Perceptual and Motor Skills, 1978, 46, 791-794.

EFFECTS OF DISTRACTING STIMULI ON COMPLEX INFORMATION PROCESSING

JOHN W. ZIMMER AND JAYNE BRACHULIS-RAYMOND
University of Nebraska-Lincoln *State University of New York-Oneonta*

Summary.—Student performance on an information-processing task was compared under four conditions: popular music, connected speech, industrial noise, and a control condition. Results indicated significant differences between the reading control and industrial-noise conditions. Contrary to previous reports, no facilitative effects were found for the music condition nor was connected speech a significant distractor.

Recent reports on the effects of various distracting stimuli on human performance have evidenced two major defects. First, results obtained have been somewhat equivocal, due in part to the dissimilar stimuli and response requirements employed by various investigators and to methodological deficiencies, primarily a lack of suitable control conditions (Finkelman & Glass, 1970). Second, the tasks utilized have generally presented low requirements to subjects, which has hindered generalization to more complex "real world" activities.

For instance, investigations of noise distractors have indicated performance decrements on such diverse activities as auditory perception, vigilance tasks, detection of grammatical errors in proofreading and simplified arithmetic and creativity tasks (Jerison, 1959; Finkelman & Glass, 1970; Wolf & Weiner, 1972; Kaltsounis, 1973; Nober, 1973; Davies, Lang, & Shackleton, 1973; Weinstein, 1974). On text recall, however, no effects were apparent under noise conditions (Weinstein, 1974).

Studies of music as a mediating factor on human performance indicate relative effectiveness for facilitating task-related learning, cooperative behavior and learning, and retention of lexical items in language sequences (Hahn, 1972; Stainback, Stainback, & Hallahan, 1973; Chertock, 1974). Davies, *et al.* (1973), however, found that although difficult vigilance task scores were higher under music conditions, the converse was true for easy tasks. Additionally, subjects tested without music, or who encountered music only as they entered the experimental setting, significantly outperformed subjects exposed to music throughout the session (Fogelson, 1973; Stanton, 1975). Results obtained from studies using taped speech as a distractor have been equally variegated (Wolf & Weiner, 1972; Kaltsounis, 1973).

The present study was undertaken to determine the effects of three classes of distracting stimuli on a complex information-processing task. The apparent irrelevance of the outcomes obtained utilizing simplified activities to more realistic materials and settings seemed to justify further investigation of the effects of distractors on higher order tasks.

Method.—Fifty-four subjects, reporting to pre-scheduled 45-min. periods, were randomly assigned in small groups to one of four study conditions.

Materials employed were prose passages developed by Bruning (1968a), with an extensive history of use in learning/memory investigations (Bruning, 1968b; Rickards & DiVesta, 1974; Rickards, 1976). Each of the 50 text paragraphs consisted of a superordinate statement derived from three specific or subordinate level sentences describing various aspects of a fictitious African nation. Materials were presented in booklet form, two text paragraphs to a printed page, with sequences randomized for each subject.

Three types of distracting stimuli were utilized, connected speech, popular music, and intermittent industrial noises, all presented at a constant *db* level via cassette recorder. A reading control group encountered only familiar ambient background noise present in the lab.

As text booklets were distributed, subjects were instructed to begin reading as quickly and carefully as possible while the distracting stimuli were introduced. Following completion of a mask questionnaire regarding their ability to concentrate during the task, a 72-item posttest sampling both superordinate and subordinate levels of information was unexpectedly administered.

Results.—One-way analyses of variance across groups on over-all scores ($F_{3,50} = 1.99$, $p < .15$), superordinate level test items ($F_{3,50} = 1.98$, $p < .15$), and subordinate level scores ($F_{3,50} = 1.59$, $p < .15$) were nonsignificant. However, with the marked mean differences obtained between scores for subjects in industrial noise and reading control conditions *post hoc* analyses were conducted to assess whether or not these differences were significant. Total score ($t = 2.45$, 28 *df*, $p < .05$), as well as superordinate ($t = 2.18$, 28 *df*, $p < .05$), and subordinate test components ($t = 2.43$, 28 *df*, $p < .05$) evidenced significant differences. No other comparisons were significant, however.

