# The Neuropsychological Significace Of Mi In Relation : To Attentional Deficits On RT Perfomance



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| その他のタイトル | 注意障害がMotor Impersistenceに及ぼす影響 |
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| journal or publication title | 教育科学セミナリー |
| volume | 24 |
| page range | 27-41 |
| year | 1992-12-15 |
| URL | http://hdl.handle.net/10112/00019467 |

# The Neuropsychological Significance Of MI In Relation To Attentional Deficits On RT Performance

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## INTRODUCTION

Motor impersistence (MI) was originally coined by Fisher (1956), to designate a disorder after Oppenheim (1895) reported the phenomenon. That is l inability to sustain certain voluntary motor acts such as closing of the eyes, protruding of the tongue, central or lateral gaze fixation, or making a prolonged "ah-" sound. Basing the efforts for its standardization by Joynt, Benton, Fogel in 1962, and Ben-Yishzy, Diller, Gerstman & Haas in 1968, Benton, Spreen, Varney, and Hamsher (1983) developed a test of more objective measurement for MI.

Recent works have suggested that MI, as well as unilateral spatial neglect, is due to right hemisphere brain damage. For example, Joynt, Benton and Fogel (1962) found that motor impersistence was present in 26% of bilateral hemispheric brain disease patients, 26% of patients with right hemisphere lesions, and 19% of the case with left hemisphere disease. Furthermore, [注1] "marked motor impersistence"(1) was shown by 6 % of left hemisphere patients compared to 15% of the right hemispheric cases and 16% of the bilateral and diffuse cases. Later, research by Hirai & Komatu (1983) found that 30 % of CVA patients showed symptoms of MI.

However, the neuropsychological significance of MI is still far from clear despite most of recent studies suggested that the mechanism of MI

[注1] (1) Joynt RJ, et al: "Behavioral and pathological correlated of motor impersistent". Neurology 12: 876-881, 1962 can be attributed to attention deficits. MI has variously been considered as a form of apraxia that results from impaired cortical control movement, or as an expression of a weakness in attention and concentration (Benton, Spreen, Hamsher, & Varney ,1983). The mechanism of MI has also been viewed as expression of variability of mental function or distractivity of attention, as is likely seen in patients with cortical disease (Yamadori, 1984). While most theories relate MI to attention deficit, Carmon (1970) stated that MI could occur as a consequence of utilization of proprioceptive information about the spatial location of one's body parts, and Levin (1973) suggested a relationship between MI and performance on a proprioceptive feedback task in patients with right hemisphere lesion.

Unilateral spatial neglect (USN), another major neuropsychological sign caused by right hemisphere, is characterized by failure to respond to or acknowledge stimuli on one side of a individual's extrapersonal space. The neuropsychological mechanism is related to dysfunction of arousal and attentional mechanisms (Heilman, 1985). According to Mesulam (1985), the process of attention is a composite of two major components; "a matrix or state function" and "a vector or channel function". The former is considered general attention, which regulates overall information processing capacity, detection efficiency, focusing power or vigilance level : and the latter is directed attention regulating the direction and target of attention in any one of the behaviorally relevant spaces. Clinically, a severe impairment of the entire matrix of attention can result in an " acute confusional state ", in which patients show distractivity of attention, impersistence, perseveration, or cognitive and behavioral disturbance. The major clinical picture of defficits in the vector aspect of attention is unilateral neglect which is more associated with the distribution of attention in extrapersonal space. He suggests that the disability for directing the focus of awareness toward behaviorally relevant sensory events in extrapersonal space, may be significantly involved in the emergence of USN.

In this study, we attempted to elucidate the neuropsychological significance of MI in relation to the mobilization of attention by giving reaction time (RT) experiments to patients with right hemisphere damage. RT test is now widely utilized as a useful neuropsychological indicator for mobilizing attention.

## METHODS

I. Subjects

42 right-handed CVD patients (21males and 21 females), with CT-confirmed right hemisphere lesions, were involved in this study. Their average age is (57.56, SD±11.89), all having completed compulsory 8 years education. They were tested at least one month post stroke and had no motor weakness of the right hand nor lower cranial nerve signs which could influence their testing performance.

