

中度知的障害の外的記憶方略における変化過程

Change process of external memory strategies in individuals with moderate mental retardation

渡 邊 雅 俊

Masatoshi WATANABE

Introduction

In order to remember things during our daily lives, many people use external memory strategies such as placing objects in special places, taking memos, or using alarms rather than internal memory strategies such as repetition or mnemonic devices (Harris, 1980; Intons-Peterson & Fournier, 1986). Making practical use of external visual clues as an external memory strategy is a necessary cognitive skill for those with mental retardation to properly adjust to society.

Bray, Saarnio, Borges, & Hawk (1994) conducted a comparative analysis of the features of external memory strategies used by children CA 11 years old with mild mental retardation and non-retarded subjects of ages 7 and 11. The recall task was conducted by first presenting subjects with a moveable object such as a miniature toy and an unmoveable target object. Next, an instruction such as "Place the eraser on the chair." was read aloud. The task required subjects to place a freely moveable object (e.g. eraser) to the target (chair). The number of instructions for one trial was either two instructions or four instructions depending on the condition. Results indicated that similar to children without mental retardation, many children with mental retardation made use of external memory strategies. Children with mental retardation tended to use object-oriented external strategies (pointing at the moveable object, holding the object) compared to target-oriented external strategies (moving the object close to the target). The object-oriented memory strategies were not as effective as the target-oriented memory strategies widely used by 11 year-old children without mental retardation. However, children with mental retardation were able to utilize target-oriented strategies when given the hint "You may move the moveable object while listening to the instructions." This is also observed in 7 year-old children without mental retardation who are the same mental age.

A comparative analysis was conducted for CA 11 and 17 year-olds with mental retardation with 7, 9, 11, and 17 year-olds without mental retardation using a recall task with a story that is easily relatable for children (haunted house story) (Fletcher & Bray, 1995). The task in this study required participants to first listen to a description such as "The apple is above the ghost." Participants then placed the moveable object (apple) in the correct position relative to the ghost presented on a computer screen. The instructions ranged from one sentence to seven sentences. For the 11 and 17 year-olds without mental retardation and 17 year-olds with mental retardation, they tended to make use of an arrangement strategy (placing the moveable object in front of the target) for the more difficult recall tasks with more sentences. This indicated that children with and without mental retardation can change strategies in response to the difficulty (memory load) of the task.

Fletcher, Huffman & Bray (2003) conducted a study to identify conditions that promote the use of the arrangement strategy. A comparative analysis was conducted using three conditions. In one condition, the participants were solely given a verbal hint. The second condition provided a physical hint to rearrange

the locations of the moveable objects (the target was moved closer to the moveable objects in the computer screen). The third condition combined the previous two types of hints. For the third condition, usage rates of arrangement strategies became similar for 17 year-old children with mental retardation compared to 17 year-old children without mental retardation. However, usage rates of arrangement strategies for 11 year-old children with mental retardation did not reach similar rates compared to 11 year-olds without mental retardation. 11 year-olds with mental retardation (MA 7 years old) were similar to 7 year-olds without mental retardation in which both groups continued to use object-oriented external strategies which are not as effective in recall tasks. Also, these two groups were unable to change strategies in response to increasingly difficult tasks. These results indicate that the developmental use of strategies by children with mental retardation is affected by chronological age.

These previous studies point toward several research themes. The first point is that there have not been any distinctions made for children with moderate mental retardation. For example, the participants in the study by Bray et al. (1994) had an average IQ of 64.3. Children with moderate, mild mental retardation who are limited in their abilities to use internal memory strategies should have a higher need to use external memory strategies compared to children with only mild mental retardation. The second point is that the individual differences between participants in each of the employed strategies have not been examined. When the amount of information to recall and the difficulty of the tasks increase, it becomes necessary to use more effective strategies. There are people who are able to respond to the increasingly difficult tasks and those who are not. The clarification of the differences between these two groups is important when examining how to provide support. Taking these points into account, this study aims to examine the changes in strategies employed by participants in response to more difficult recall tasks as well as determining the factors involved for children with moderate mental retardation.

Method

Participants

Participants consisted of 18 students enrolled in a special needs education school for the mentally challenged (12 boys, 6 girls). The mean age of participants is 15 years and 7 months (Range: 12 years 9 months to 16 years 10 months). The mean FIQ measured by WISC-III is as follows (standard deviation listed in parenthesis): 49.2 (3.9), VIQ 51.8 (3.3), PIQ 55.4 (6.1).

