Cognitive Psychology

— Language and Thinking —

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Cognitive Psychology

Research in Psychology ⎧ basic research
⎩ practical research

◆ Practical research

（clinical psychology, educational psychology, forensic psychology. . .）

Main goal - to deal with real problems

◆ Basic research

Main goal - to clarify human mental activities

The core of psychology is research in cognitive psychology.

A Framework of Understanding

Cognitive psychology's assumption :

mental activities = information processing

- Input of information = perception
- Selection of information = attention
- Storage of information = memory
- Representation of information = concept
- Expression of information = language
- Processing of information = thought

etc.

Purposes of Research

To clarify the mechanisms of human information processing

ex.: Memory

- How do we remember things?
- Why do we forget things?
- Why is memory distorted?
- Why are some things easy to forget,

.

.

.

Research Themes Closely Related to Real Life

- Why is eyewitness testimony fallible?
- Do “subliminal cuts” have any effect?
- Do children have a special ability to learn language?

.
.
.
.

Research Methods in Cognitive Psychology

Main methods - experiments

Additional methods: computer simulation, measuring brain function, etc.

Cognitive psychology
- ≠ "process industry"
- = "intellectual industry"

Experiments
- × expensive experimental equipment
- ○ PCs, paper and pencil

Takano's Research Themes

1. Visual perception
2. Memory
3. Visual imagery
④ Language and thought
⑤ Form cognition
6. Inference
⑦ Culture

English Issues

- Discussion on English as an official language
  （ex. Yoichi Funabashi）
- A proposal to adopt English as the national language
  （ex. Arinori Mori）

Criticism of the Japanese Language

- English — logical
- Japanese — illogical

(ex.: omission of subjects, equivocal expressions, etc.)

∴ Using Japanese

→ prevents speakers from thinking theoretically

（The linguistic relativity hypothesis）

The Linguistic Relativity Hypothesis

(The Sapir-Whorf Hypothesis)

Language { = means of communication
         { means of thinking

{ The strong hypothesis: language = thought

{ The weak hypothesis: language ⇒ thought

∴ A difference in language ⇒
a difference in thinking

Whorf's Example (1)

"Snow"

- English: one word (snow)
- Eskimo
  : many words
  - fluttering snow,
  - melting snow,
  - dry snow,
  - etc.

Whorf's Example (2)

The Hopi Indian language

"Flying things" (except birds) = { insects, airplanes, aviators, etc.

Whorf's argument : Problems

Differences in language:

The evidence was presented

Differences in thought:

The evidence was not presented

∴ Subsequent studies —

Consider differences in thought patterns.

Research on Colors

Language = basic color terms
Thought = color perception

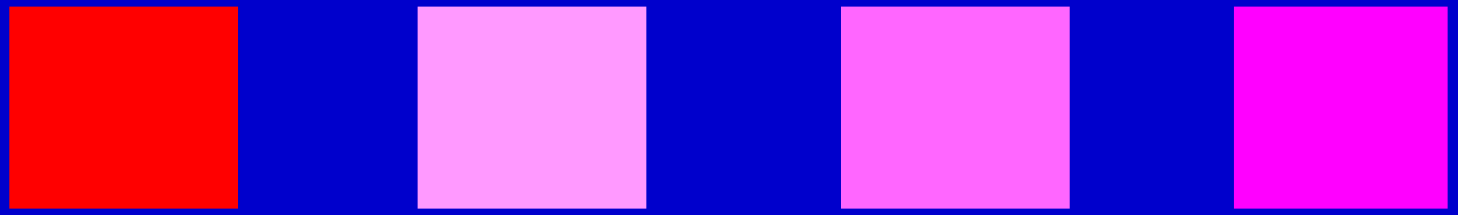
Basic color terms
- English: 11 words
- the Dani language: 2 words (light/ dark)

Hypothesis: The Dani are inferior to Americans in color perception.

Psychologists' research findings

In their ability to distinguish colors: Americans = The Dani

Daily Experience



"Peach" ≠ a basic color term

However, we can distinguish { "red" and "peach" / different tones of "peach" }

∴ Test results on Dani people concur.

But..., color perception = thought ?

Color perception: genetically determined

∴ The possibility that it is affected by language is small.