2. Procedure

All subjects were given our neuropsychological test battery at admission to the hospital. The battery included tasks for MI, USN, and attention.

< 2a. MI >

In order to test the presence or absence of motor impersistence, four tasks were given to the subjects. The tasks were :

(1) keeping eyes closed (two 20-seconds trials)

(2) protruding tongue with blindfolded (two 20-seconds trials)

(3) protruding tongue with keeping eyes open (two 20-seconds trials)

(4) fixation of gaze in both left and right lateral visual fields (one 30 second trial of each side).

The administration of the tasks was originally devised by Benton, Spreen, Varney, and Hamsher(1983). More than one failure out of the four tasks was judged to indicate the presence of MI.

< 2b. USN>

Following tasks were utilized for detecting whether the subject has USN;

Table 1: Sammary of clinical data for patients with right hemisphere lesion

| Case | Age | Sex | Hand | On set of illness | Diagnosis |
|---|---|---|---|---|---|
| 1 | 67 | M | R | 38 days | Infarction |
| 2 | 42 | M | R | 42 | " |
| 3 | 46 | M | R | 43 | Hemorrhage |
| 4 | 68 | M | R | 44 | " |
| 5 | 59 | F | R | 46 | Infarction |
| 6 | 61 | M | R | 50 | " |
| 7 | 44 | F | R | 71 | Hemorrhage |
| 8 | 65 | F | R | 76 | " |
| 9 | 56 | F | R | 84 | " |
| 10 | 60 | M | R | 90 | Infarction |
| 11 | 47 | M | R | 91 | Hemorrhage |
| 12 | 65 | F | R | 94 | Infarction |
| 13 | 62 | F | R | 97 | " |
| 14 | 71 | M | R | 98 | Hemorrhage |
| 15 | 68 | F | R | 98 | Infarction |
| 16 | 54 | M | R | 102 | Hemorrhage |
| 17 | 49 | M | R | 107 | Infarction |
| 18 | 34 | F | R | 108 | Hemorrhage |
| 19 | 40 | M | R | 109 | " |
| 20 | 74 | M | R | 110 | Infarction |
| 21 | 72 | M | R | 112 | " |
| 22 | 63 | M | R | 122 | " |
| 23 | 71 | F | R | 124 | " |
| 24 | 47 | M | R | 129 | Hemorrhage |
| 25 | 49 | F | R | 139 | " |
| 26 | 70 | F | R | 149 | Infarction |
| 27 | 51 | F | R | 153 | " |
| 28 | 57 | F | R | 158 | " |
| 29 | 57 | F | R | 158 | " |
| 30 | 76 | F | R | 163 | " |
| 31 | 50 | F | R | 167 | Hemorrhage |
| 32 | 72 | M | R | 171 | " |
| 33 | 62 | M | R | 184 | " |
| 34 | 59 | M | R | 206 | " |
| 35 | 46 | M | R | 229 | Infarction |
| 36 | 23 | F | R | 257 | Hemorrhage |
| 37 | 70 | F | R | 270 | " |
| 38 | 78 | F | R | 375 | Infarction |
| 39 | 66 | M | R | 414 | " |
| 40 | 55 | M | R | 434 | " |
| 41 | 63 | F | R | 435 | " |
| 42 | 64 | F | R | 2577 | " |

(1) Line bisection. Either omitting to bisect the lines or shifting the bisected points on conrtalesional fields is regarded as USN. (See Figure1)

(2) Copying a picture of a flower. Omitting or distorting of the picture in a conrtalesional side are regarded as USN (See figure2).

(3) Copying a picture of a cube. Omitting or distorting of the picture in a conrtalesional side are regarded as USN (See Figure3).

(4) Three-dimensional block construction using models. Omittion of the blocks in contralesional side is as USN.

More than one failure out of these four tasks was considered as a sign of USN.

< 2c. Reaction time (RT) as the attention tasks)

Subjects were asked to press a single button as quickly as possible with their right index finger whenever a visual target stimulus appeared on the video monitor. A total of 33 target stimuli presented as one block ( circles, triangles, and squares each) were shown at the central fixation point at eye level. The occurrence and duration of these types of target stimuli were randomized by computer, and responses that occurred between 135 and 1269 milliseconds following target onset were recorded.

