT effect and individual differences in stimulus-seeking, then the rate of perceived verbal transformations should be positively correlated with the SSS score. To test this prediction was the primary purpose of the present study. Furthermore, the experiment was so planned as to provide information regarding: (1) the feasibility of a group method of studying the VT effect, (2) the effect of disclosure-nondisclosure instructions upon the VT effect, and (3) the course of the phenomenon over time.

METHOD

The SSS was administered to all Ss in three classroom groups, and shortly thereafter they were exposed to a 4-min tape recording of the word "distress" repeated every 1.15 sec. The tape was manufactured by playing a closed loop of tape with one repetition of the word and rerecording it upon a second tape recorder. This insured that the successive repetitions of the word were identical. The tape was played at the front of the classroom with sufficient sound intensity to be clearly audible in all parts of the room. The Ss were provided with an answer sheet ruled into four portions corresponding to the 4 successive minutes of the tape. The Ss were instructed to make a tally mark upon the sheet each time they heard a change on the tape, with each alternation between different forms counting as a change. At the end of each minute of stimulation, the Ss were instructed by the examiner to "switch to the next box." At the end of the 4-min tape they were asked to write down all the different forms they had heard, including nonsense forms.

The three groups of Ss tested had the following characteristics:

Group ND1 (nondisclosure): N = 18, mean age 37.5, mean education 16+ years. This consisted of graduate students in a learning course. The repetitive nature of the tape was not revealed.

Group ND2 (nondisclosure): N = 31, mean age 22.55, mean education 14+ years. This consisted of undergraduate students in an educational psychology course. The nature of the tape was not disclosed to this group.

Group D (disclosure): N = 36, mean age 22.22, mean education 14+ years. This undergraduate educational psychology class was instructed regarding the repetitive nature of the tape but was told that people nevertheless tended to hear changes under these conditions.

Table 1
Mean Numbers of VTs per Successive 1-min Intervals by Groups, and Totals

	Minute 1	Minute 2	Minute 3	Minute 4	Total
Group ND1 (N = 18)	7.74	14.00	15.63	16.05	53.42
Group ND2 (N = 31)	4.68	10.39	13.77	15.26	44.10
Group D (N = 36)	6.55	8.83	9.61	10.17	35.17
Combined Group	6.21	10.66	12.59	13.46	42.92

RESULTS

Analysis of the data in Table 1 with regard to the mean number of VTs produced during successive minutes of the 4-min test period indicates the VTs are produced according to a negatively accelerated growth function, with a significantly larger number of VTs produced by the combined groups during Minute 4 than during Minute 1 ($t = 6.23$, $df = 85$, $p < .01$).

Although the older group (ND1) produced a greater total number of VTs during the 4-min test than did the younger group (ND2) under the same disclosure conditions, this difference was not significant ($t = .87$, $df = 48$, $p > .05$).

With regard to the disclosure conditions, the mean VTs of Groups ND2 and D were statistically compared. Although the total VTs produced by these groups did not differ significantly ($t = 1.23$), they did differ significantly when the mean VTs were compared during Minute 4 ($t = 2.12$, $df = 65$, $p < .05$).

No sex differences were found (females: $N = 40$, mean total VTs = 38.95; males: $N = 27$, mean total VTs = 39.26).

The Pearson correlation coefficients between the Sensation-Seeking Scale (SSS) and the total number of VTs produced during the test was +.22 for Group ND1 and -.16 for Groups ND2 and D combined. Neither coefficient differed significantly from zero.

The modal number of forms perceived by the Ss in all groups was two. Besides "distress," the most commonly reported form was "this dress." Fifteen different forms were reported, many of which were nonsense forms or slightly changed variants of "distress" (e.g., "distruss," "this duress," "distre," "disgress," "dired," "diskera," "discorrect," "distroest"). The number of different forms reported by Group D was 13, while Group ND2 reported 3.

DISCUSSION

Satiation

The correlational findings do not support the prediction from the satiation analysis, presented above. Apparently, in agreement with Warren (1968), a satiation analysis of the VT effect is not adequate to what is known about the phenomenon at this time.