Bloom's Hypothesis

「思考らしい思考」: language ⇒ thought ？

Alfred H. Bloom

: a psychologist and linguist at Swarthmore College

"The Linguistic Shaping of Thought"（1981）

English vs. { Chinese / Japanese }

Differences in Language

Linguistic devices

1. Counterfactual conditionals
2. Hypostatization

English — ○

Chinese, Japanese — ×

Counterfactual Conditionals

$=$ { Subjective past
Subjective past perfect

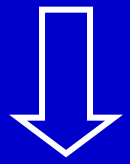
ex.: If John had gone to the library,

he would have seen Mary.

Hypostatization

= Nominalization

That measure will be approved by Congress.



The approval of that measure by Congress may be quicker than expected.

Differences in Thinking

{ Counterfactual conditionals
  Hypostatization }

= expressions of abstract & scientific thought

Americans : linguistic training — ○
Chinese, Japanese : 〃 — ×

∴ Ability for abstract & scientific thinking
: Americans ＞ Chinese, Japanese

Bloom's Experiments

Presenting paragraphs ⇒ multiple-choice questions

- Five experiments: comparing (American college students / Chinese college students)
- One experiment: comparing (American college students / Japanese college students)

Results（percentage of correct answers）:

Americans ＞ Chinese, Japanese

Arguments

- Criticism from Chinese psychologists （Au, Liu）
  : The results of Bloom's experiments are not replicable

- Bloom's counterarguments

: { Difference in linguistic materials / English ability of the subjects } → failed to replicate

Cf. MacNeill（trans. by Katori, Hiroto, et al.）『心理言語学 (Psycholinguistics)』（Saiensu-sha）