All RT testing were performed in a acoustically treated room with controlled temperature and lighting. Subjects sit upright in a wheel chair and press a single button response panel in front of their right hand. Each subject completed a training onset as an initial warm up block of 33 trials to achieve an asymptotic level of performance.

To evaluate SRT, the subjects were instructed to press the button as quickly as possible after they detect any of the visual stimuli ( all of circle, triangle, and square shaped targets) on the monitor. After the training block, the subjects were required to complete a block of 33 trials with 1 minute break between blocks. Each block lasted approximately 3 minutes.

The CRT measures RT in response to one of the three types of all targets. In the training block, the subjects were required to respond only to circle shaped targets, which occurred randomly in 11 out of 33 trials. As with the SRT task, the first block of 33 trials was regarded as

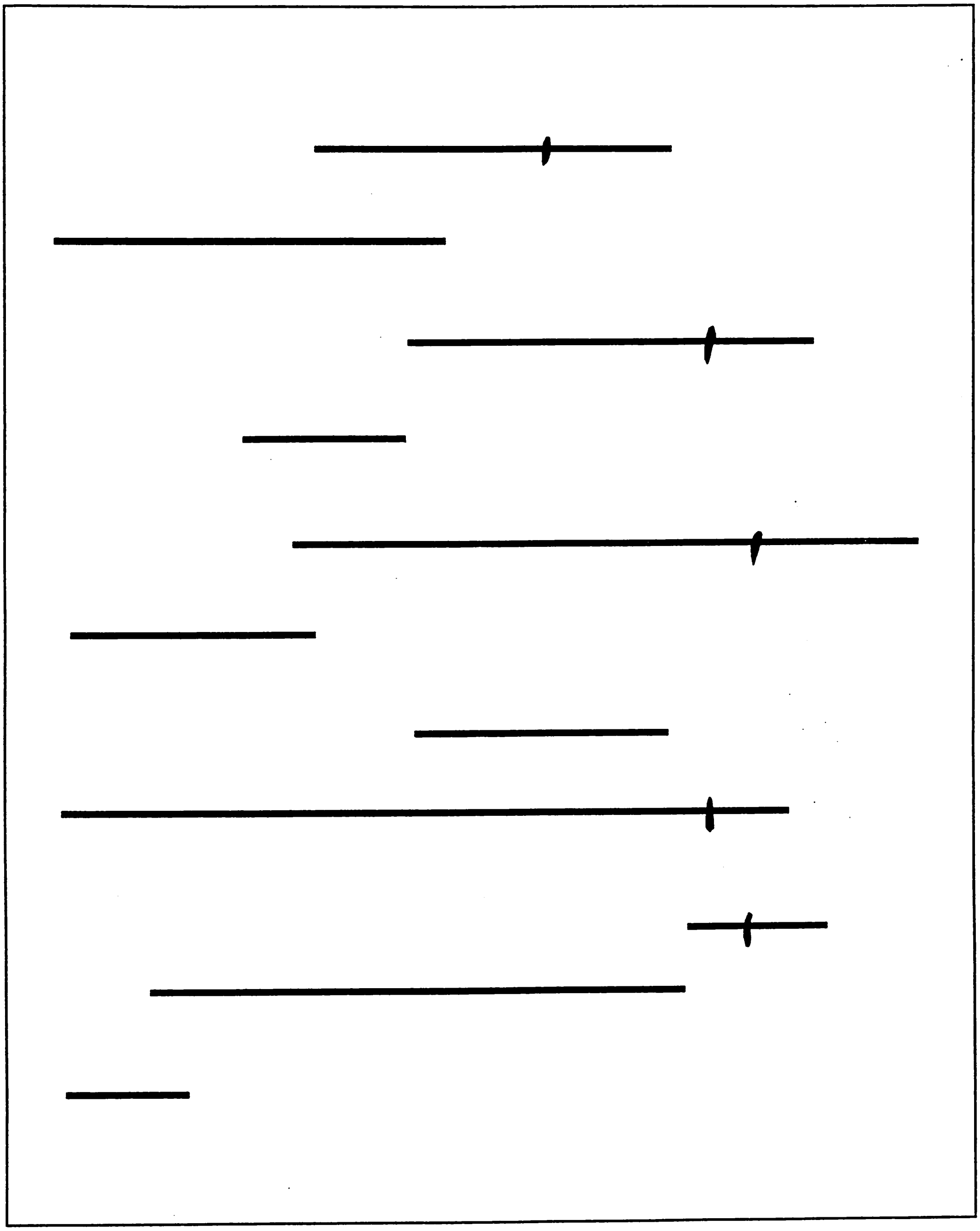

Figure 1: line bisection

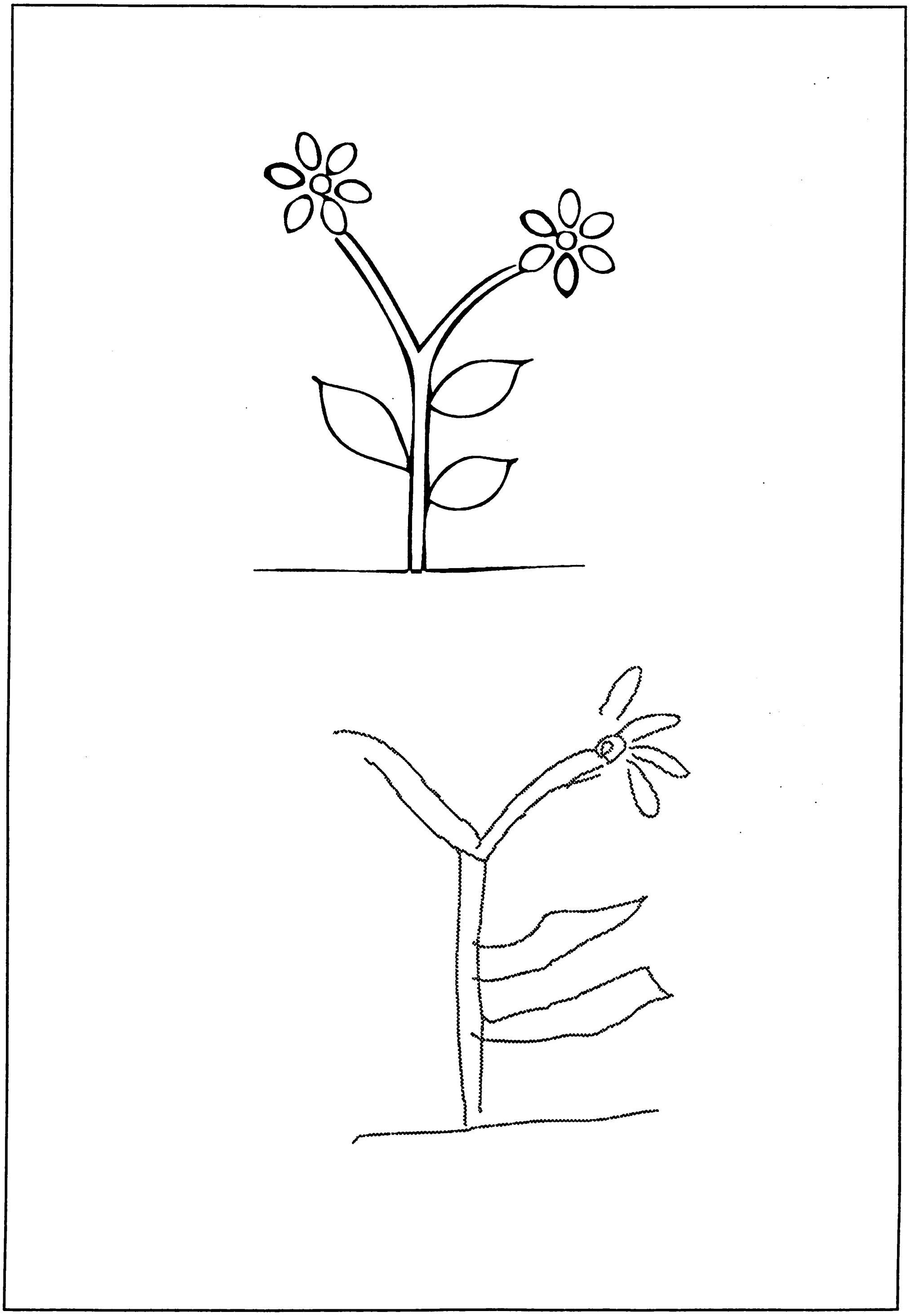

Figure 2 : copying a flower

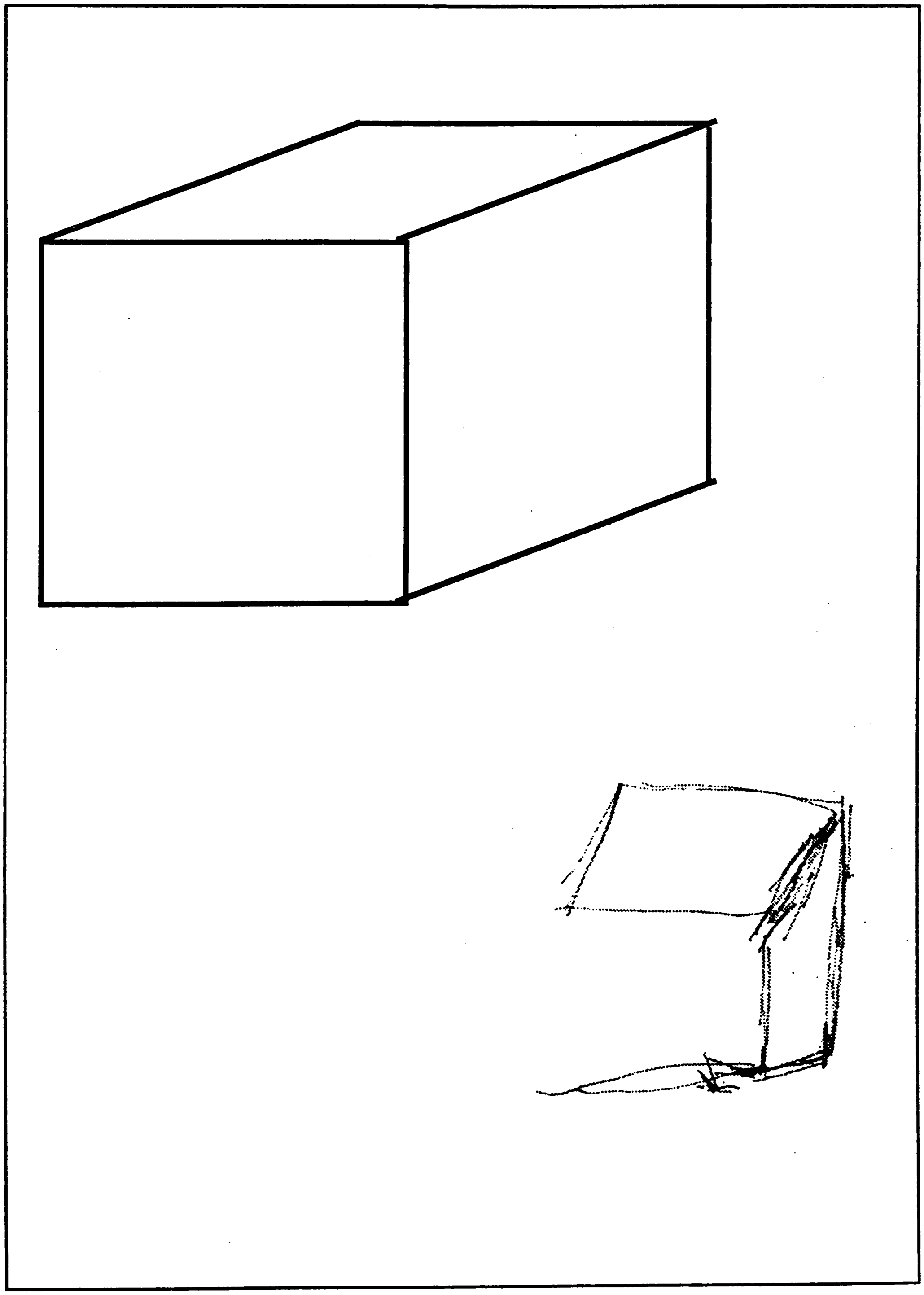

Figure 3 : Copying a cube

training, and the following 2 blocks of 33 trials, that measured the CRT responding to triangle and square shaped targets, were recorded.

