

# 産業安全のマネジメント

: 注意の個人差測定に基づく対策の提案

## Industrial safety management: measuring individual differences in attention

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## Outline

- ▶ **Background:** The relationship between industrial safety and individual differences in attention.
  - How have Japanese industries prevented accidents?
  - How should unresolved issues be managed?
- ▶ **Research:** Developing the Compound Digit Checking Test (CDCT; 複合数字抹消検査)—an EASY tool for measuring attentional traits
  - What is CDCT?
  - How should the CDCT be used for industrial safety?
- ▶ **Conclusion:** Psychologists should be more involved in industrial safety management.

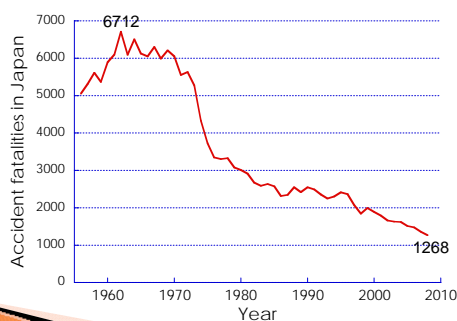
## How have Japanese industries prevented accidents?

- ▶ In the 1960s, workers who committed a human error were held responsible for accidents.
- ▶ The only countermeasure for such accidents was the dismissal of the worker from the workplace—the so-called **finger-pointing-type countermeasure** (責任追及型).
- ▶ Since nothing in the work environment was changed, except the worker's dismissal, similar accidents kept occurring repeatedly.

## How have Japanese industries prevented accidents?

- ▶ In the 1970s, new approaches for accident prevention were developed.
- ▶ An important assumption of these approaches was that “To err is human.”
- ▶ Therefore, in the error-inducing context, anyone in general can make mistakes.
- ▶ The countermeasure for such accidents was the removal of the cause of human error—the so-called **cause-investigation-type countermeasure** (原因追究型).

## Outcomes of the new approaches



## Unresolved issues of new approaches

- ▶ The number of countermeasures is large.
  - “Lateral spread (水平展開)” is a major strategy of the cause-investigation-type countermeasure.
  - However, this strategy increases the number of countermeasures successively.
- ▶ Individual countermeasures are less realistic.
  - Every worker is required to pay attention to all the countermeasures.
  - Workers cannot develop the attitude of “Me today, you tomorrow, (明日はわが身)” which is very important for preventing accidents.

## How should unresolved issues be managed?

- ▶ Hint: We are well aware of the following:
  - A high intake of salt increases the risk of developing hypertension.
  - A high intake of sugar increases the risk of developing diabetes.
  - Smoking increases the risk of developing cancer.
- ▶ Question: When do we become obsessed about these risks over our lives?
  - Answer: Some signs are detected by a physical examination!!
- ▶ The message “Be careful of EVERY risk” is NOT an effective warning.

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## How should unresolved issues be managed?

- ▶ We have proposed the “**trait-responsive-countermeasure**” (特性対応型).
  - This countermeasure gauges individual traits of information processing, particularly attentional function, and deals with workers’ tendencies on the basis of the results of the measurement.
  - ⇒ It emphasizes specific types of errors that have a higher risk of occurrence.
  - ⇒ It is more realistic because the measurement results have a scientific basis.

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## Developing the CDCT—an EASY tool for measuring attentional traits

- ▶ In the industrial field...
  - we cannot install proper equipments that we usually use in the laboratory.
  - the measurement time has to be made as short as possible.
- ▶ We have developed a Compound Digit Checking Test (CDCT複合数字抹消検査; Gyoba, Ohashi, & Morikawa, 1999).

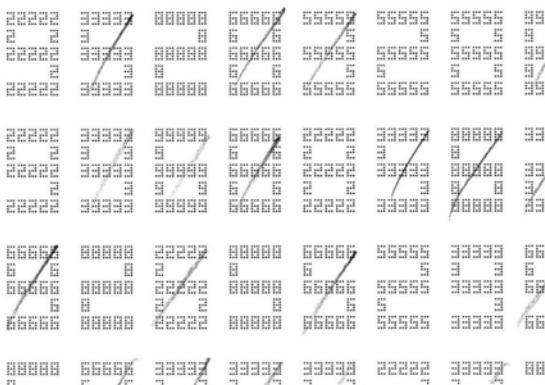
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## The CDCT is...

