



Proposal and Evaluation of a Method to Promote Organizational Learning to Foster a Safety Culture in Nuclear Power Plants

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1. Introduction

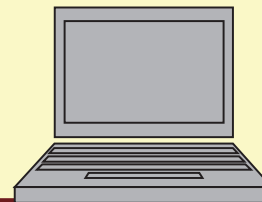
- Safety in nuclear power plants
 - The highest priority
- Human factors for safety
- A safety culture
 - necessary for safety in nuclear power plants.
 - defined as an

“assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive attention warranted by their significance.” (IAEA, 1991)



Learning activity

- Organizational learning activities are essential to foster a safety culture.
- Organizational learning
 - learning from information of past accidents and incidents in organization.
- Numerous accidents are reported by large organizations such as nuclear power plants.
- A computer database
 - Useful tool for organizational learning.
 - Powerful search function



Purpose of this study

A problem

A few learning activities continue.

- Discontinue is caused by a lack of motivation. (B. Anol 2001, L. Paul et al. 2003)

The purpose of this study

Proposal and evaluation of a method to enhance motivation to promote organizational learning activity with database use.

- Especially, We pay attention to psychological **attachment** as motivation to database use.

2. Survey of spontaneous learning activities

- A few workers in maintenance sections of nuclear power plants use original database spontaneously for learning activity.

There are unique motivation factors?

- Survey for motivation of spontaneous learning activity was conducted.
- Interview and questionnaire survey
- A interviewee was a chief of a work group of a maintenance section.



Detail of the chief's spontaneous learning activity

- His database
 - Files of Paper Documents.
- Input
 - Abstract of official reports of accidents.
 - Analysis of cause of accidents
 - Technical drawings of machines
- View
 - He refers database when accidents occur.
 - He sometimes reviews database without particular reason.



Answers of the interview

○ These are some answers of the interview.

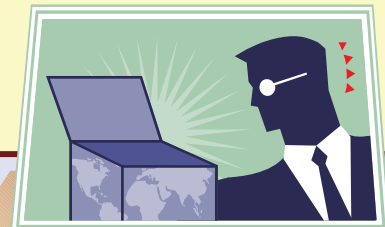
1. *「I made my database as a hobby rather than work. My database is property. I don't want database to be forgotten.」*
2. *「At first I had filed documents in some way, now I cannot abandon them because they are valuable.」*
3. *「I ordered my workers to make their own databases several times, but they did not.」*
4. *「Once, my boss gave concrete instruction to make a file and keep important data on the file, but the instruction was not rooted.」*
5. *「Young workers haven't experienced usefulness of database.」*
6. *「However there are not a particular reason to view database, I feel that it give me something valuable for my work.」*

○ Some motivation factors are revealed.

“Perceived value”

1. *「Young workers haven't experienced usefulness of database.」*
2. *「However there are not a particular reason to view database, I feel that it give me something valuable for my work.」*

- The chief has “perceived value” as a motivation factor.
- He experienced some accidents.
- Accidents showed him how valuable database is in such situations of accidents.
- Technical improvements reduced occasions of accidents and producing such occasion is difficult.



“Attachment”

1. *「I made my database as a hobby rather than work. My database is property. I don't want database to be forgotten.」*
 2. *「At first I had filed documents in some way, I cannot abandon them because they are valuable. 」*
- The chief felt emotional bond to his database.
 - He has psychological “attachment” which means special emotion, loving a particular object, as a motivation factor.
 - It takes long time to foster attachment.

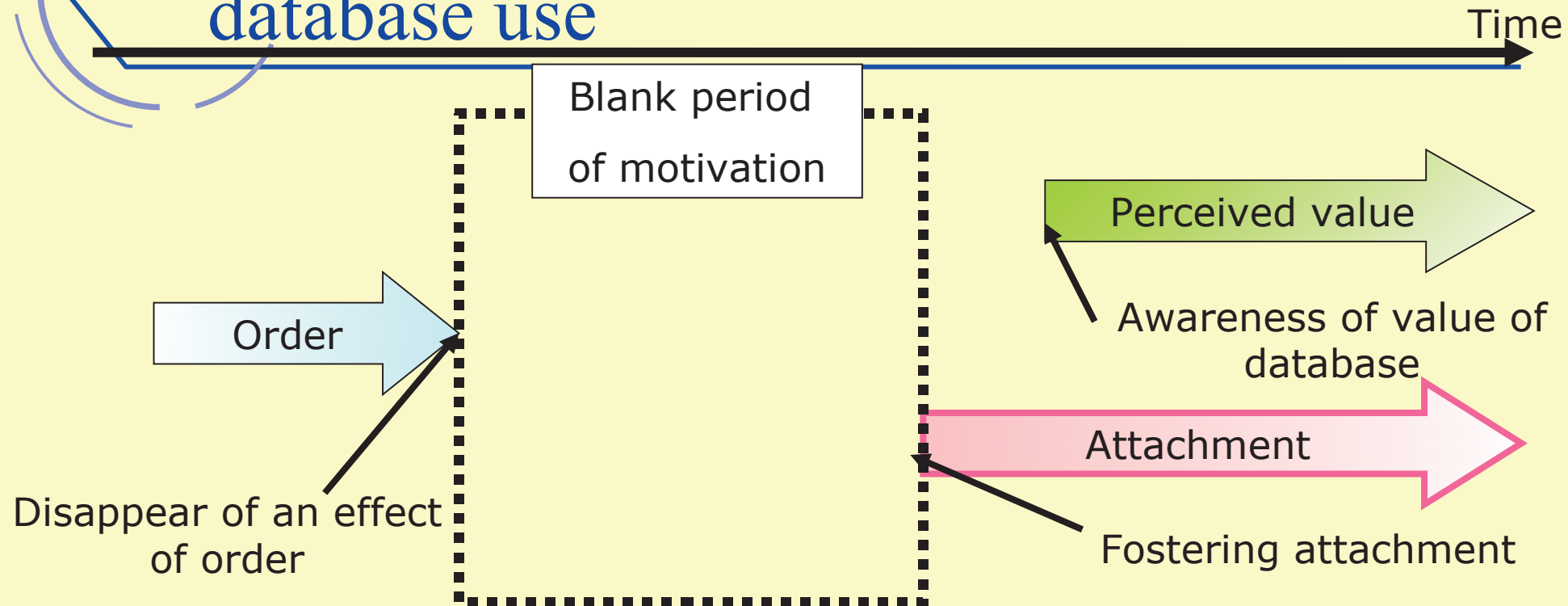
Attachment

“Order”

1. *「I ordered my workers to make their own databases several times, but they did not.」*
 2. *「once, my boss gave concrete instruction to make a file and keep important data on the file, but the instruction was not rooted.」*
- There is a motivation factor in the case of not spontaneous leaning, “order” .
 - Boss or reader gave workers to make database.
 - An effect of “order” disappear immediately.



Time-variation model of motivation in database use



- When workers reach blank period, they will drop out.
- Enhancement of some motivation factor is necessary to bridge “blank period of motivation”.

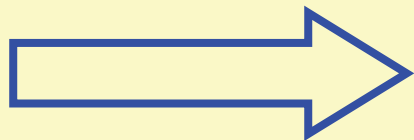
3. Proposal of a method to foster database attachment

- “Order”

- The fact that the chief's attempts all failed means this is an improper factor.

- “Perceived value”

- It is difficult to realize “value” because accidents do not so often occur.