Relative to a major focus of the investigation, our results yielded no significant differences between the music condition and the reading control group, contrary to data reported by Hahn (1972), Stanton (1975), and others (Jerison, 1959; Kaltsounis, 1973), suggesting that with more complex processing tasks the facilitative effects of music on performance may not be present. Noise

TABLE 1

MEANS AND STANDARD DEVIATIONS OF SUBJECTS' SCORES

Conditions	Over-all		Subordinate		Superordinate	
	M	*SD*	*M*	*SD*	*M*	*SD*
Reading Control	47.70	9.96	21.53	3.97	26.18	6.44
Industrial Noise	38.00	11.80	17.15	5.54	20.85	6.50
Music	43.62	7.90	19.85	4.33	23.77	4.34
Speech	43.72	11.65	19.45	5.05	24.27	7.99

condition results, however, do confirm previous research (Finkelman & Glass, 1970; Nober, 1973; Davies, Lang, & Shackleton, 1973). Finally, the speech group, while partially distracted during the task, performed somewhat better on the posttest than either the noise or, surprisingly, the music condition.

The lack of facilitative effects for the music condition may, in part, be attributable to habituation as proposed by Culbert and Posner (1960) in that students appear able to "gate out" familiar stimuli, e.g., music, while studying—especially when processing materials approaching those normally encountered in academic settings. Wolf and Weiner (1972) and Kaltsounis (1973) in studies employing simpler tasks arrived at similar conclusions.

Methodologically testing a variety of potentially distracting stimuli attains importance when more complex information-processing activities, not simple repetitive tasks, are utilized, insofar as these complex tasks approach those performed in academic or technical settings. Few pursuit-rotor or digit-counting tasks exist in "real world" settings, but reading and retaining memos, lessons, etc., are integral parts of the daily regimen of these situations. The relatively pronounced disruptive effects of noise distractors in the present study support Knirk's (1970) contention that the acoustic environment must be considered in, for example, educational settings.

REFERENCES

BRUNING, R. H. The effects of intra-paragraph organization and level of adjunct questioning on learning from written materials. Unpublished doctoral dissertation, Univer. of Nebraska, 1968. (a)

BRUNING, R. H. The effects of review and test-like events within the learning of prose materials. *Journal of Educational Psychology*, 1968, 59, 16-19. (b)

CHERTOCK, S. L. Effect of music on cooperative problem solving by children. *Perceptual and Motor Skills*, 1974, 39, 986.

CULBERT, S. S., & POSNER, M. I. Human habituation to an acoustical energy distribution spectrum. *Journal of Applied Psychology*, 1960, 44, 263-266.

DAVIES, D. R., LANG, L., & SHACKLETON, V. J. The effects of music and task difficulty on performance at a visual vigilance task. *British Journal of Psychology*, 1973, 64, 383-389.

FINKELMAN, J. M., & GLASS, D. C. Reappraisal of the relationship between noise and human performance by means of a subsidiary task measure. *Journal of Applied Psychology*, 1970, 54, 211-213.

FOGELSON, S. Music as a distractor on reading-test performance of eighth grade students. *Perceptual and Motor Skills*, 1973, 36, 1265-1266.

HAHN, S. L. The effect of music in the learning and retention of lexical items in German. Unpublished doctoral dissertation, Univer. of Kansas, 1972.

JERISON, H. J. Effects of noise on human performance. *Journal of Applied Psychology*, 1959, 43, 96-101.

KALTSOUNIS, B. Effect of sound on creative performance. *Psychological Reports*, 1973, 33, 737-738.

KNIRK, F. G. Acoustical and visual environments affect learning. *Audio-visual Instruction*, 1970, 15, 34-35.

NOBER, L. W. Auditory discrimination and classroom noise. *The Reading Teacher*, 1973, Dec., 288-291.

RICKARDS, J. P. Processing effects of advanced organizers interspersed in text. *Reading Research Quarterly*, 1975-1976, 11, 599-622.

RICKARDS, J. P., & DIVESTA, F. J. Type and frequency of questions in processing text material. *Journal of Educational Psychology*, 1974, 66, 354-362.

STAINBACK, S. B., STAINBACK, W. C., & HALLAHAN, D. P. Effect of background music on learning. *Exceptional Children*, 1973, 40, 109-110.

STANTON, H. E. Music and test anxiety: further evidence for an interaction. *British Journal of Educational Psychology*, 1975, 45, 80-82.

WEINSTEIN, N. D. Effect of noise on intellectual performance. *Journal of Applied Psychology*, 1974, 59, 548-554.

WOLF, R. H., & WEINER, F. F. Effects of four noise conditions on arithmetic performance. *Perceptual and Motor Skills*, 1972, 35, 928-930.

Accepted March 14, 1978.