Stimuli were generated by an MSX microprocessor and displayed on a 14 inch video monitor. The computer recorded responses and response latencies, and sent the data to the printer adjacent to the computer in order to be displayed on papers. Finally the data was stored on a ma-genetic disk for subsequent analysis.

## RESULT

Five subjects out of a total of 42 failed to complete the RT test because of the following reasons: 2 subjects failed to detect the visual targets due to their visuo-spatial disorder and palinopsia, and 3 failed to continue the overall trials because of the apparent lack of maintaining the ability to concentrate on the task. Therefore, the only 37 subjects were treated for the subsequent statistical analysis.

Eleven subjects out of 37 (29.7%) showed signs of only MI (the MI group), and 12 subjects (32.4%) presented symptoms of both MI and USN (the MI & USN group). Whereas 9 subjects (24.3%) showed neither MI nor USN (the NONE group), 5 cases (13.5%) resulted in the presence of only USN (the USN group).

Table 2 is a summary of mean, and SD of SRT for each group, and Table 3 is these of CRT for all groups. It is revealed that the SRT is significantly faster than CRT in every group (see Figure 4).

Analysis of variance was used to examine the responses the group ( MI, USN, MI&USN, and NONE) in SRT and CRT testing. In addition, Fisher's PLSD was assessed as a posterior comparison test.

The analysis revealed no significant main effect between the groups in the mean SRT whereas there was a significant main effect of the groups, $F (3,33) = 3.497$, $P \leqq .05$ in the mean CRT. The results showed that the slowest CRT group was the MI&USN group (582.4msec. ; SD 161.467), followed by the USN (466.74 ; SD65.048), the MI (457.636 ; SD

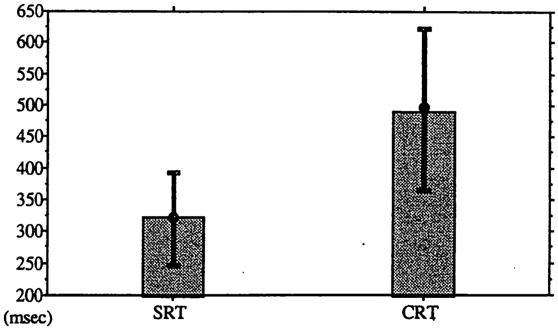


Figure 4: Mean difference of SRT and CRT on total subjects

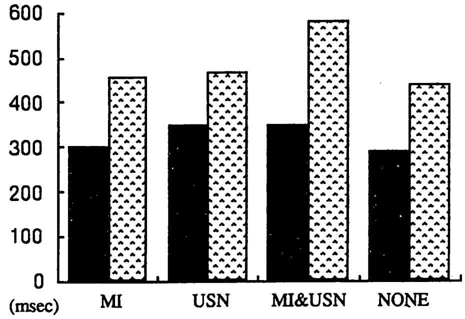


Figure 5: RT as a funcion of groups (MI, USN, MI&USN, and NONE)



Table 2: Means and SD of SRT for groups ( MI, USN, MI&USN, and NONE)

| Group | Count: | Mean: | Std.Dev: |
|---|---|---|---|
| MI | 11 | 302.545 | 66.134 |
| USN | 5 | 348.78 | 94.626 |
| MI&USN | 12 | 349.6 | 68.17 |
| NONE | 9 | 291.377 | 70.871 |

Table 4 : Multiple comparisons of mean differnce of SRT

| Comparison | Mean Diff: | Fisher PLSD: |
|---|---|---|
| MI vs. USN | -46.235 | 78.966 |
| MI vs. MI&USN | -47.055 | 61.114 |
| MI vs. None | 11.169 | 65.805 |
| USN vs. MI&USN | -.82 | 77.931 |
| USN vs. NONE | 57.403 | 81.662 |
| MI&USN vs. NONE | 58.223 | 64.559 |