“Attachment” was selected.

is



Factors to foster attachment

○ Attachment

- It originally means a baby's emotional bond to his/her mother.
- An emotional bond to a specific object

○ Factors to foster attachment

- Meeting psychological desires for Self efficacy, gratification or relationship.
- Spending psychological cost
- Connection to identity

Meeting
Psychological
desires

Connection
to identity

Psychological
cost

Fostering
Attachment

P.C. When, J.M. Deborah, P.
Joseph(2006)
H.N.J. Schifferstein, R. Mugge
P. Hekkert (2003)

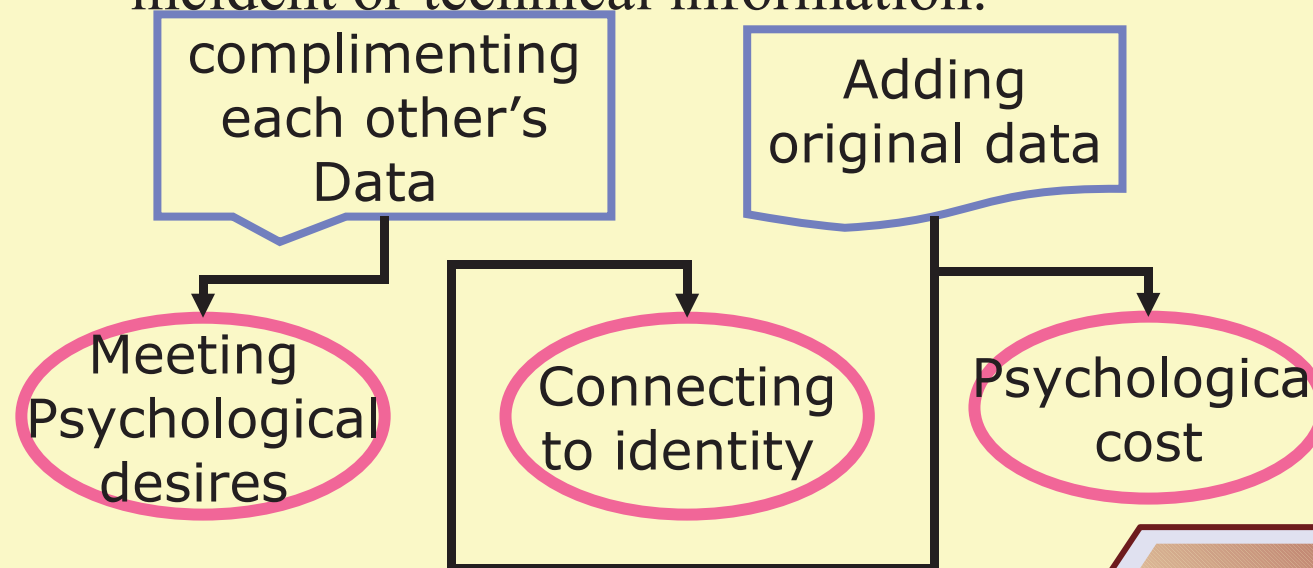
Method to foster database attachment

1. Complimenting each other's data

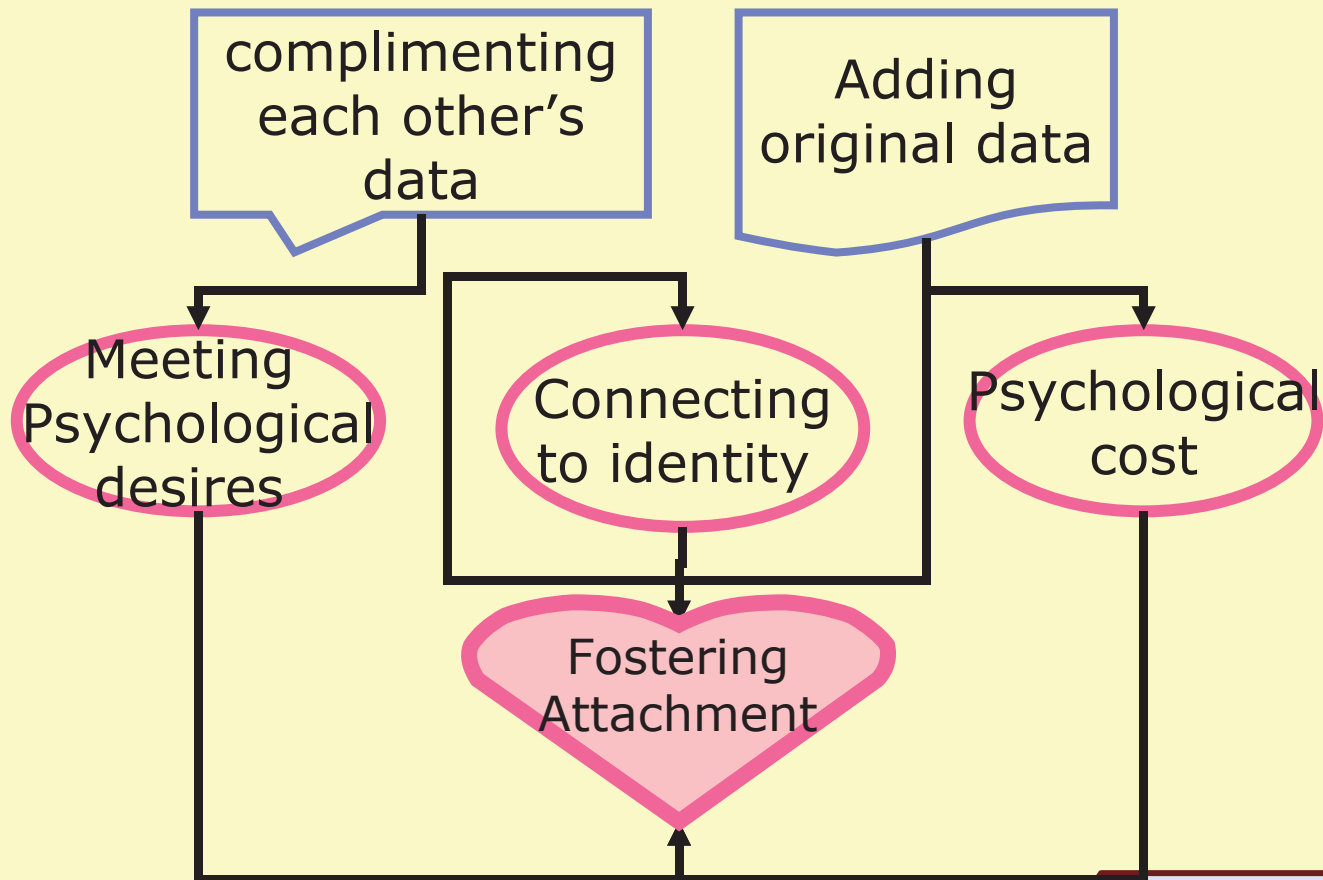
- It is used in a small group

2. Adding original data

- Original data is opinion or an impression about an accident.
- Not original data means objective data, situation of incident or technical information.



Summary of the proposed method



4. Experiment

- An subject experiment was conducted

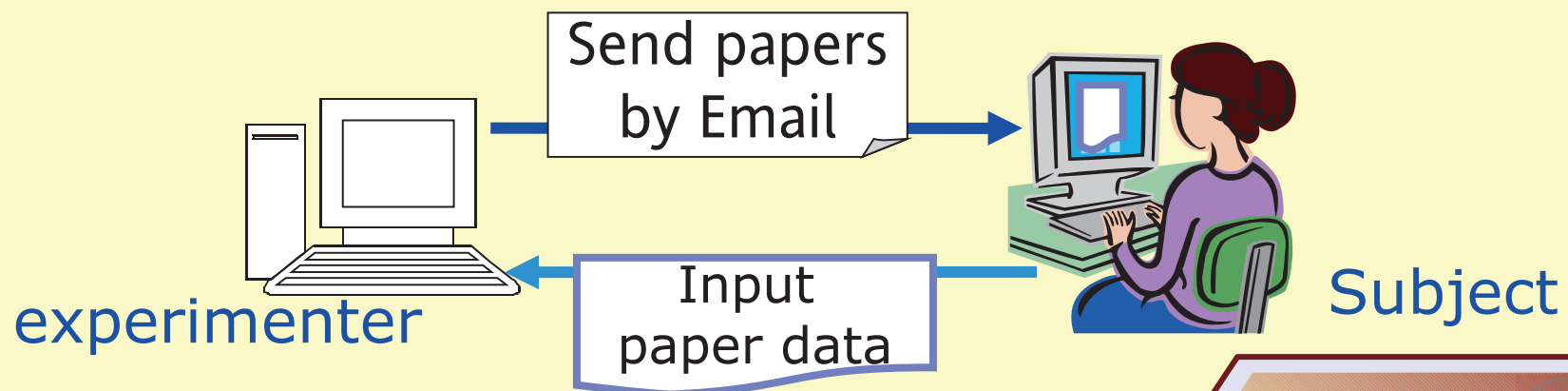
The purpose of this experiment
evaluation of the proposed method to foster
database attachment.