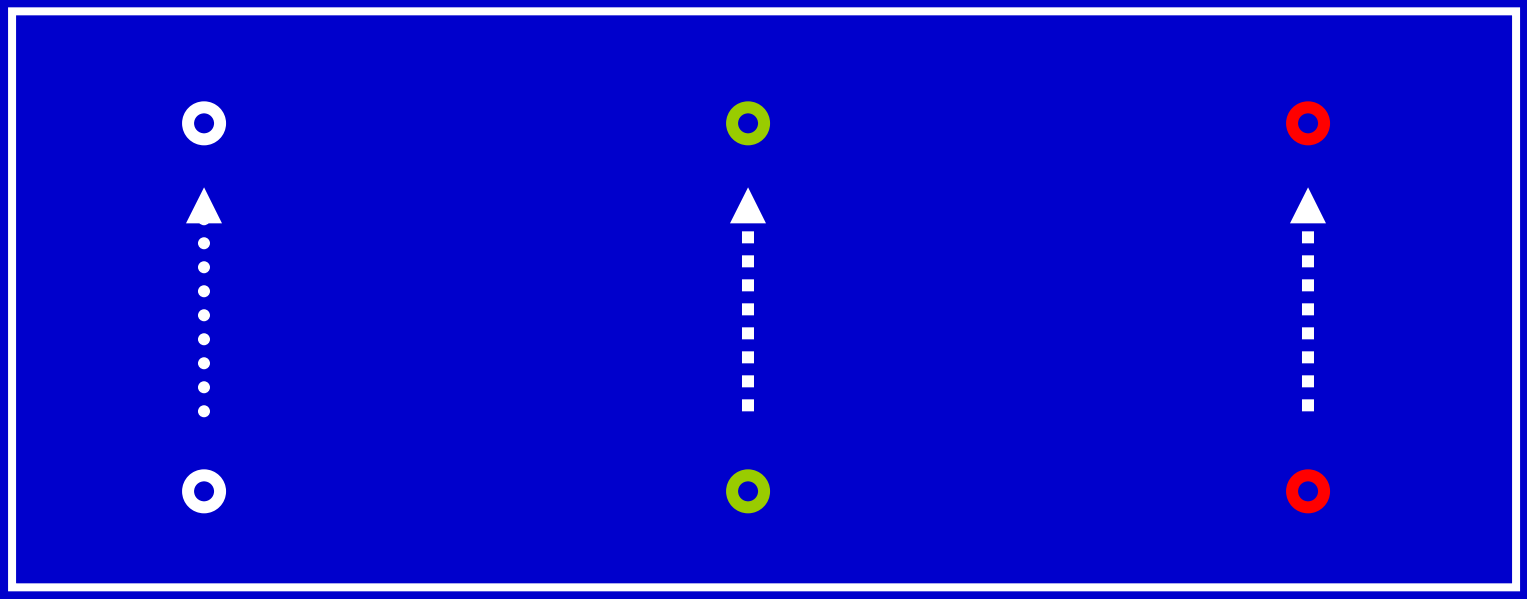
Points of the Arguments

Extraneous variables — uncontrolled

∴ Interpretation of the experimental results — unclear

Extraneous variables
= variables that can affect effect variables (the percentage of correct answers) in addition to cause variables (language)

Confounding Extraneous Variables



Cause ?

Effect

Extraneous variables

Extraneous Variables

Differences between (Americans / Chinese, Japanese) ≠ only language / = many other things

［Assumption］

General mental ability： American subjects ＞ Chinese subjects

↓

［Results］

The score： 〃 ＞ 〃

Control Conditions

Control conditions → control of extraneous variables

[Methods]
- experimental conditions : counterfactual conditions — ○
- control conditions : 〃 — ×

[Results]
- experimental conditions : Americans > Chinese
- control conditions : 〃 = 〃

→ proving Bloom's hypothesis

Lack of Control Conditions

Bloom's experiments
Au's experiments
Liu's experiments
} lacked control conditions

∴ certain conclusions — impossible

Only one of Bloom's experiments has a control condition.

= an experiment in hypostatization

Experiments in Hypostatization

Read the following paragraph and the question based on it. Choose the best answer from the four alternatives below and write your answer in the blank.

Paragraph 1

A recent report on pollution stated: Living in a polluted environment can cause lung disease; but living in a polluted, comparatively high altitude location increases the danger and, conversely, living in a polluted, low altitude location decreases it. Oddly enough, however, living in a polluted high altitude location and eating a lot of fatty foods turns out to be just like living in a polluted, low altitude location.

Alternatives

Q: According to the above report, which of the circumstances below would be likely to be the most harmful to your health?

A. A polluted, low altitude location, and eating a lot of fatty foods.

B. A polluted, relatively high altitude location, and eating a lot of fatty foods.

C. A polluted, relatively high altitude location, and eating very little fatty foods.

D. Crazy question.

Paragraph 2

A recent report on pollution stated: There exists a relationship between living in a polluted environment and getting lung disease; at comparatively high altitudes the relationship is stronger and at comparatively low altitudes it is weaker. Oddly enough, moreover, at comparatively high altitudes, eating more fatty foods renders the relationship between living in a polluted environment and getting lung disease equivalent to that existing in low altitude locations.

Bloom’s assumption

Paragraph 1
Paragraph 2

- The content is the same.
- Only the degree of hypostatization is different.
  - Paragraph 1 : the degree of hypostatization — small
  - Paragraph 2 : the degree of hypostatization — large

A Comparison between Paragraph 1 and 2 (e.g.)

［Paragraph 1］

Living in a polluted environment can cause lung disease; but living in a polluted, comparatively high altitude location increases the danger and, conversely living in a polluted, low altitude location decreases it.

［Paragraph 2］

There exists a relationship between living in a polluted environment and getting lung disease; at comparatively high altitudes the relationship is stronger and at comparatively low altitudes it is weaker.

