DOCUMENT RESUME

ED 287 251 EC 200 558

AUTHOR	Marcell, Michael M.
TITLE	Attention and Short-Term Memory in Down's Syndrome.
PUB DATE	Apr 87
NOTE	8p.; Paper presented at the Biennial Meeting of the Society for Research in Child Development (Baltimore, MD, April 23-26, 1987).
PUB TYPE	Speeches/Conference Papers (150) -- Reports - Research/Technical (143)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Attention Span; *Auditory Stimuli; *Discrimination Learning; *Downs Syndrome; Elementary Secondary Education; *Short Term Memory; *Visual Stimuli
IDENTIFIERS	*Distraction

ABSTRACT

To determine whether Downs Syndrome (DS) persons' recall could be improved by procedures that minimized auditory and visual distractions during auditory memory tasks, 16 DS, 12 non-DS mentally retarded and 12 non-mentally retarded persons (mean ages 16, 16, and 5 years, matched for mental age) listened to, looked at, and tried to remember digit sequences. Although the three groups did not differ in their recall of visually presented stimuli, DS subjects showed significantly poorer recall of auditorially presented stimuli than the other two groups (which did not differ). Furthermore, the poor auditory memory of DS subjects did not improve under testing conditions designed to minimize auditory and visual distractions. Results suggested that poor auditory short-term memory for verbal information is tied more closely to DS than to low intelligence in general, and is not caused by a special susceptibility of DS individuals to attentional distractors. (Author/CL)

Attention and Short-Term Memory in Down's Syndrome

Michael M. Marcell, Carol Harvey, L. Paige Cothran
Department of Psychology
The College of Charleston
Charleston, South Carolina 29424

Down's Syndrome (DS) individuals, relative to nonretarded individuals, have greater difficulty remembering brief sequences of verbal information presented auditorially. Previous research suggests at least two possible attentional explanations of their difficulty: They are especially susceptible to auditory distraction and off-task glancing during laboratory tasks. The primary goal of this experiment was to determine whether DS recall could be improved by procedures that minimized auditory and visual distractions during auditory memory tasks. A second goal was to determine whether the deficient pattern displayed by DS subjects in previous studies was characteristic of mentally retarded people in general or DS individuals specifically. DS, non-DS mentally retarded, and nonretarded persons listened to, looked at, and attempted to remember sequences of digits. Although the three groups did not differ in their recall of visually-presented stimuli, DS subjects showed significantly poorer recall of auditorially-presented stimuli than the other two groups (which did not differ). Furthermore, the poor auditory memory of DS subjects did not improve under testing conditions designed to minimize auditory and visual distractions. It was suggested that poor auditory short-term memory for verbal information is: a) tied more closely to Down's Syndrome than to low intelligence in general, and b) not caused by a special susceptibility of Down's Syndrome individuals to attentional distractors.

Paper presented at the biennial meetings of the Society for Research in Child Development in Baltimore, Maryland, April, 1987.

Attention and Short-Term Memory in Down's Syndrome

When asked to remember auditorially- or visually-presented words, Down's Sydrome (DS) individuals show either equivalent or better recall of visual than auditory information (Burr & Rohr, 1978; Marcell & Armstrong, 1982; McDade & Adler, 1980). Interestingly, nonretarded (NR) persons reliably show a different pattern: superior memory for sequences of auditory information (Crowder, 1978; Engle, 1977; Murray & Roberts, 1968; Watkins & Watkins, 1980). Research on auditory short-term memory has typically employed the classic digit span test in which subjects are asked to repeat sequences of numbers. Because the digit span test has been described as a measure of attentiveness as well as memory (Torgesen, 1982; Sattler, 1974), it is possible that poor auditory memory is due, at least in part, to difficulty in maintaining attentiveness during the sequential presentation of spoken items. Unlike stationary visual stimuli which can be repeatedly scanned, auditory stimuli are sequential and transient and are often neither salient nor engaging to children of normal intelligence.

Previous research suggests at least two possible connections between poor auditory memory and attentional problems of the retarded: Retarded individuals may be especially susceptible to auditory distraction (Zekulin, Gibson, Mosley, & Brown, 1974) and off-task glancing (Krupski, 1977). The primary goal of this experiment was to explore the possibility that poor auditory memory in DS subjects might be improved through procedures that minimize auditory and visual distractions during auditory memory tasks. Four experimental procedures were used. The first involved the silent presentation of visual stimuli (sequences of the digits 1-9) on a video screen. This control task provided an opportunity to replicate earlier findings of a "modality effect" (better recall of information presented auditorially than visually) in NR, but not DS, children. The three remaining procedures embodied different ways of presenting auditory stimuli. The first of these was the freefield presentation of spoken digits from the speaker of a blank video screen. In this traditional task the subject had to focus on the to-be-remembered items and avoid the ambient auditory and visual distractions that are inevitable even in a relatively quiet and sparse testing room of a school (e.g., the sound of shuffling feet, sporadic noises in the hallway, the presence of pencils and paper on a table top). The second auditory procedure involved the presentation of digits over heavily padded headphones. This technique minimized the likelihood that a subject was distracted by non-essential sounds during testing. The third auditory procedure involved the freefield presentation of digits coupled with the subject wearing opaque goggles. This task eliminated the possibility that the subject engaged in off-task glancing during testing.