- the method should be evaluated by workers in nuclear power plants, but it is difficult because it might be disturb the plant operation.
- 40 university students joined as subjects, and records of academic papers were selected as contents of database.



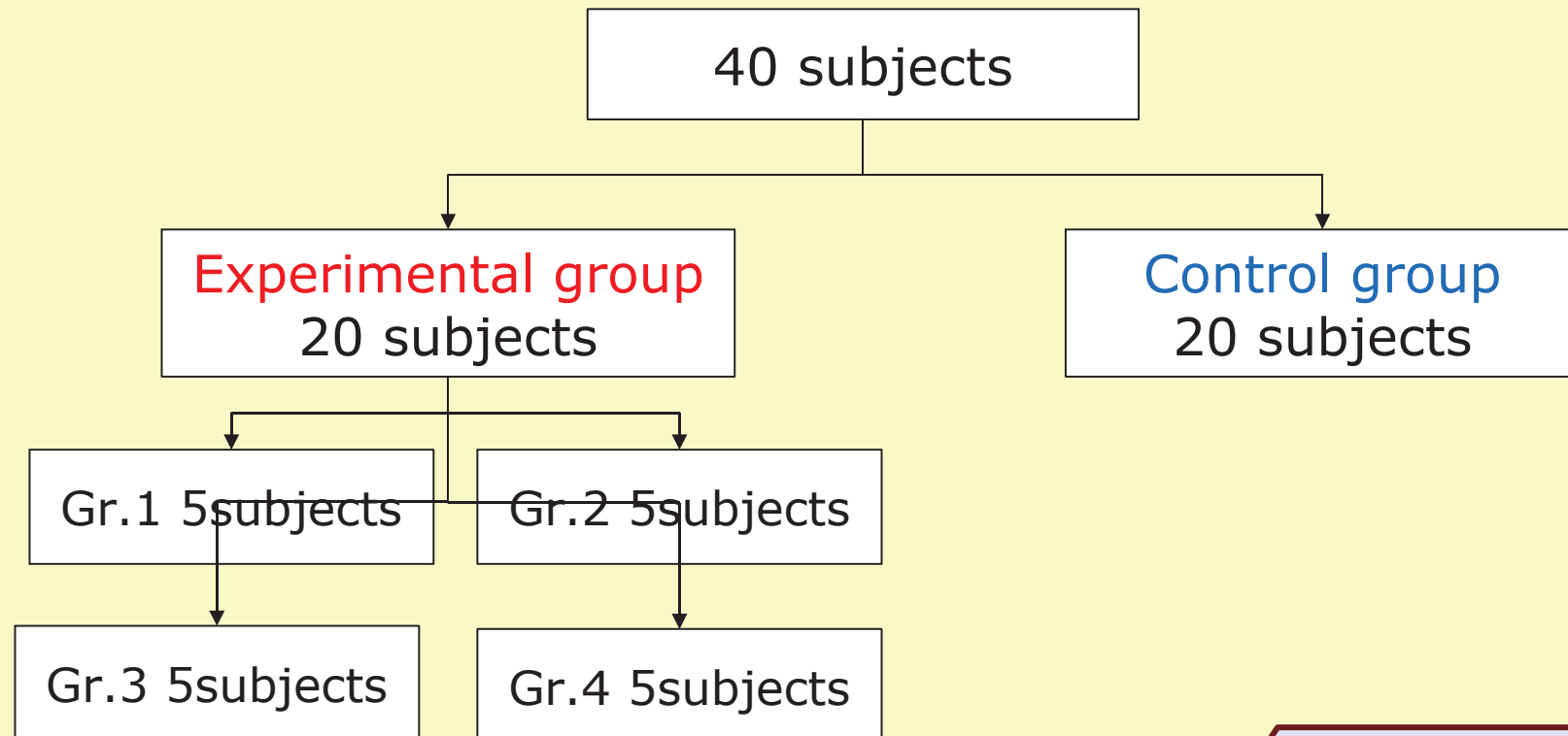
Conditions and methods

- Subjects were paid 10000 Japanese yen (about 100\$) to join the experiment.
- Subjects read 2 academic papers a week (total 8 papers in 28 days) and input paper data.
- Papers are about “human interface” in which no subject major.

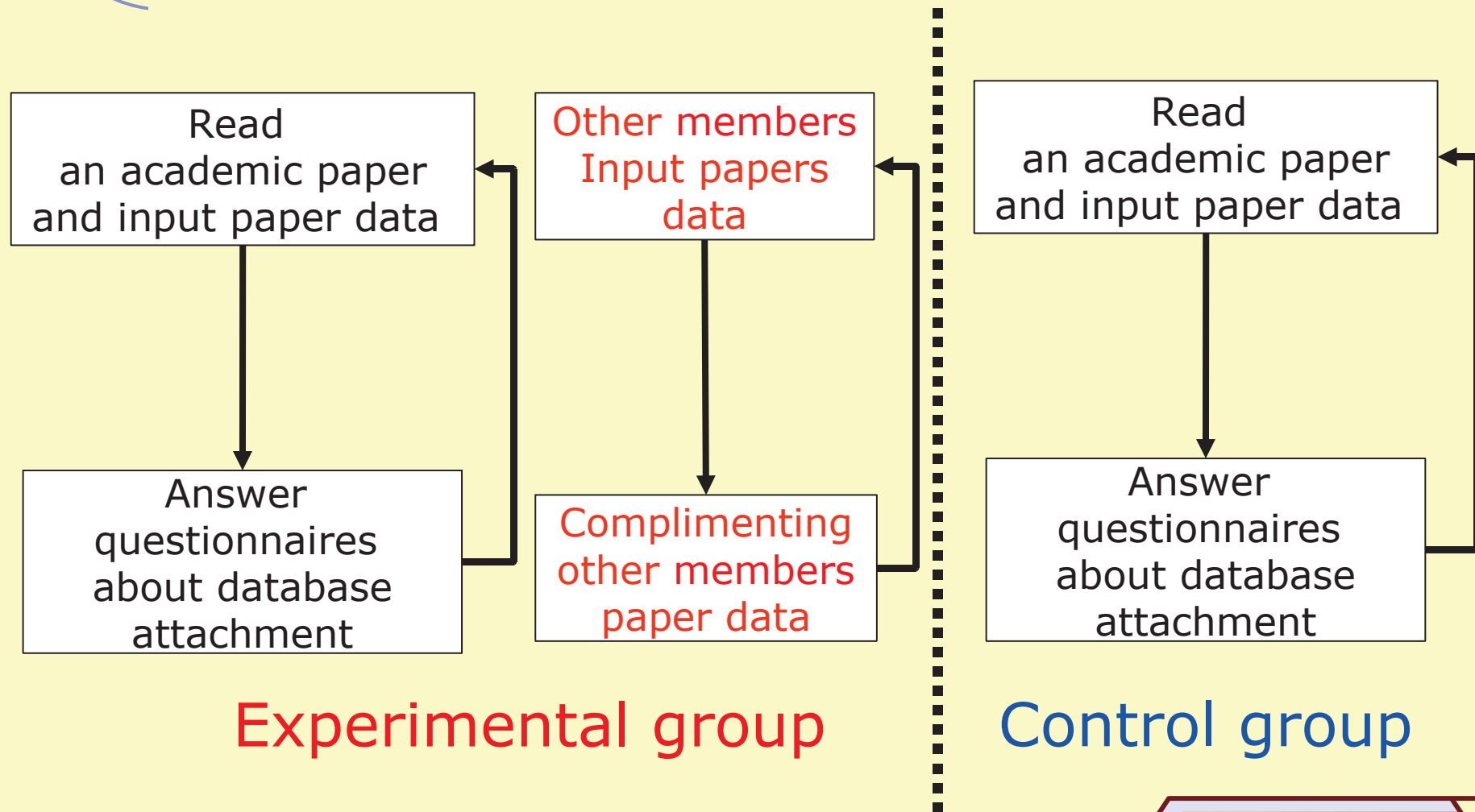


Experimental group and control group

- Subjects were divided into 2 groups, experimental group were divided into 4 sub groups.
- Differences between all groups were minimized.



