

Role of Inhibition Functions in Elderly Drivers' Pedal Misapplication

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This document is based on the following research presentation.

Kimura, T., and Shinohara, K. (2012). Pedal misapplications by older drivers induced by difficulty with inhibition function. *Proceedings of 4th Automotive User Interferences and Interactive Vehicular Applications*, 269 — 272

<https://dl.acm.org/citation.cfm?id=2390301>

Main Contents of This Study

☞ Evaluating and Comparing Cognition Functions of Younger and Older People

☞ Focus on “inhibition functions” among cognitive functions

- Multiple number of tasks executed for evaluating inhibition functions

☞ Results

- Differences in inhibition functions of younger and older people
- Older people tend to face difficulties with inhibition
- Possibility suggested that accelerator/brake pedal misapplication may be related to cognitive functions



☞ Importance of development of method of evaluating inhibition functions and education and training related to driving

Awareness of the Issue (1): Relationship between pedal misapplication and cognitive functions

One cause of occurrence of pedal misapplication

☞ Unable (it is difficult) to execute evasive action when it is found that a “mistake” has been made

(Example) Possibility of stepping on the accelerator!

→ Stop stepping on the accelerator and move the foot away from it.

(avoidance of mistake)

→ Continue stepping on the accelerator, not stopping the act.

(occurrence of a mistake)

Awareness of the Issue (2): Difficulty in stopping the act and recognizing the issue.

Stopping the act = Inhibition



One of the cognitive functions known in psychology

“Inhibition function”

It is a function related to the control of behavior, and in this study, it refers to stop (inhibit) executing a certain decision/action and executing a different decision/action.



Focus on the differences in the inhibition function of the younger and older people, and make comparisons

Evaluation of the Inhibition Function

☞ Simon Task (Simon, 1990)

☞ Stroop Task (Stroop, 1935)

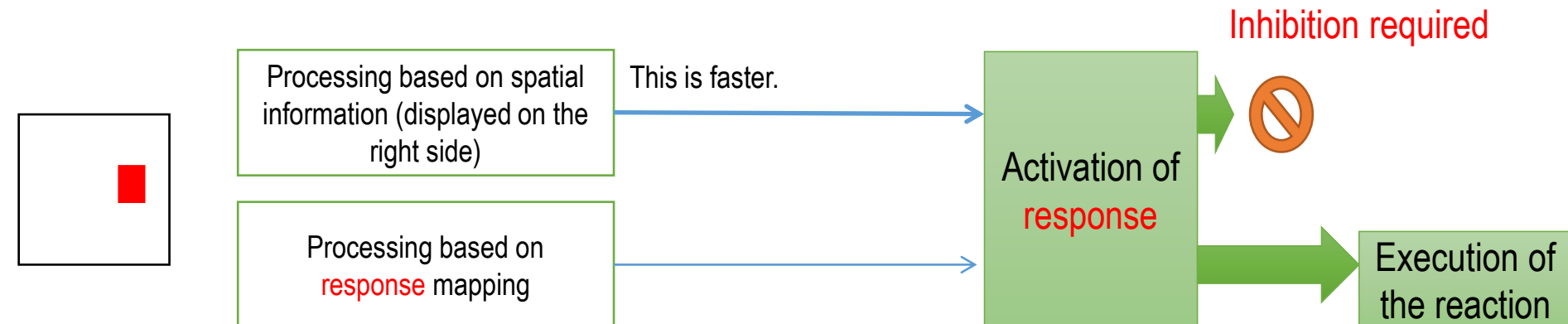
☞ Stop Signal Task (Verbruggen, Logan, and Stevens, 2008)