Age

Warren & Warren (1966) tested nursery-school children, 8- to 10-year-olds, and young adults, and concluded that the VT effect manifested itself rather abruptly some

time after Age 6 and occurred to comparable degrees in 8- to 10-year-olds and young adults. After Age 60 the VT effect tended to disappear. What happens between the 20s and Age 60 is unclear. Taylor & Henning (1963) found that the scores of 35-year-olds fell between those of the young adults and the aged. Our results, which indicate no difference between our older and younger groups, do not confirm Taylor and Henning's findings. The course of this effect during the middle years requires further experimental analysis.

Temporal Changes

Warren (1968) reports that verbal transformations occur at about the same rate throughout a 3-min test session. Our results are at variance with his report. Warren² feels that this may be the result of differences in the rate of presentation used in the two studies. He used a 3/sec rate, while our rate was less than 1/sec. He furthermore reports (Warren, 1968) that the number of transformations is a function of the number of repetitions to which the S is exposed, rather than of stimulation time (1 min at 3/sec equivalent to 3 min at 1/sec). If this is the case, a finer breakdown of his data (e.g., by 15-sec intervals) might show the growth function herein obtained.

Disclosure Conditions

As Warren (1968) points out (and these authors' experience confirms), Es who are aware of the nature of the stimulus tapes do, nonetheless, experience VTs. It is surprising, therefore, that our results indicate that disclosure of the repetitive nature of the stimulus material reduces the number of VTs reported, at least during the later minutes of the tape. Natsoulas' (1965) suggestion that Ss are averse to reporting that they "hear things" may be the reason for a lower number of VTs in our disclosure group. It would seem, however, that reticence would be most prominent at the beginning rather than at the end of the session (when the phenomenon seems to become most compelling). In our data the disclosure group (D) actually produced a greater (though not significant) mean number of VTs during the first minute than did the nondisclosure group (ND2).

It is possible that the effect of disclosure would be to inhibit either the perception of or the report of the more radical percepts such as nonsense forms. A survey of the forms reported by our Ss, however, indicates

a greater variety of forms (many of which are nonsense forms) reported by our disclosure group (D, 13 forms) than are reported by our nondisclosure group (ND2, 5 forms). This requires further investigation, however, since it appears that one of the weaknesses of the present investigational method is the manner in which the forms are reported (see below). The precise mechanism producing this instructional effect is presently unclear to these observers.

Method

Finally, the method of group administration seems promising as a means of gathering large quantities of data regarding the VT phenomenon. Its weakness appears to be in gathering data on the precise forms perceived by the Ss, since the method, as used here, requires a retrospective report by the Ss. Probably this would result in fewer nonsense forms' being reported, since these might slip from memory more rapidly than a common word form. Warren² reports that he has compared the immediate and retrospective reports of his Ss and found that the forms heard during the first minute or two were likely to have been forgotten by the time the S made his retrospective report. On the other hand, a possible advantage of the group method is that it avoids the interaction with and possible interference with the phenomenon which would seem likely to occur in Warren's method, in which the S calls out and pronounces each form as he perceives it, while simultaneously listening to the tape.

REFERENCES

- NATSOULAS, T. A. A study of the verbal-transformation effect. *American Journal of Psychology*, 1965, 78, 257-263.
- QUAY, H. C. Psychopathic personality as pathological stimulation-seeking. *American Journal of Psychiatry*, 1965, 122, 180-183.
- TAYLOR, M. M., & HENNING, G. B. Verbal transformations and an effect of instructional bias on perception. *Canadian Journal of Psychology*, 1963, 17, 210-223.
- WARREN, R. M. Verbal transformation effect and auditory perceptual mechanisms. *Psychological Bulletin*, 1968, 70, 261-270.
- WARREN, R. M., & GREGORY, R. L. An auditory analogue of the visual reversible figure. *American Journal of Psychology*, 1958, 71, 612-613.
- WARREN, R. M., & WARREN, R. P. A comparison of speech perception in childhood, maturity, and old age by means of the verbal transformation effect. *Journal of Verbal Learning & Verbal Behavior*, 1966, 5, 142-146.
- ZUCKERMAN, M., KOLIN, E. A., PRICE, L., & ZOBB, I. Development of a sensation-seeking scale. *Journal of Consulting Psychology*, 1964, 28, 477-482.

NOTES

1. The authors wish to express their appreciation to Dr. Lincoln Henry and William Crosswait, of Black Hills State College, for generously donating class time for this study, and to R. M. Warren for valuable suggestions regarding technique and interpretation of the data.
2. Personal communication.