Tasks



Items of papers data

title,
authors,
abstract,
keywords,
purpose,
usefulness,
originalities,
original data
(summery
or impression)

Experimental group

title,
authors,
abstract,
keywords,
purpose,
usefulness,
originalities

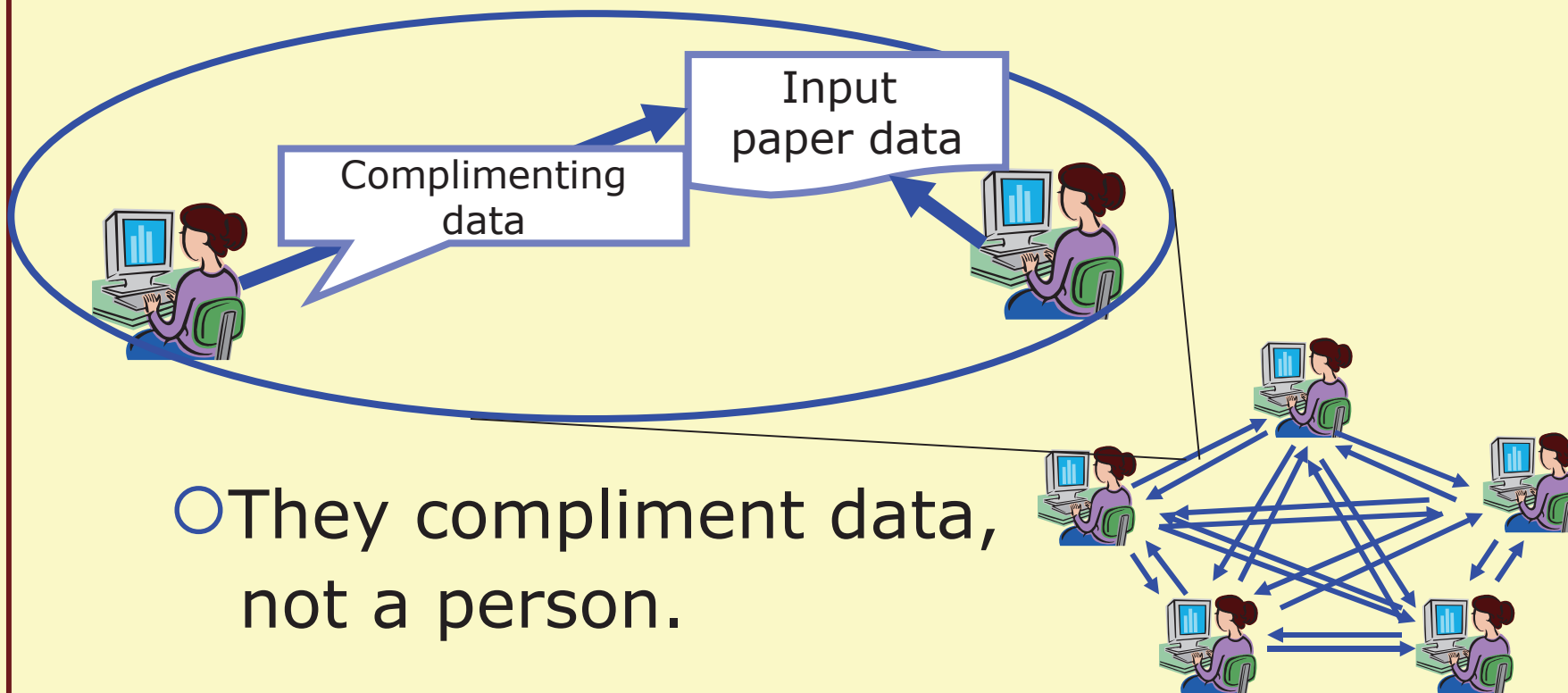
Control group

An example of paper's data

Date	30/06/2008
Title	Study for control method to improvement of productivity of office workers -Development of CPTOP, a method for evaluation of productivity -
Authors	Kenji ENOMORO, Hiroshi
Abstract	The authors have developed a performance test, CPTOP (Cognitive Performance Test of Productivity), which combines 11 basic tasks to evaluate intelligent abilities of office workers.....
keywords	Productivity, Office Effect, Task Performance, Learning Effect
purpose	Development of a method of evaluation of productivity
Usefulness	Original method to quantitative and easy evaluation of intellectual productivity in office.
Originalities	It is useful to Improve intellectual productivity in office tasks.
Summary of impression	In this study, authors aim at.....
Compliment	It is simple and good summary

Compliment each other's data

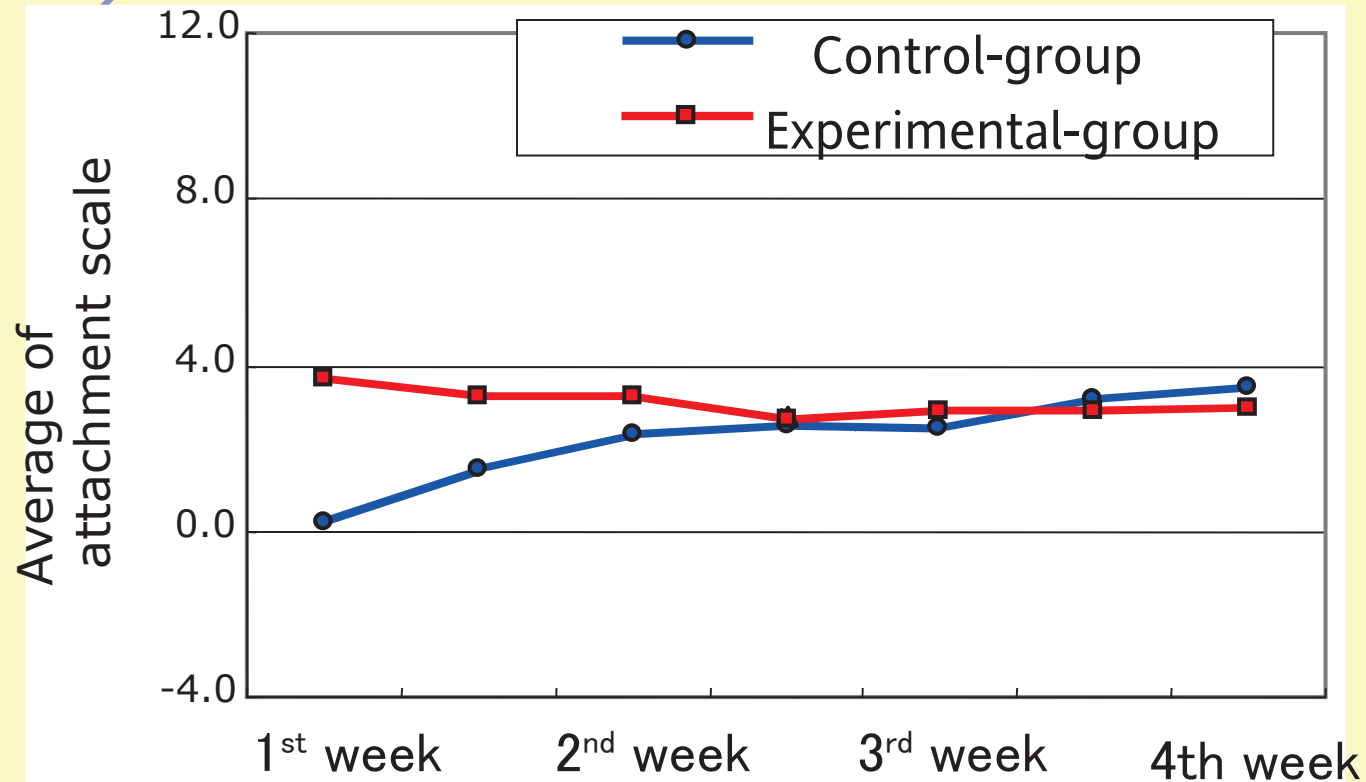
- Subjects of experimental group compliment each other in sub-group.