Simon Task

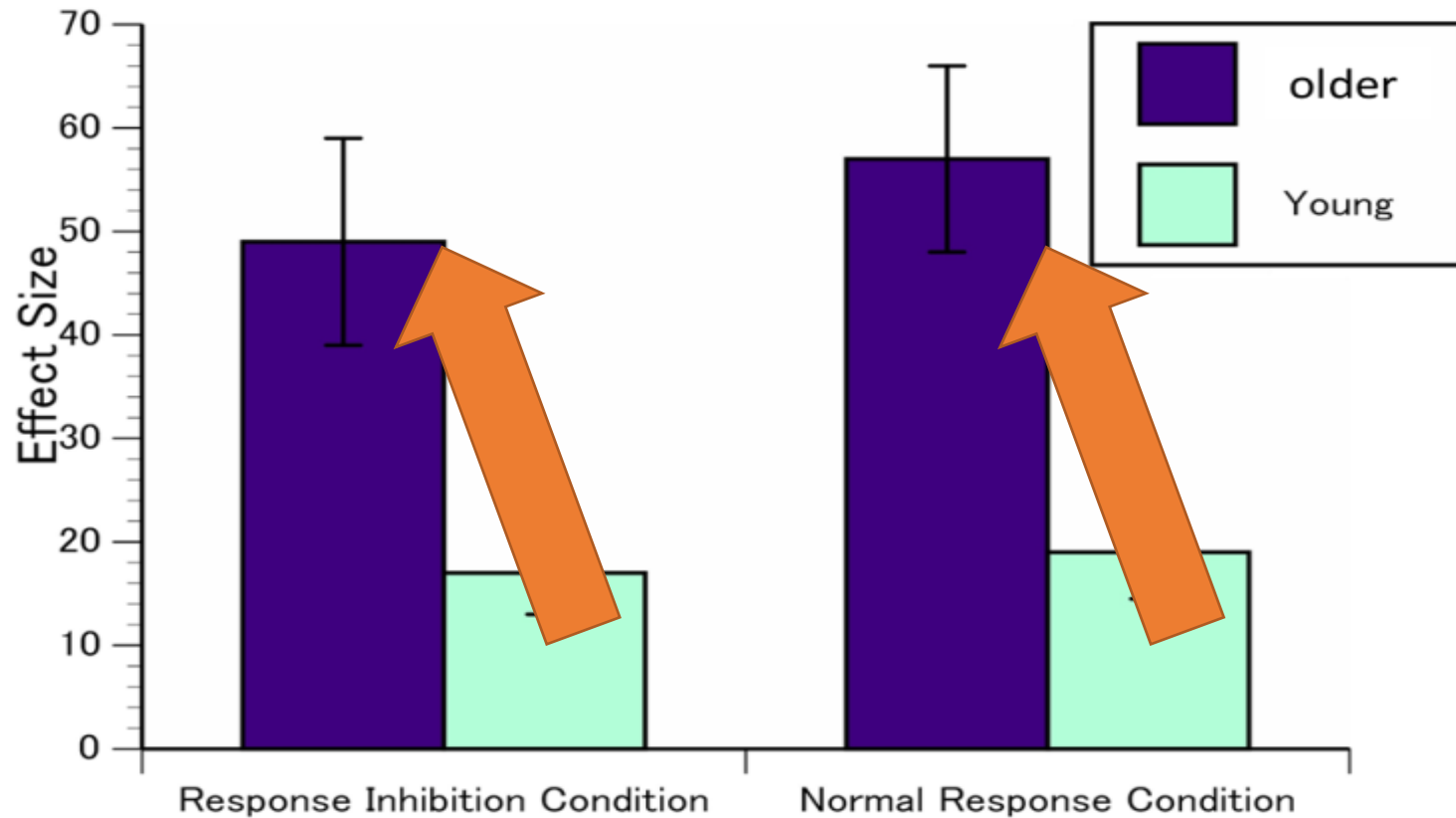
Inhibition task using spatial information

(Example) ■ = left, ■ = right

- ☞ **Response** mapping forms “left.”
- ☞ ■ may sometimes be displayed on the right side (see the figure below)
- ☞ If spatial information and **response** mapping are incompatible, inhibition is necessary.