The Structure of the Experiment

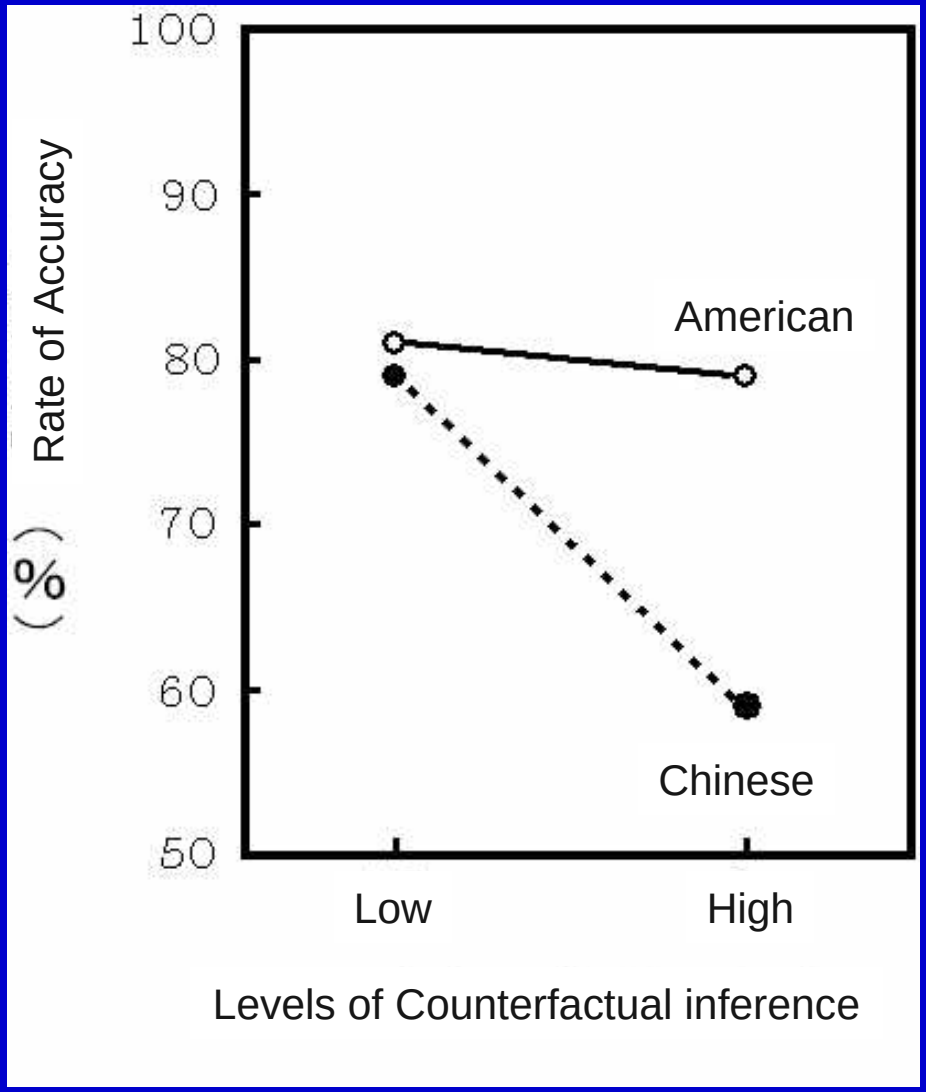
Paragraph 1: the degree of hypostatization —small (= the control condition)

Paragraph 2: the degree of hypostatization — large (= the experimental condition)