- A simple test that measures attentional ability
- ▶ 144 compound digit patterns are printed on each page of test sheets (totally 5 sheets).
- ▶ Each compound pattern comprises a global digit that contains 17–19 local digits.
- ▶ Subjects are required to look for “3” or “6,” which appears on the global or local level.
- ▶ The test comprising 5 sheets is to be completed within 15 minutes.

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## Sample of a CDCT sheet



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## Analysis of the CDCT

- ▶ Detection rates are calculated for the analysis of the CDCT.
- ▶ Index for the tendency of attentional allocation
  - G%: Global-target detection rate
  - L%: Local-target detection rate
- ▶ Index for characteristics of attentional switching
  - GG%: Global-target detection rate after global target
  - GL%: Local-target detection rate after global target
  - LG%: Global-target detection rate after local target
  - LL%: Local-target detection rate after local target

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## Research 1: Aging

- How does attentional control over global and local information decline with age?
- 65 subjects were tested (ages ranging from 23 to 54 years,  $M = 39.9$ ).
- Results:** Aging deteriorates the expansion of attentional focus severely, as indicated by the decrease in LG% (see Fig.1).

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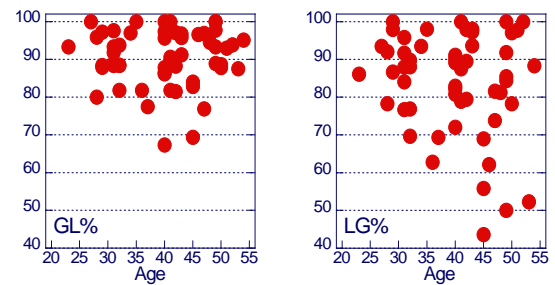


Fig.1: Scattergram of the detection rate (%) as a function of age. Left: GL%; right: LG%. Each symbol signifies the detection rate of a subject.

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## Research 2: Training tool

- Does the CDCT have a function of improving subjects' ability of attentional control?
- 33 subjects were divided into two groups, Control group performing a simple addition task and CDCT training group.
- Both groups were asked to answer attention-related tests before and after training.
- Results:** After CDCT training, the subjects were able to control or switch their attention more effectively or swiftly (see Fig.2).

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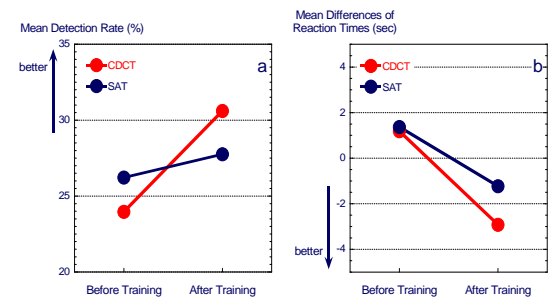


Fig.2: Comparisons between attentional performance before and after training. a: Proof reading Test (PRT); b: Group Embedded Figure Test (GEFT)

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## Summary of CDCT research

- We developed a simple test called CDCT for measuring the ability of attentional control over global and local information.
- From the CDCT data, we found that the ability of subjects at expanding attentional focus from local to global information tends to deteriorate with age.
- The CDCT is also useful as a training tool for improving attentional control.
- We are now applying the CDCT to some industrial fields, confirming usefulness of the CDCT for the industrial safety.  
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## How should the CDCT be used for industrial safety?

- In different kinds of workspaces, workers are required to pay attention to different objects.
- However, their attentional resources have severe limitations; therefore, workers should develop good control over their attentional performance.
- It is necessary to understand their own individual characteristics of attention and to train their attentional abilities accordingly for maintaining industrial safety.

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## One good example of the application of the cognitive measurement in the industry

- ▶ In Japan, professional drivers (bus, taxi, truck) are required to take a driving aptitude test on a timely basis.
- ▶ Driving aptitude test:
  - Questionnaire × 3
  - Performance test × 3
  - Physical test × 3
- ▶ Feedback based on the test results is provided to each driver with advice on accident prevention.
  - An example of such advice: You have a tendency to act before check. Try check-oriented driving.

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## Conclusions

- ▶ Measuring individual differences in cognitive skills is very significant for industrial safety.
- ▶ However, it is necessary to provide thorough instructions for the appropriate use of measurement (not for finger-pointing but for cause-investigation), so that individuals won't be dismissed on the basis of their results.
- ▶ Further studies will be needed to clarify the relationship between accidents and individual differences in cognition, in practical working situations.

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