- They compliment data, not a person.

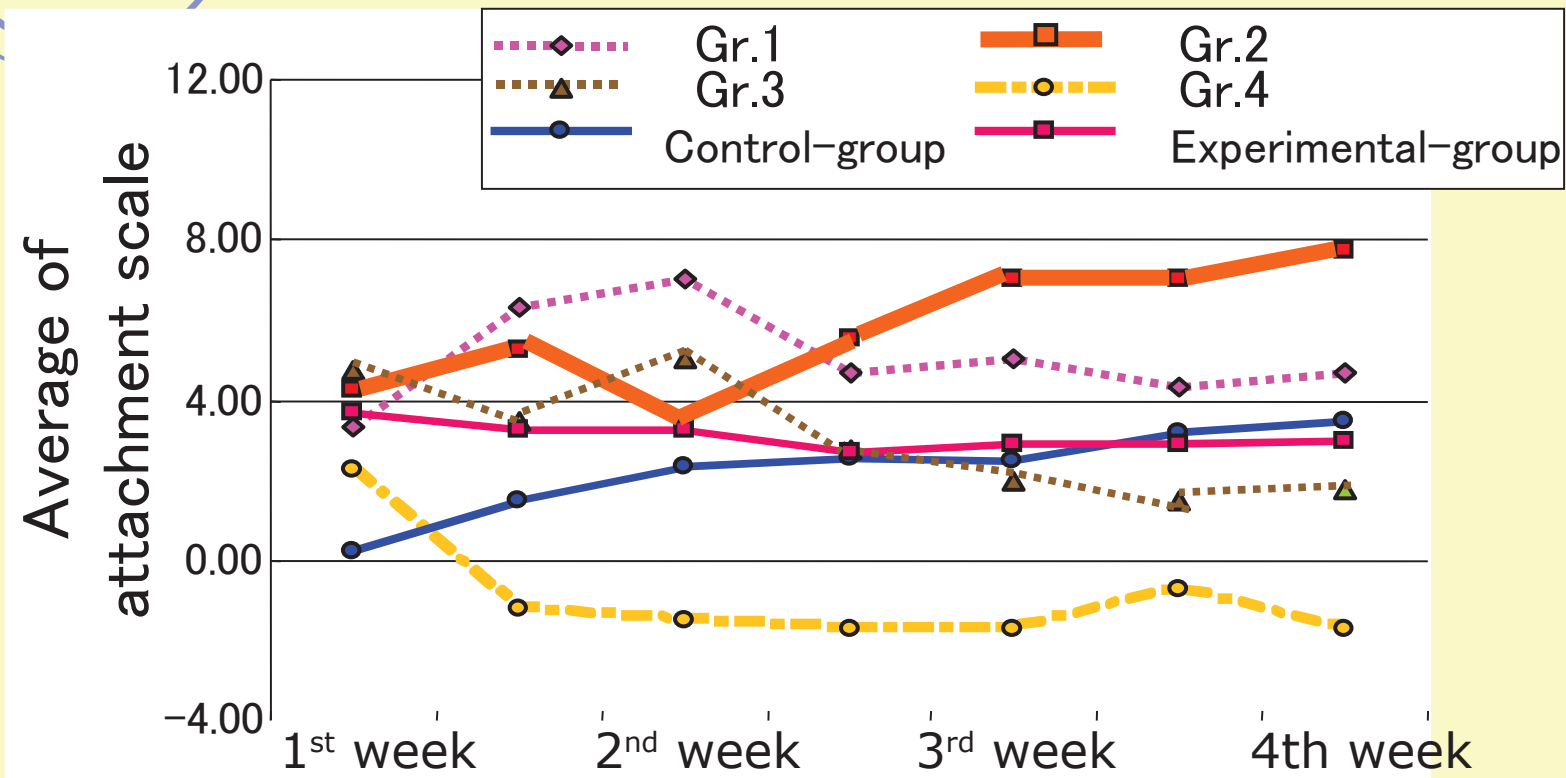


Results



- Attachment scale is sum of four indexes about attachment ($\alpha = .83$, reliable enough).
- Attachment of two groups got closed.
- got bored in the proposed method?

Attachment scale



- In experimental-group, **only Gr.2** significantly increased.
- What is the reason?





Compliments

Compliments were classified.

Type A: Compliments which refer to writing style of original data.

"itemizing results made it easy to understand." (Subject17)

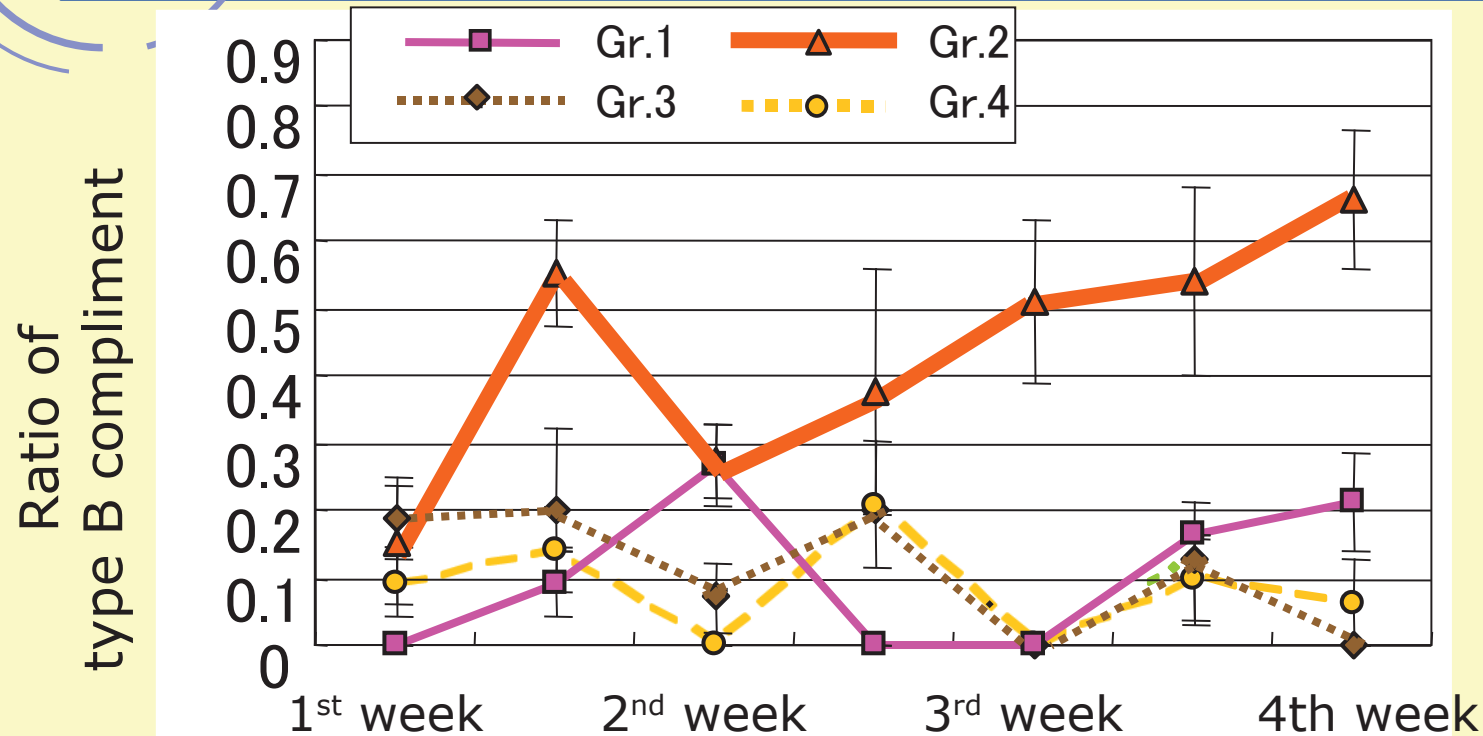
Type B: Compliments which express writer's interest in studies or paper's theme.