A second goal of the experiment was to determine whether the poor auditory memory displayed by DS subjects in previous studies was characteristic of mentally retarded people in general or DS individuals specifically. This question was evaluated by testing, in addition to samples of DS and NR subjects, a sample of non-DS mentally retarded (MR) subjects. The presence of an MR group allowed exploration of the possibility that poor auditory memory is not a characteristic of low intelligence in general, but is rather a trait of those persons whose mental retardation results from Down's Syndrome.

The subjects are described in Table 1. DS, MR, and NR groups were matched on mental age, and DS and MR groups were matched on chronological age. Each subject completed all four experimental tasks and was instructed and encouraged, through reminders and demonstration during practice trials, to watch or listen carefully to the numbers and try to repeat them in the correct order. In each task, random digit sequences of increasing length were presented until the subject substituted an incorrect item or forgot a correct item in two consecutive sequences.

Memory span scores were derived by recording the length of the longest sequence remembered correctly by a subject. This score reflected a subject's highest level of performance and provided a traditional estimate of the span or capacity of short-term memory. An <u>order recall</u> memory span score was defined as the longest sequence in which all digits were recalled in the correct order. A 3 (group) x 4 (task) ANOVA revealed significant effects of group, $F(2,37)=6.43$, $p < .004$, task, $F(3,111)=16.36$, $p < .00001$, and group X task interaction, $F(6,111)=3.84$, $p < .002$. The means associated with the interaction effect can be found in the top portion of Table 2. The scores of the DS group did not differ across the four tasks. Thus, not only did DS subjects fail to show the modality effect, but their auditory memory was enhanced by neither of the conditions designed to reduce auditory and visual distractions. Furthermore, each of their three auditory scores was significantly lower than the comparable MR and NR scores (which did not differ). In contrast, both MR and NR groups had auditory scores higher than their visual scores. Thus, non-DS mentally retarded persons performed like children of normal intelligence in that they showed a clear and strong modality effect. It is also interesting to note that the visual scores of the three groups did not differ. Thus, poor DS short-term memory was apparent only in remembering <u>auditory</u> stimuli.

It has been suggested (Ashman, 1982; Hartley, 1982; Snart, O'Grady, & Das, 1982) that the primary DS memory difficulty is in remembering <u>sequential</u> information. Thus, a secondary analysis was conducted to determine whether the poor DS auditory memory exhibited in the order recall analysis was tied to the task requirement that items be recalled in order. In this <u>item recall</u> analysis, a memory span score was defined as the longest sequence in which all digits were correctly recalled, regardless of order. A 3 x 4 ANOVA yielded significant effects of group, $F(2,37)=5.59$, $p < .008$, task, $F(3,111)=8.85$, $p < .00001$, and group x task interaction, $F(6,111)=3.23$, $p < .006$. As can be seen in the bottom portion of Table 2, all pairwise differences for the interaction effect were exactly parallel to those of the previous analysis. (The only departure was a marginally significant DS-MR AG comparison.) Therefore, when the data were rescored for the recall of items in any order, Down's subjects still showed poor auditory memory. Their auditory memory deficiency thus appeared to be "general" in that they showed greater difficulty than MR and NR subjects in remembering the identities as well as the sequences of auditorially-presented items.

In summary, the results clearly indicated that: a) DS subjects displayed an auditory short-term memory deficit that was not a function of general mental retardation or low intelligence; and b) tasks designed to reduce or eliminate the disruptive effects of auditory and visual distractions failed to result in improved recall for DS subjects. We agree with Das (1978) that retarded people in general seem to be adequately focused and attentive during short, familiar, and simple memory tasks. We also agree with Ellis (1970) and Dempster (1981) that attention does not appear to be the most important variable influencing retardate performance on short-term memory tasks. A deeper understanding of the poor auditory memory of DS subjects may come from the systematic isolation and manipulation of digit span task characteristics other than attentiveness. For instance, the linguistic nature of stimulus items (cf. Lamberts, 1981; Philipchalk & Rowe, 1971) and the speed with which incoming items are identified (cf. Campione, Brown, & Ferrara, 1982; Das, 1985; Saccuzzo & Michael, 1984; Torgesen & Houck, 1980) appear to be potentially fruitful avenues of investigation.

TABLE 1

DESCRIPTION OF SUBJECTS

		MA[a]		CA[b]	
Group	N	Mean	SD	Mean	SD
DS	16	58.7	13.5	201.1	28.8
MR	12	58.0	17.9	196.3	39.1
NR	12	56.8	13.3	66.7	3.0

Note: DS = Down syndrome, MR = non-DS mentally retarded, NR = non-mentally retarded.

[a]MA = mental age in months. MA was measured by the Age Equivalence index of the Peabody Picture Vocabulary Test-Revised (PPVT-R) (Dunn & Dunn, 1981).

[b]CA = chronological age in months.