Prediction
- paragraph 1: Americans = Chinese
- paragraph 2: Americans > Chinese

Result = Prediction

Bloom's Results



Paragraph 1 Paragraph 2 （Bloom, 1981）

Interpretation of the Experimental Results

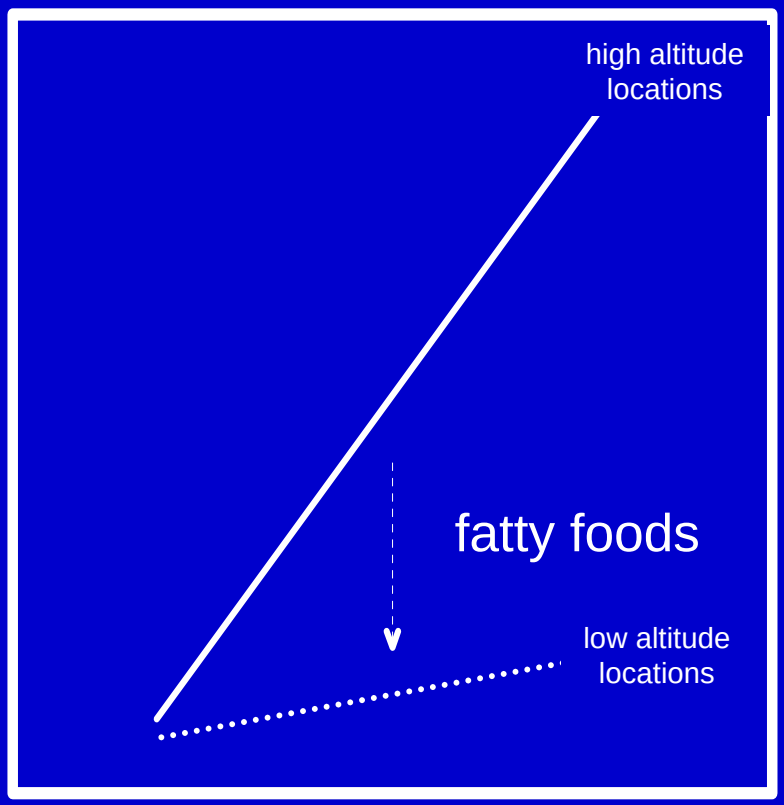
Do experiments in hypostatization

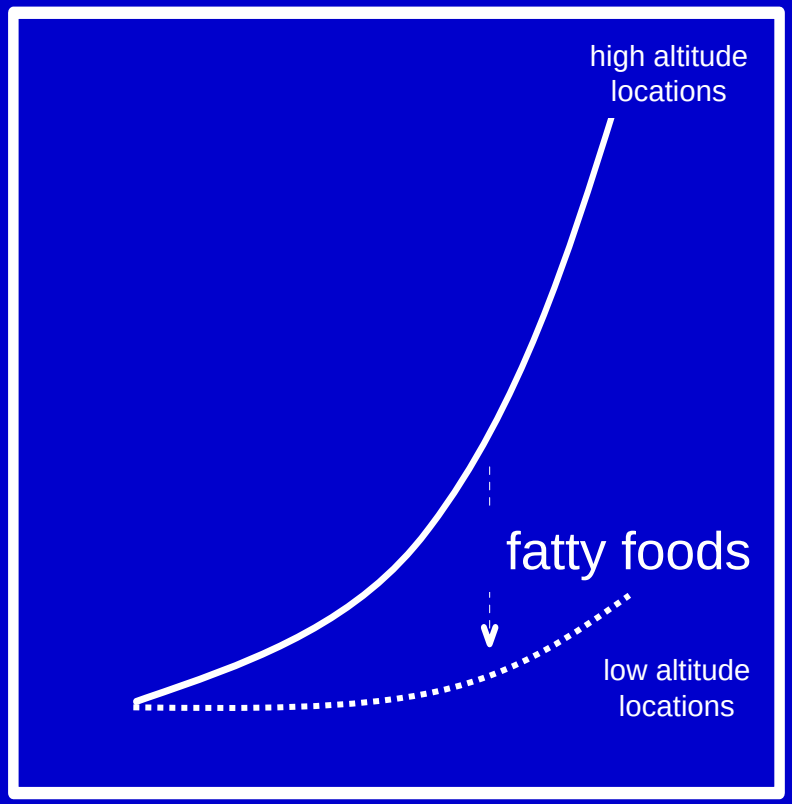
$\longrightarrow$ proving Bloom's hypothesis？

The problem ＝ a methodological flaw

The difference in $\left(\begin{array}{l}\text{the experimental condition}\\ \text{the control condition}\end{array}\right)$ ≠ the degree of hypostatization

The Functional Relationship of Paragraph 1





Answer = C （A polluted, relatively high altitude location, and eating very little fatty foods）

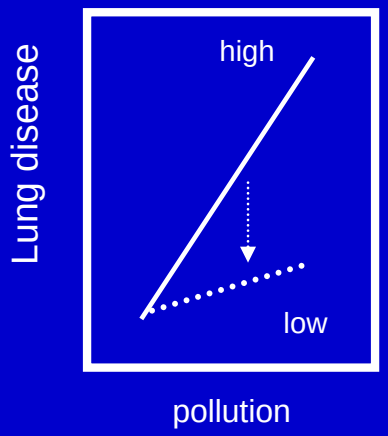
The Functional Relationship of Paragraph 2

There exists a relationship between living in a polluted environment and getting lung disease; at comparatively high altitudes the relationship is stronger and at comparatively low altitudes, it is weaker.