Result of the Simon Task



Suggests that inhibition is more difficult for older people

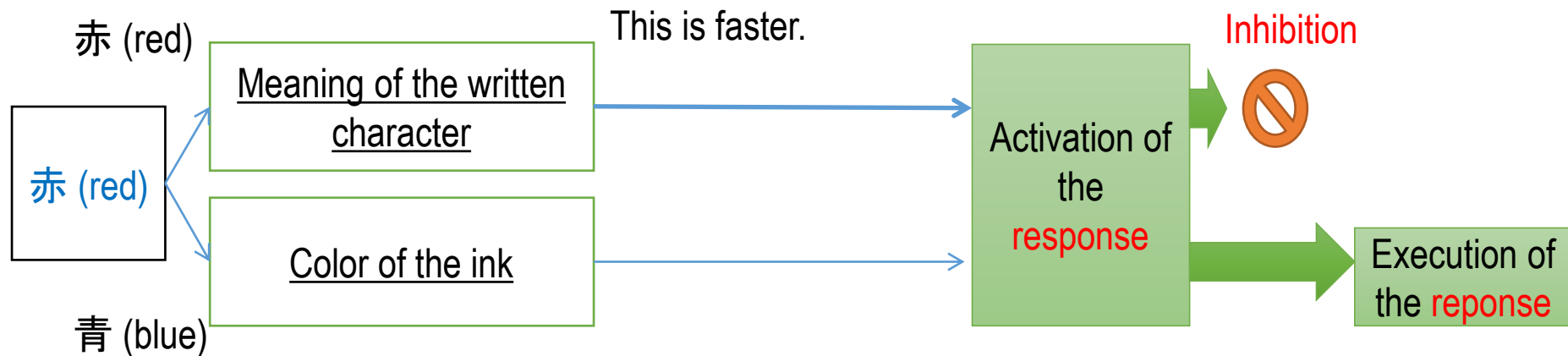
Stroop Task

The “color of the written character” and the “meaning of the written character” are incompatible.