Materials

Plastic miniature toys (moveable objects) resembling twelve common foods (apple, cake, grapes, tangerine, strawberry, fish, lemon, rice ball, tomato, banana, watermelon, carrot) and six different colored (red, blue, yellow, green, white, black) plates (target) were used for this study. The moveable objects and targets were placed 30cm apart on a vinyl board (50x60x1cm). The vinyl board was painted white for the region containing the moveable objects and black for the region containing the targets (Figure 1).

Task and Procedures

The tasks were conducted individually in an open room within the school during lunch breaks or after school. The participants first practiced the recall task. The task required participants to place a moveable object in the correct target according to instructions read by the investigator. The instructions followed the same

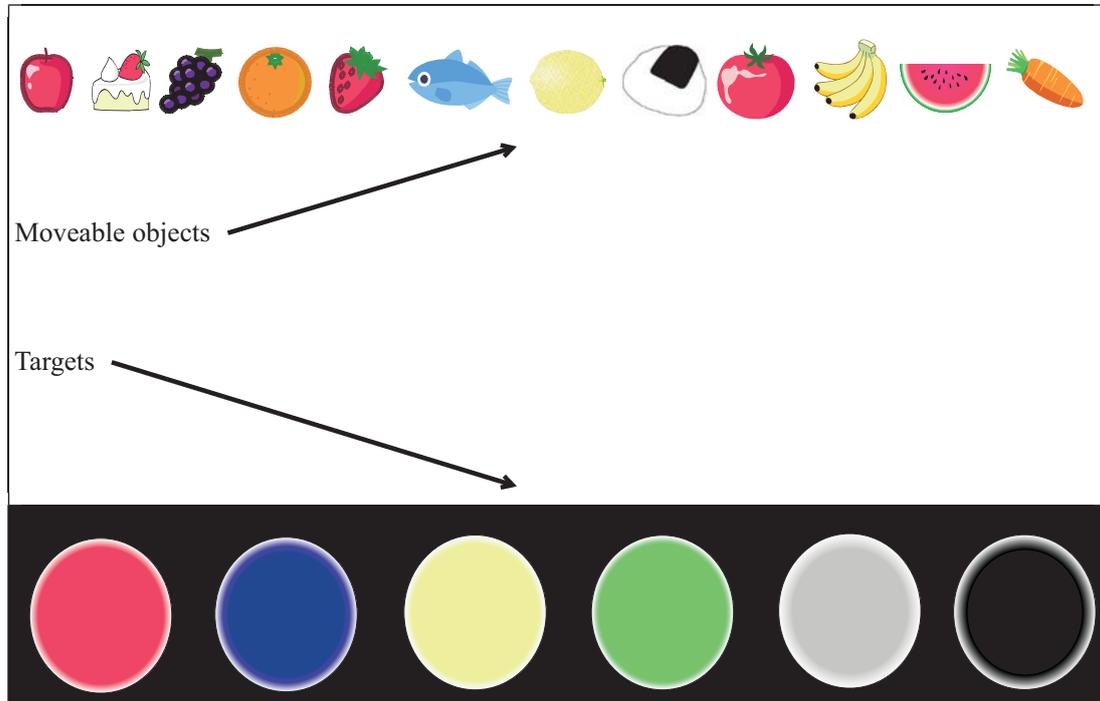


FIG. 1 Moveable objects and Targets in Recall Tasks

sentence structure of “Please place the moveable object on the target.” For example, “Please place the grapes (moveable object) on the red plate (target).” The names of the moveable objects and targets were reviewed before beginning the task. Next, the investigator read the instructions and signaled to the participant “You may begin.” The participant would then place the moveable object on the target. After the participants successfully completed two practice instructions consecutively, the official tasks were conducted. Before the start of the official tasks, the participants were told that they are allowed to touch and move the moveable objects while listening to the instructions but could only move the objects within the white area (region for the moveable objects). They were instructed, “This time, you may touch and move the moveable objects while I (investigator) am reading the instructions even before I tell you to begin. However, you may only move the objects within the white region. You may not place the objects on the plate (target) until I tell you to begin.” The experiment began with three trials of tasks with two instructions (two-instruction tasks). Next, a five-instruction task was conducted. Before the five-instruction task, participants were told that the recall task would become more difficult and a practice five-instruction task was conducted. Six trials of the five-instruction task were conducted. Two patterns of instructions were provided for each recall task which was randomly assigned to the participants.