TABLE 2

MEAN ORDER RECALL AND ITEM RECALL MEMORY SPAN SCORES

FOR THE GROUP X TASK INTERACTION

Group[a]	Visual[b]	Auditory Freefield	Auditory Headphones	Auditory Goggles
	Order Recall Scoring of Tasks			
DS	2.7 (0.6)	2.8 (0.8)	2.9 (0.8)	2.6 (0.6)
MR	2.7 (0.9)	3.8 (1.3)	3.6 (1.3)	3.6 (1.6)
NR	2.8 (1.1)	4.3 (0.7)	4.2 (0.9)	4.1 (1.2)
	Item Recall Scoring of Tasks			
DS	2.9 (0.7)	2.9 (0.7)	2.9 (0.9)	2.9 (0.8)
MR	3.0 (1.1)	3.8 (1.3)	3.3 (1.4)	3.5 (1.6)
NR	3.0 (1.1)	4.4 (0.7)	4.3 (1.0)	4.2 (1.1)

Note. The reader should not directly compare order and item recall scores. These numbers are products of different scoring systems and represent different ways of exploring the same data.

[a]DS = Down's syndrome, MR = non-DS mentally retarded, NR = non-mentally retarded.

[b]The number in parentheses following the mean is the standard deviation.

References

Ashman, A. F. (1982). Coding, strategic behavior, and language performance of institutionalized mentally retarded young adults. American Journal of Mental Deficiency, 86, 627-636.

Burr, D. B., & Rohr, A. (1978). Patterns of psycholinguistic development in the severely mentally retarded: A hypothesis. Social Biology, 25, 15-22.

Campione, J. C., Brown, A. L., & Ferrara, R. A. (1982). Mental retardation and intelligence. In R. J. Sternberg (Ed.), Handbook of human intelligence (pp. 392-490). New York: Cambridge University Press.

Crowder, R. G. (1978). Sensory memory systems. In E. C. Carterette & M. P. Friedman (Eds.), Handbook of Perception, Vol. 8: Perceptual coding. New York: Academic Press.

Das, J. P. (1978). Attention. In J. P. Das & D. Baine (Eds.), Mental retardation for special educators. Springfield, IL: Charles C. Thomas, 31-47.

Das, J. P. (1985). Aspects of digit-span performance: Naming time and order memory. American Journal of Mental Deficiency, 89, 627-634.

Dempster, F. N. (1981). Memory span: Sources of individual and developmental differences. Psychological Bulletin, 89, 63-100.

Ellis, N. R. (1970). Memory processes in retardates and normals. In N. R. Ellis (Ed.), International review of research in mental retardation (Vol. 4). New York: Academic Press.

Engle, R. W. (1977). A developmental study of the Prelinguistic Auditory Store (PAS). Intelligence, 1, 358-368.

Hartley, X. Y. (1982). Receptive language processing of Down's Syndrome children. Journal of Mental Deficiency Research, 26, 263-269.

Krupski, A. (1977). Role of attention in the reaction-time performance of mentally retarded adolescents. American Journal of Mental Deficiency 82, 79-83.

Lamberts, F. (1981). Sign and symbol in children's processing of familiar auditory stimuli. American Journal of Mental Deficiency, 86, 300-308.

Marcell, M. M., & Armstrong, V. (1982). Auditory and visual sequential memory of Down syndrome and nonretarded children. American Journal of Mental Deficiency, 87, 86-95.

McDade, H. L., & Adler, S. (1980). Down syndrome and short-term memory impairment: A storage or retrieval deficit? American Journal of Mental Deficiency, 84, 561-567.

Murray, D. J., & Roberts, B. (1968). Visual and auditory presentation, presentation rate and short-term memory in children. British Journal of Psychology, 59, 119-125.

Philipchalk, R. P., & Rowe, E. J. (1971). Sequential and nonsequential memory for verbal and nonverbal auditory stimuli. Journal of Experimental Psychology, 91, 341-343.

Saccuzzo, D. P., & Michael, B. (1984). Speed of information-processing and structural limitations by mentally retarded and dual-diagnosed retarded-schizophrenic persons. American Journal of Mental Deficiency, 89, 187-194.

Sattler, J. M. (1974). Assessment of Children's Intelligence. Philadelphia: W. B. Saunders.

Snart, F., O'Grady, M., Das, J. P. (1982). Cognitive processing by subgroups of moderately mentally retarded children. American Journal of Mental Deficiency, 86, 465-472.

Torgesen, J. K. (1982). The use of rationally defined subgroups in research on learning disabilities. In J. P. Das, R. F. Mulcahy, & A. E. Wall (Eds.), Theory and research in learning disabilities (pp. 111-131). New York: Plenum.

Torgesen, J. K., & Houck, D. G. (1980). Processing deficiencies of learning-disabled children who perform poorly on the digit span test. Journal of Educational Psychology, 72, 141-160.

Watkins, O. C., & Watkins, M. J. (1980). The modality effect and echoic persistence. Journal of Experimental Psychology: General, 109, 252-278.

Zekulin, X. Y., Gibson, D., Mosley, J. L., & Brown, R. I. (1974). Auditory-motor channeling in Down's syndrome subjects. American Journal of Mental Deficiency, 78, 571-577.