"Relationship" = the slope of function { + / – }

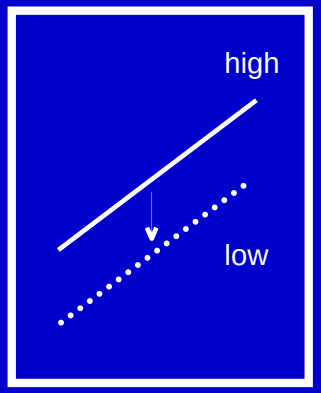
"The relationship is strong" = function's { slope is steep / intercept is high }

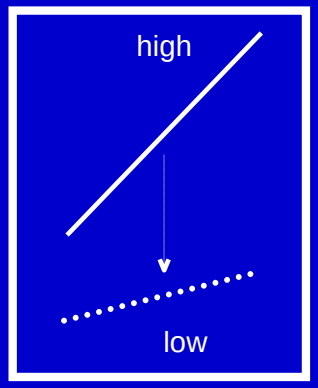
The Functional Relationship of Paragraph 2

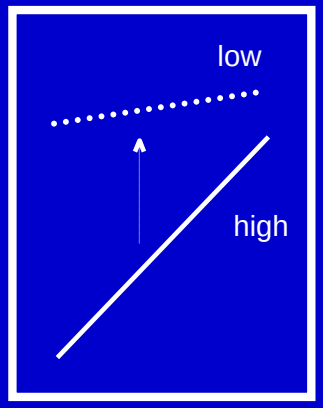