Results

1. Effectiveness and classification of external memory strategies

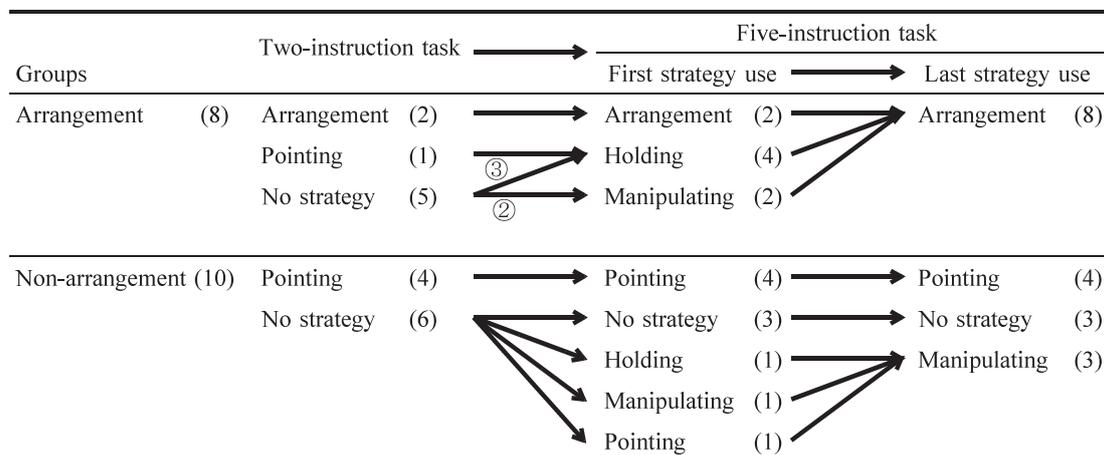
The actions of the participants were recorded by a video camera. Analysis of the recordings resulted in the classification of four different types of strategies: 1. Pointing strategy (pointing at the moveable object or target while the instructions are being read), 2. Holding strategy (holding the moveable object while the

instructions are being read), 3. Manipulating strategy (moving the moveable objects to the front or back or gathering the moveable objects in one place while the instructions are being read), and 4. Arrangement strategy (placing the moveable object in front of the target while the instructions are being read). To examine the effectiveness of each strategy for the recall tasks, the mean recall rates were calculated (standard deviations listed in parenthesis). Results were as follows: no strategy 20.1% (20.0), pointing strategy 24.6% (20.9), holding strategy 45.0% (16.5), manipulating strategy 35.2% (21.2), arrangement strategy 96.1% (9.3). Analysis of variance demonstrated that there was a significant effect of strategy use ($F_{(4,103)}=78.0, p<.01$). Multiple comparisons from the LSD method revealed that the recall rate for the arrangement strategy was significantly greater compared to other strategies. The mean recall rates of the manipulating strategy and holding strategy were significantly higher than the mean recall rate from using no strategy ($MSe=332.1, p<.05$). These results indicate that the arrangement method is the most effective strategy for recalling instructions. Also, the manipulating strategy and holding strategy improves recall rates compared to using no strategy.

2. Changes in strategy use

The strategy used by each participant for the two-instruction task was deemed to be the most effective strategy employed during the three trials (Order of effectiveness: arrangement strategy, holding strategy, manipulating strategy, pointing strategy, no strategy). For the five-instruction task, the strategy employed for the first of six trials was deemed to be the “first strategy used,” and the strategy employed for the sixth trial was deemed to be the “last strategy used.” The changes in external memory strategies used by the participants are listed in Table 1.

FIG. 1 Moveable objects and Targets in Recall Tasks



Notes. () Number of strategy use; ○ Number of classification in no strategy use group (5 participants).

1) Arrangement strategy use group (8 participants)

For this recall task, eight out of eighteen participants made use of the arrangement strategy which was the most effective out of all strategies. Two participants used the arrangement strategy from the two-instruction task. These two participants continued to use the arrangement strategy for the five-instruction task and correctly recalled all instructions. Five out of the six remaining participants in this group did not use a strategy for the two-instruction task. One of the participants chose to use the pointing strategy. These six participants correctly

answered all two-instruction tasks. For the five-instruction task, these participants used the holding strategy or the manipulating strategy for the “first strategy used.” Participants made some errors using these strategies. When they switched to the arrangement strategy, they were able to correctly recall all instructions.