"I could concretely image visualization of conversations."
(Subject13)

Type C: Compliments which refer to impression to papers in original data.

"I felt it was meaningful because this data express own opinion to the paper." (Subject15)

Type B compliments



- Only Gr.2 increased in Type B,
“Compliments which express writer’s interest in studies or paper’s theme.”



Characteristics of each type compliments

Type A : *“itemizing results made it easy to understand.”*

- It tends to be boring, writing styles are not so different.
- Appreciation is not needed to write Type A.

Type B : *“I could concretely image visualization of conversations.”*

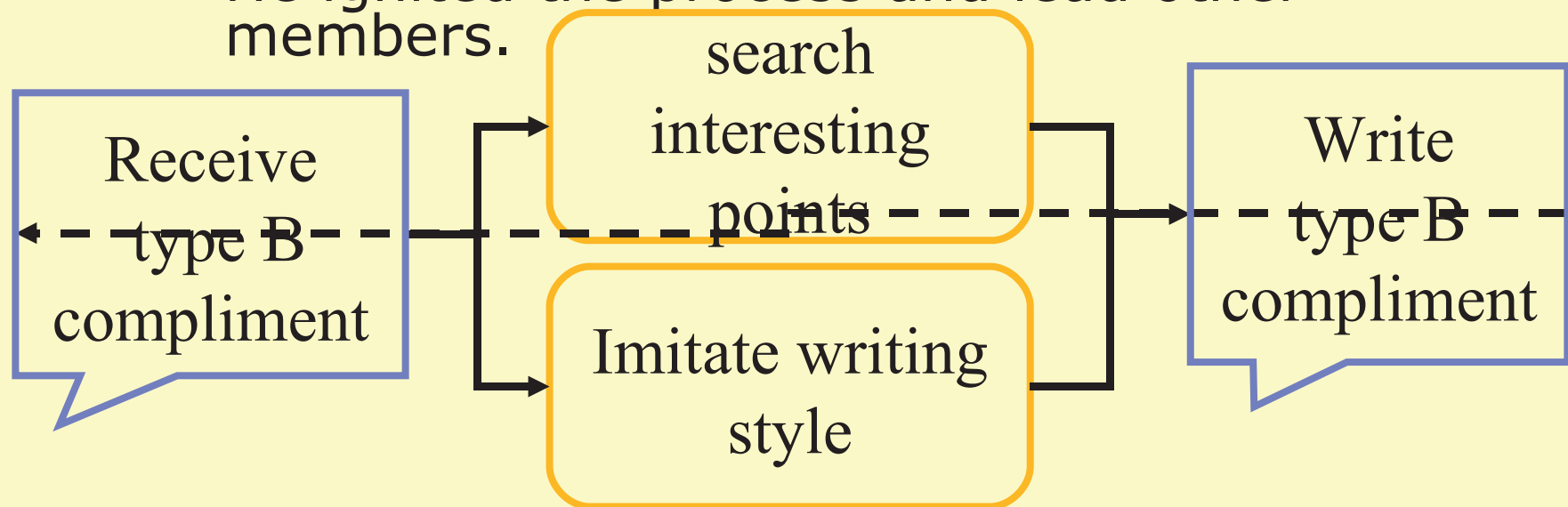
- It needs appreciation of summaries or impressions.
- When someone receives Type B, his/her “desire to relationship” is met greatly, then database attachment would be fostered.

Type C : *“I felt it was meaningful because this data express own opinion to the paper.”*

- It can foster attachment, but depends on particular type of data.
- There are few Type C compliments.

A process of compliments increase

- In Gr.2, following process lead increase of type B compliments.
- Subject 10 was a key person.
 - He was strongly sending Type B compliments.
 - He ignited the process and lead other members.



Proposal of revised method to foster database attachment

1.

complimenting
each other's
data

Revised

Complimenting
in the way which
expresses
interest in contents

Similar to Type B

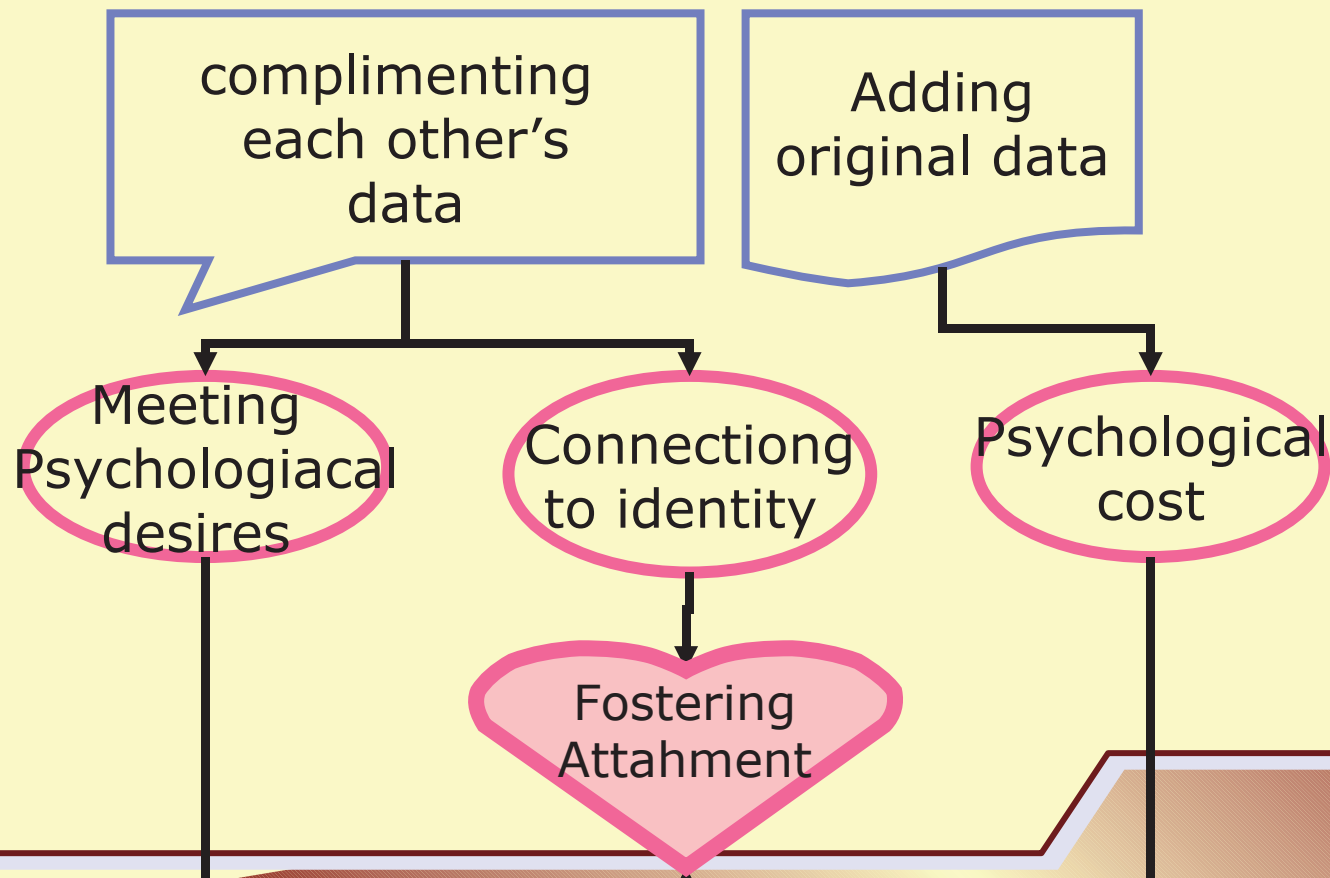
2. Add following way

Someone play a central role in
” complimenting in the way which expresses interest in
contents”