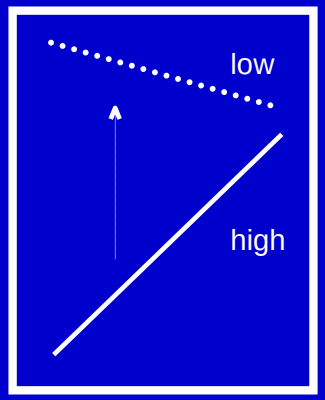
high: high altitude locations

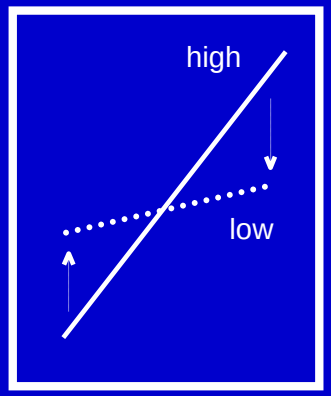
low: low altitude locations



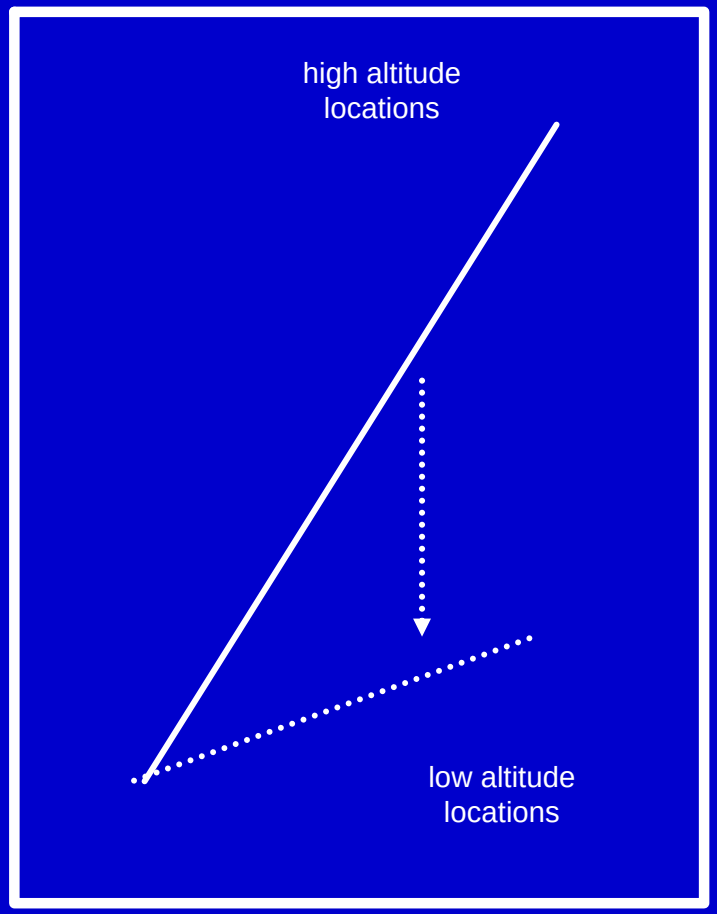






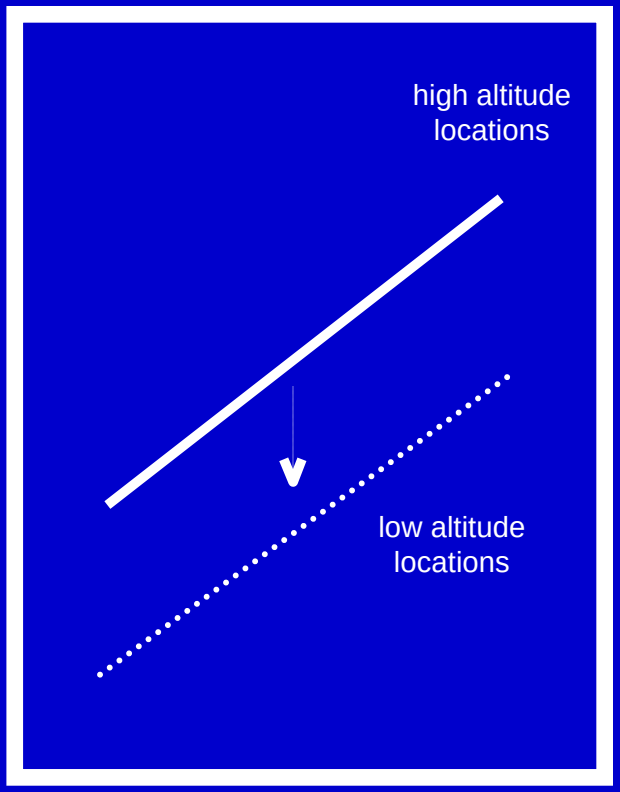


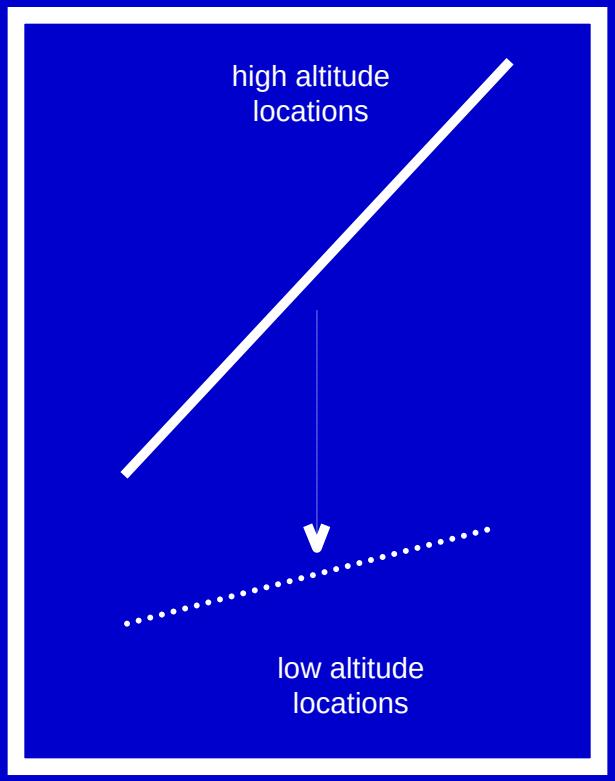
The Functional Relationship of Paragraph 2-(1)