Table 3: Means and SD of CRT for groups ( MI, USN, MI&USN, and NONE)

| Group | Count: | Mean: | Std.Dev: |
|---|---|---|---|
| MI | 11 | 457.636 | 95.717 |
| USN | 5 | 466.74 | 65.048 |
| MI&USN | 12 | 582.4 | 161.467 |
| NONE | 9 | 441.378 | 66.358 |

Table 5 : Multiple comparisons of mean differnce of CRT

| Comparison | Mean Diff: | Fisher PLSD: |
|---|---|---|
| MI vs. USN | -9.104 | 125.355 |
| MI vs. MI&USN | -124.764 | 97.016* |
| MI vs. None | 16.259 | 104.463 |
| USN vs. MI&USN | -115.66 | 123.712 |
| USN vs. NONE | 25.362 | 129.635 |
| MI&USN vs. NONE | 141.022 | 102.485* |

* Significant at 95%

95.717), and the NONE(441.378 ;SD 66.358), (See Figure 5). Thus the multiple comparison test was used to assess the mean differences between group. The USN group did not differ significantly from the MI & USN group. On the contrary, when comparing the results of subjects with the MI and the MI & USN, the 124.764 msec difference was significant ( $P \leqq .05$). Similarly there is the 141.022 significant difference between the MI & USN group and the NONE group ( $P \leqq .05$). The summaries of the comparison of the mean difference and Fisher PLSD on SRT/CRT each group are shown in Table 4 and 5.

## DISCUSSION

Since the MI group was 29.7% of the total subjects and the MI & USN group was 32.4% of those, a total of 62.1% of the patients with right hemisphere brain lesion showed signs of MI. Moreover, all of the five subjects who failed the RT task also showed the presence of MI. Thus approximately more than 65% of the total patients with right hemisphere lesions show the presence of MII. This number is significantly larger than the results from other studies, such as Ooe et al. (1992), Hirai (1987. 1983), or Mori, Yamadori, and Mitani (1983), because patients with more severe neurological deficits are referred to our institution.

However, our present confirms provide some support for the hypothesis that MI is one of most common right hemisphere syndrome. As Hirai (1983) argued, although USN is a rather common syndrome resulting from right hemisphere lesion, our study showed MI to occur more often than USN.

In the CRT task, only the MI & USN group is significantly slower than the NONE and the MI groups despite the fact that there was no significant difference in the SRT task among the four groups. This result implies :

(1) Both MI and USN could be involved in disorder of attention observed in right hemisphere damage, because neither the MI group nor

the USN group were different from the NONE group for CRT measurements. This finding, in turn, is in favor of some recent studies in which MI results from disorder of attention.

(2) Nevertheless attention deficits cannot totally explain the neuropsychological process of MI. If the immobilization of attention is the sole reason for MI, the MI group should show slower SRT and CRT than the NONE group. However, there is no significant mean difference of both CRT and SRT between the two groups. In other words, the right hemispheric patents with MI did not perform differently from the patients without MI in the RT tasks. It may be partly explicated that MI would not simply result from attention deficits and could be generated by other neuropsychological mechanisms.

(3) Another discussion in place for the no significant CRT mean difference between the MI and NONE and also between the USN and the NONE, is the clinical pictures of the NONE group. The NONE group does not mean that they do not show neulopsychological abnormalities including attention disorder. In fact, the NONE group in this study was slower in SRT and CRT as compared with 9 normal control subjects' SRT (mean = 222.7 , SD = 17.2) / CRT( mean = 375.3, SD = 32.4 ), although the definite statistical validity is still required for future studies. As a result, the NONE group should not be treated as control group without attention deficits.

(4) SRT requires the general attention, that is what Mesulam called the "state function"; the concept of tonic attention which is generally associated with distractivity or impersistence of attention. On the other hand, the performance in CRT involves more complex covert orientation of visual attention, that is a composite process of engagement of attention, concentration, and reorienting ( disengagement and re-engagement of attention). Therefore in CRT involved not only "state function" but also an interaction with selective attention that is called "channel function" by Mesulam. As a result, CRT is a more complicated attentive task, in which patients with more severe disorders of attention shown difficulty in completing the tasks.