Intend to produce subject 10

Original method to foster database attachment

Before revised



Revised method to foster database attachment

Someone play a central role in complimenting

Revised

complimenting in the way which expresses interest in contents

Adding original data

Meeting Psychological desires

Connectiong to identity

Psychological cost

Fostering Attachment



5. Conclusion

- The purpose of this study was proposal and evaluation of a method to enhance motivation for promoting organizational learning activity with database use.
- We explain a survey for motivation factor of spontaneous learning activity in a nuclear power plants.
- Based on the results of the survey, the method to foster database attachment was proposed as a method to enhance motivation for promoting organizational learning activity with database use.
- We conducted the subject experiment to evaluate proposed method.



Future works

- From the result of the experiments, the revised model of fostering attachment was constructed.
- In the future, we like to evaluate the revised model.
- Additionally, We like to conduct a long-term experiment in order to confirm that database attachment continue learning activity.



Thank you for your attention.





Safety culture

- a To maintain safety, it is not enough that workers follow standard procedure unconcernedly.
- a Continuous and wide-spread commitment to safety is necessary.
- a Safety culture makes organization's member commit to safety and continue commitment, even if members are changed.



Safety culture and Organizational learning

Three level of learning activity

2. Individual learning

- It can avoid that same accidents are repeated by a same worker.
- At organizational level, same accidents can be repeated.

3. Organizational learning

- It can avoid that same accidents are repeated in organization.
- If members of the organization are changed, learning activity will disappear.

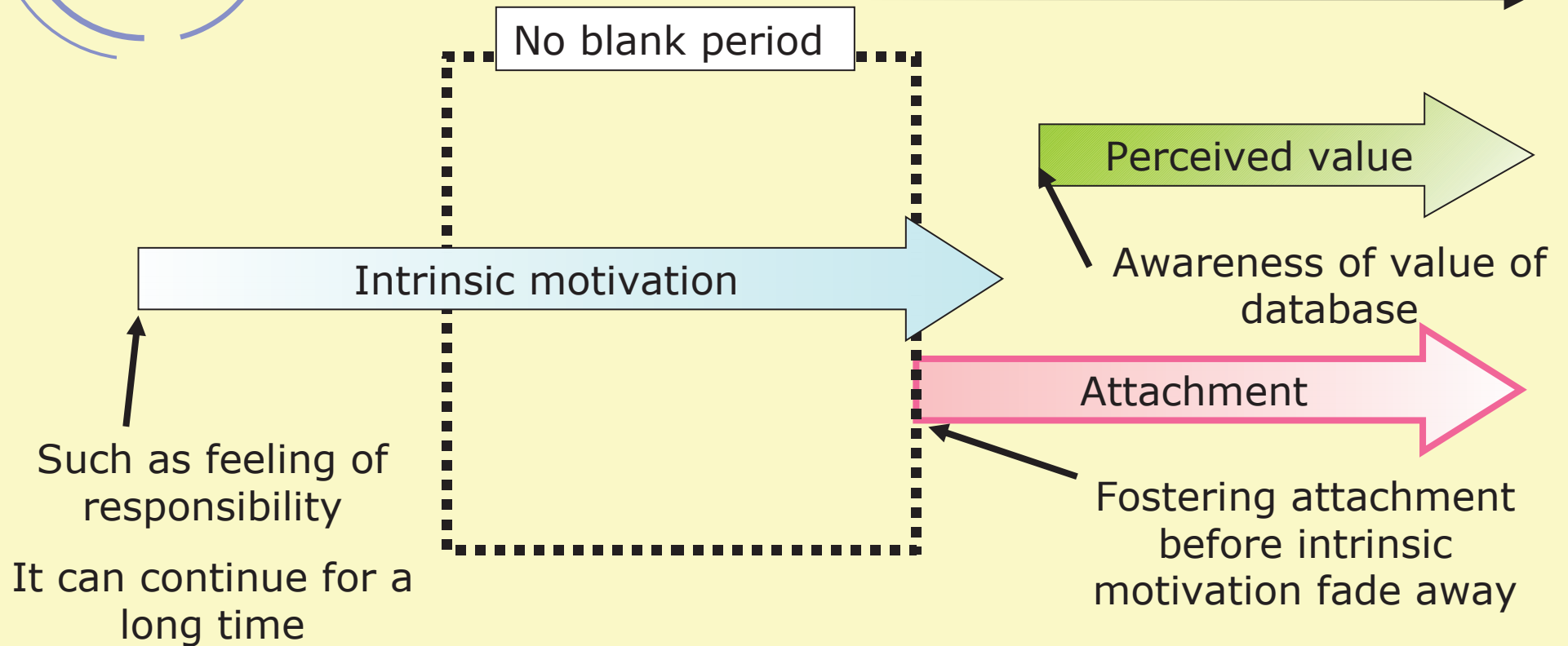
4. Organizational learning as culture

- Even if members of the organization are changed, Organizational learning can continue in the organization.

This is the reason organizational learning is essential to safety culture.

Time-variation model of motivation in the case of success

Time



The chief begun to lean by intrinsic motivation, feeling of responsibility to safety as a chief.

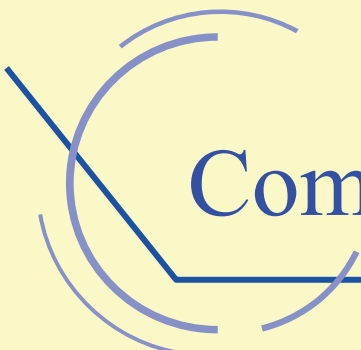
Other motivation

Exactly, other motivation factors are possible such as

- Money
- Punishment
- Commitment to safety

d Money and punish are external motivation.

d Commitment to safety is difficult.



Comparing students and nuclear workers

Both students and workers

2. don't have responsibility to database use and learning activity.
3. are so busy that they make database spontaneously.
4. don't realize value of database enough to make database spontaneously.

in common, they don't have intrinsic motivation to use database.



Prior questionnaire

- Differences between all groups were minimized based on results of following prior questionnaire.
- 7 point scale (-3 to 3)

1. Tendency to be bored
2. Tendency to foster attachment
3. Tendency to want to be praised
4. Interest in human interface
5. Experience of reading academic papers

Detail of papers

- a About Human interface
- a 4 or 6 pages
- a Profound technical terms are not used.

Detail of database system

- a One database for one subject.
- a Each database was locked by password.
- a A subject could not view other's database.
- a When subject compliment data, he/she can view only the latest data.
- a Subjects can view received compliment in his database.