2) Non-arrangement strategy use group (10 participants)

Ten out of eighteen participants did not use the arrangement strategy. Seven out of those ten participants changed their strategy use moving from the two-instruction task to the five-instruction task. Participants who did not change strategies either used the pointing strategy (4 participants) or no strategy (3 participants). These participants were able to correctly recall most instructions for the two-instruction task but were unable to correctly recall most instructions for the five-instruction task. The remaining three participants did not use a strategy for the two-instruction task but were able to correctly recall the instructions. For the five-instruction task, they began using a strategy. The “first strategy used” by these participants were pointing strategy (1 participant), manipulating strategy (1 participant), and pointing strategy (1 participant). The “last strategy used” by all three participants was the manipulating strategy. These participants were unable to correctly answer all instructions.

Discussion

This study examined how children with moderate, mild mental retardation changed their strategies when dealing with more difficult recall tasks as well as determining the factors involved. Individual differences were found for changes in external memory strategies. As displayed in Table 1, eight patterns were observed in memory strategy use changes from the nine trials beginning with the two-instruction task, followed by the first strategy used in the five-instruction task, and finally the last strategy used in the five-instruction task. Different patterns in strategy changes likely occurred due to the nine trials of the same recall task. Previous research on memory strategies used by children with mental retardation may not have been able to see these changes due to the low number of trials. Strategy changes in children with learning disabilities have been studied using the Tower of Hanoi task (Wansart, 1990). Subjects were 10 to 12 year-old children with learning disabilities. They were presented with three types of Hanoi tasks with three different initial and goal states. Participants were given ten trials for each type of task for a total of thirty trials. Analysis of the participants’ problem solving behaviors revealed that during the last trials, all participants were effectively utilizing means-ends analysis. Similar to the aforementioned study, our study demonstrates that children with moderate, mild mental retardation can learn strategies by repeating trials and can utilize more effective strategies to solve problems.

Next, we examined the differences between the participants who were able to use the most effective external memory strategy, arrangement strategy with those who were unable to use the strategy during the recall task. Eight participants utilized the arrangement strategy in this study. Excluding two participants who used the arrangement strategy for both the two-instruction task and the five-instruction task, the other participants changed strategies when moving on from the two-instruction task to the five-instruction task. This indicates that participants were able to alter their strategies in response to tasks of increasing difficulty. The participants who changed strategies were not using the most effective strategies in the beginning. The strategies were object-oriented such as holding the object or gathering the objects in one area. As a result, during the five-instruction task the participants were unable to provide correct responses at first. We hypothesize that the participants realized from their incorrect responses that they needed to shift their focus to the target as well as the objects and

adopted an arrangement strategy. This type of shift in attention in response to the recall task likely played a role in changing strategies to use the most effective strategy.

On the other hand, there were ten participants who were unable to adapt to the increased difficulty and continued to use one strategy or did not use external memory strategies. These participants continued to provide incorrect responses for the five-instruction task. There are likely two factors involved in these results. First, the participants were unable to properly judge their own errors. This study does not provide feedback for erroneous recalls. There is a possibility that participants did not realize they were making errors. Another possibility is that even if the participants realized their errors, they were overly attached to their initial strategy and could not direct attention towards the characteristics of the recall task. For example, participants may have directed their attention towards “focusing on the moveable objects” or “listening carefully to the instructions.”

This study demonstrates that children with moderate, mild mental retardation can perform recall tasks using external memory strategies. Furthermore, some participants are able to switch to a more effective strategy in response to the increasing difficulty of the task. In the future, it will be necessary to examine the possibilities of strategy transfer as well as to develop supportive methods for those who did not use the most effective memory strategy.

References

- Bray, N. W., Saarnio, D. A., Borges, L. M., & Hawk, L. W. (1994) Intellectual and developmental differences in external memory strategies. *American Journal on Mental Retardation*, 99, 19-31.
- Fletcher, K. L., & Bray, N. W. (1995) External and verbal strategies in children with and without mental retardation. *American Journal on Mental Retardation*, 99, 363-375.
- Fletcher, K.L., Huffman, L. F., & Bray, N.W. (2003) Effects of verbal and physical prompts on external strategy use in children with and without mild mental retardation. *American Journal on Mental Retardation*, 108, 245-256.
- Harris, J. E. (1980) Memory aids people use: Two interview studies. *Memory and Cognition*, 8, 31-38.
- Intons-Peterson, M. J., & Fournier, J. (1986). External and internal memory aids: When and how often do we use them? *Journal of Experimental Psychology: General*, 115, 267-280.
- Wansart, W. L. (1990) Learning to solve a problem: A microanalysis of the solution strategies of children with learning disabilities. *Journal of Learning Disabilities*, 23, 164-170.