In addition, it is interesting fact that the 5 subjects who failed the RT tasks all show motor impersistence. This can be at least partly accounted for the hypothesis that the performed in RT tasks too slowly to catch up with the consecutive visual stimuli, and that subjects may be associated with motor impersistence. In order to complete the RT task, concentration, durability and motivation are required. According to Hirai (1983), patients with motor impersistence tend to show a lack of initiative, lower durability, and emotional lability. These phenomenon negatively affect their successful completion of tasks.

## SUMMARY

In this study, we attempted to explain the neuropsychological significance of MI in relation to the attention defficits. Subjects with right hemisphere brain damage were given RT tests as the attention tasks, in addition to be assessed the presence of MI and USN. The result showed that MI, as well as USN, commonly occurred as a right hemisphere syndrome. Moreover, this study suggested that attention deficits will be important to explain the neuropsychological mechanisms of MI, but also possibly indicated that other neuropsychological processes might be related to the emergence of MI.

## REFERENCES

Benton A., Hamsher K., Varney N. R., and Spreen O., Contributions to Neropsychological Assessment, Oxford university press, New York, (1983).

Ben-Yishay Y., Diller L., Gerstman L. & Haas A., "The relationship between impersistence, intellectual function and outcome of rehabilitaion in patients with left hemiplegia", Neurology 18: 852-861, (1968).

Bey-Yishay Y., Haas A. & Diller L., "The effects of oxygen inhalation on motor impersistence in brain-damaged individuals", Neurology 17: 1003-

1010, (1967).
Carmon A. "Impaired utilization of kinesthetic feedback in right hemisphere lesions: possible implications for the pathophysiology of "motor impersistence", Neurulogy 20: 1033-1038, (1970).
Heilman K. M. and Valenstein E., Neglect and related desorders In: Clinical Neuropsychology, Oxford University Press, New Yord, 268-307, (1979).
Hirai S. and Komatu M., "Motor impersistence", Sogo Rihabilitaion, 11: 697-701. (1983).
Hirai S., Sakai Y., and Hatta M., "Motor impersistence", Shinkeishinrigaku, 3:
11-17, (1987).
Joynt R. J., Benton A. L. & Fogel M. L., "Behavioral and pathological correlates of motor impersistence", Neurolgy 23: 876-881, (1962).
Karnath H. O., "Dificits of attention in accute and recovered visual hemi-neglect", Neuropsychologia 26: 27-43, (1988).
Lopez O. L., Becker J. T., and Boller F., "Motor impersistence in Alzeheimer's disease", Cortex 27: 93-99, (1991)
Levin H., "Motor impersistence and proprioceptive feedback in patients with unilateral cerebral disease", Neurology 23: 833-841, (1973).
Misulam M. M., Attention, confisional states, and neglect : In Principles of Behavioral Neurology, F. A. Davis Company, Philadelphia, 125-168, (1985).
Mori E., Yamadori A., and Mitani Y,. "Behavior - neurological syndromes after acute infarction in the right middle cerebral artery territory", Shinkeishinnrigaku, 3: 198-208, (1987).
Ooe Y. et al., "Motor impersistence to chuishougai ni tuite", At: the 16th Conference of neuropsychology. (1992)
Oppenheim H., "Zur Symptomatologie der Pseudobulbarparalyse", Neurologisches Centralblatt 14: 40-41, (1895).
Robertson I., "Anomalies in the laterality of omissions in unilateral left visual neglect: implications for an attentional theory of neglect", Neuropsychologia, 27: 157-165, (1989).

Roeltgen M. G., Roeltgen D. P., and Heilman K. M., "Unilateral motor impersistence and hemispatial neglect from a right striatal lesion", Neuropsychiatry, Neuropsychology, and Behavioral Neurology, 2: 125-135, (1989).

Yokoyama K. and Sumimura M., "Deficits of attention involved in anterograde memory disorders of patients of Alzheimer disease", Shinkeishinrigaku 5: 40-46, (1989).

Yokoyama K. et al., "Lack of heart rate changes during an attention-demanding task after right hemisphere lesions", Neurology, 37: 624-630, (1987).