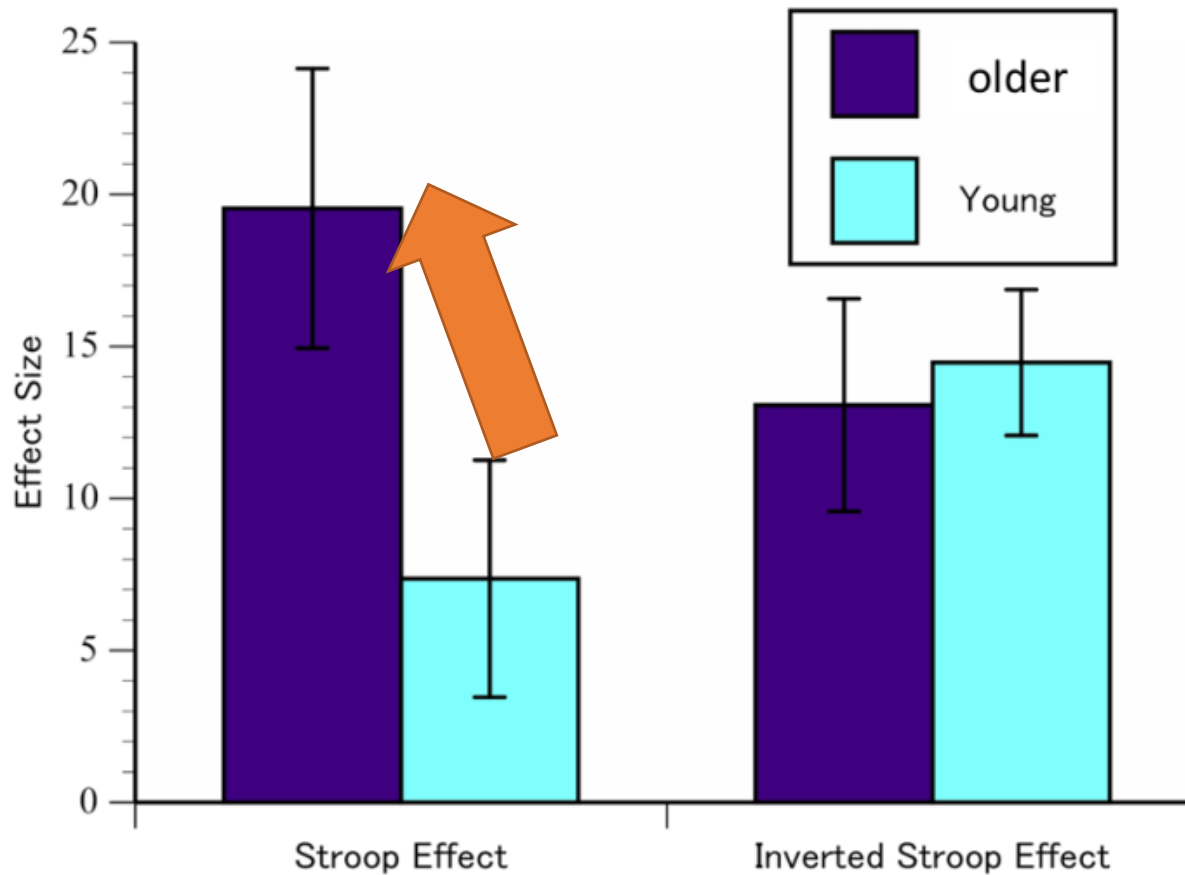
Color of the character: 赤 (red) → blue

Meaning of the character: 赤 (red) → red

☞ Because the meaning of the character is activated, it is necessary to inhibit the “meaning” when answering for the “color.”