Questionnaire about attachment

1. I feel attachment to database.
2. If my database were destroyed, I would feel disappointment.
3. Inputting database is not so hard
4. I feel self expression in my database
5. I feel like review my database
6. If I was complimented for my database, I would not be pleased.

a 7 point scale (-3 to 3)

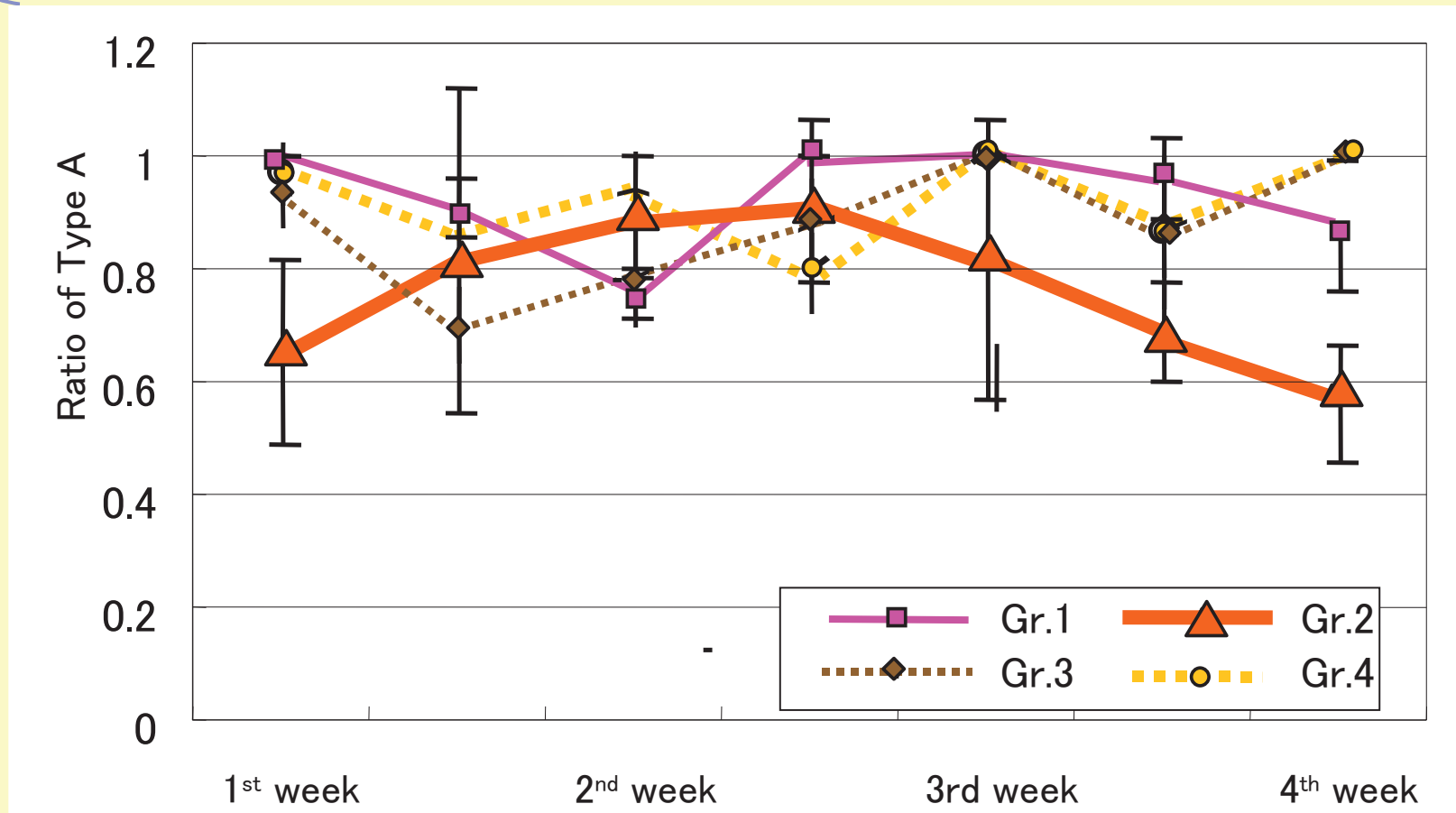
a 3. and 6. are reversed question.



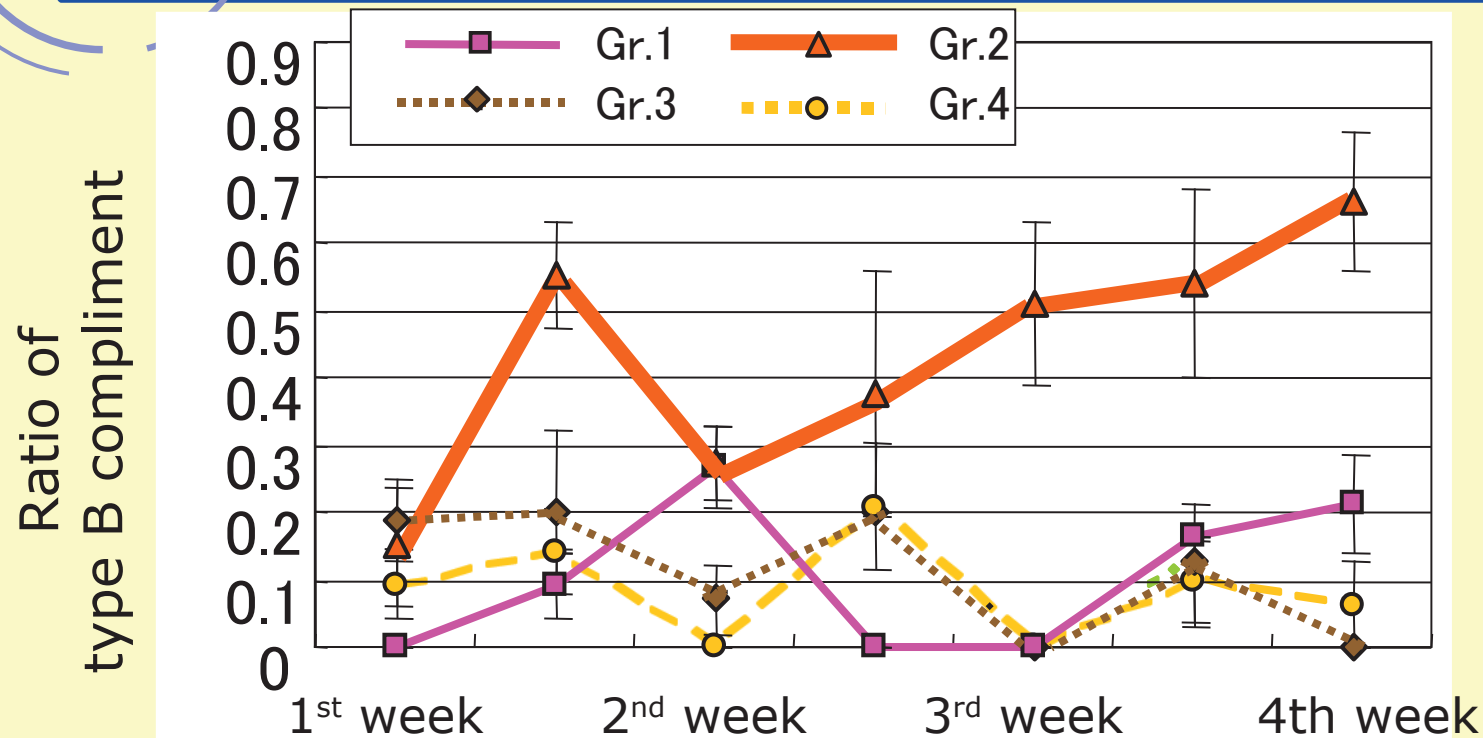
Classification of compliments

- a 4 experimenter classified compliments independently.
- a Average and standard deviation of four experimenter were calculated.
- a Average and SD were expressed as ratio to all compliments.

Ratio of type A compliments



Ratio of Type B compliments



- Only Gr.2 increased in Type B,
“Compliments which express writer’s interest in studies or paper’s theme.”



Ratio of type C compliments