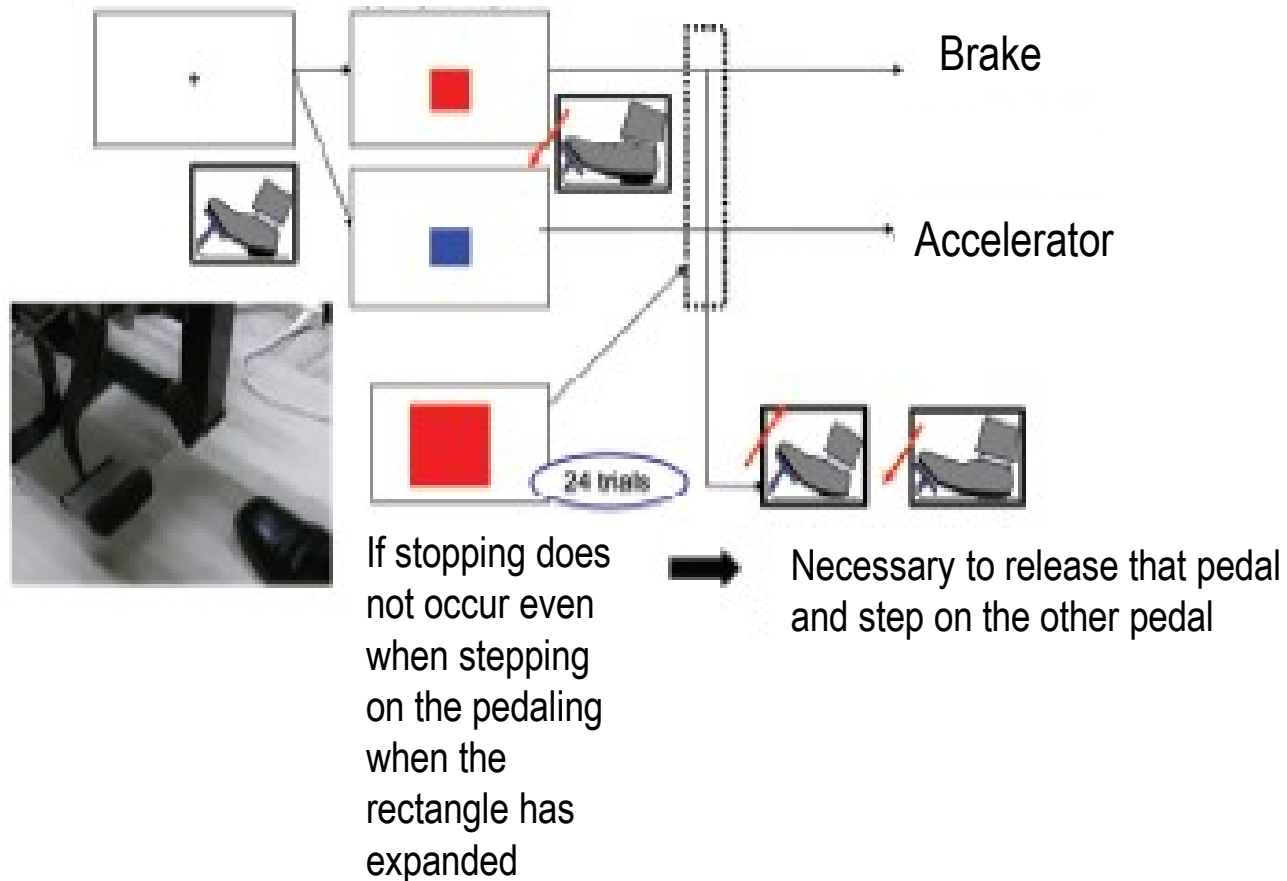
Result of the Stroop Task



The Stroop effect is larger for older people, but differences are not seen in the inverted Stroop effect.

Pedal Operation Task

Pressing the appropriate pedal required when the rectangle expands

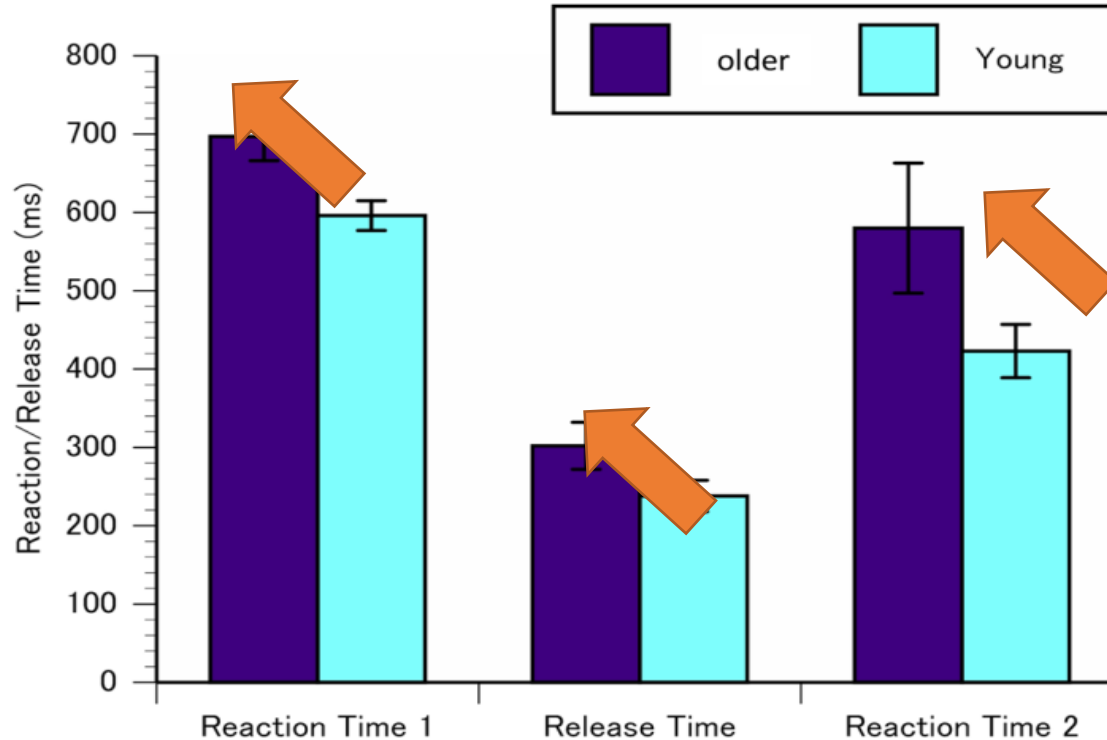


Results of the Pedal Operation Task

RT 1: Reaction time until the first pedal is pressed

Release time: Time for moving the foot away from the first pedal

RT 2: Reaction time until the next pedal is pressed



In either case, it took longer for the older people than the younger people.

Discussion

Results indicated that there are differences in the inhibition function between younger and older people.

The relationship between driving an automobile and the **executive** function has also been shown **in the previous studies** (Pollard and Sussman, 1989; Freud et al., 2008; Lococo et al., 2012)



It is thought that the inhibition function taken up in this study also reflects **the executive** function.

Future research

- (1) Education and training for understanding the changes in the inhibition function and applying that to driving are sought.
- (2) It is necessary to study the development of screening methods with regard to changes in the inhibition function.