Answer: C

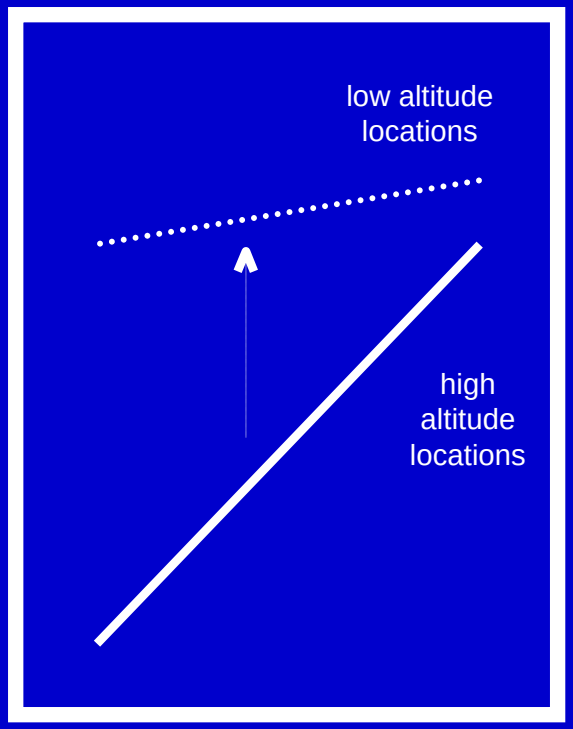
The Functional Relationship of Paragraph 2-(2)





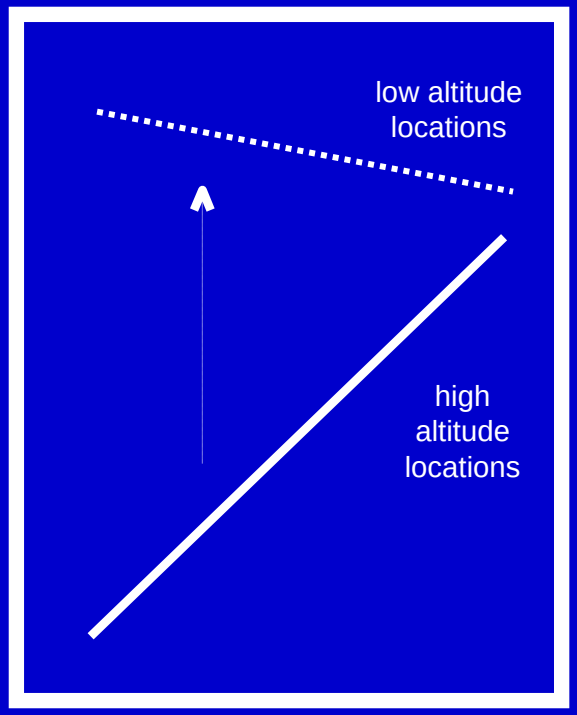
Answer : C

The Functional Relationship of Paragraph 2-(3)



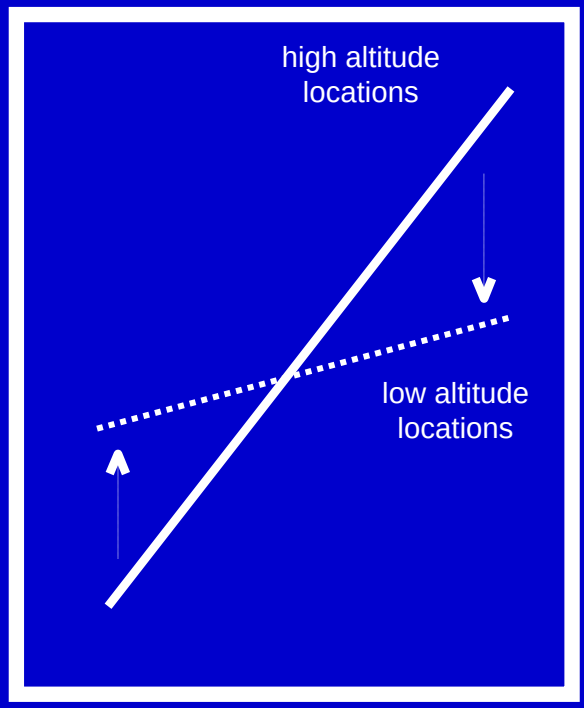
Answer : A (?)

B



Answer : A (?)

B



Answer

: depends on the degree of pollution

Question

A methodological flaw

→ Paragraph 1（the control condition）： Answer ＝ C

Paragraph 2（the experimental condition）： Answer＝ D（?）

Question： Why does the flaw influence the outcome?

→ ○ Chinese subjects ？

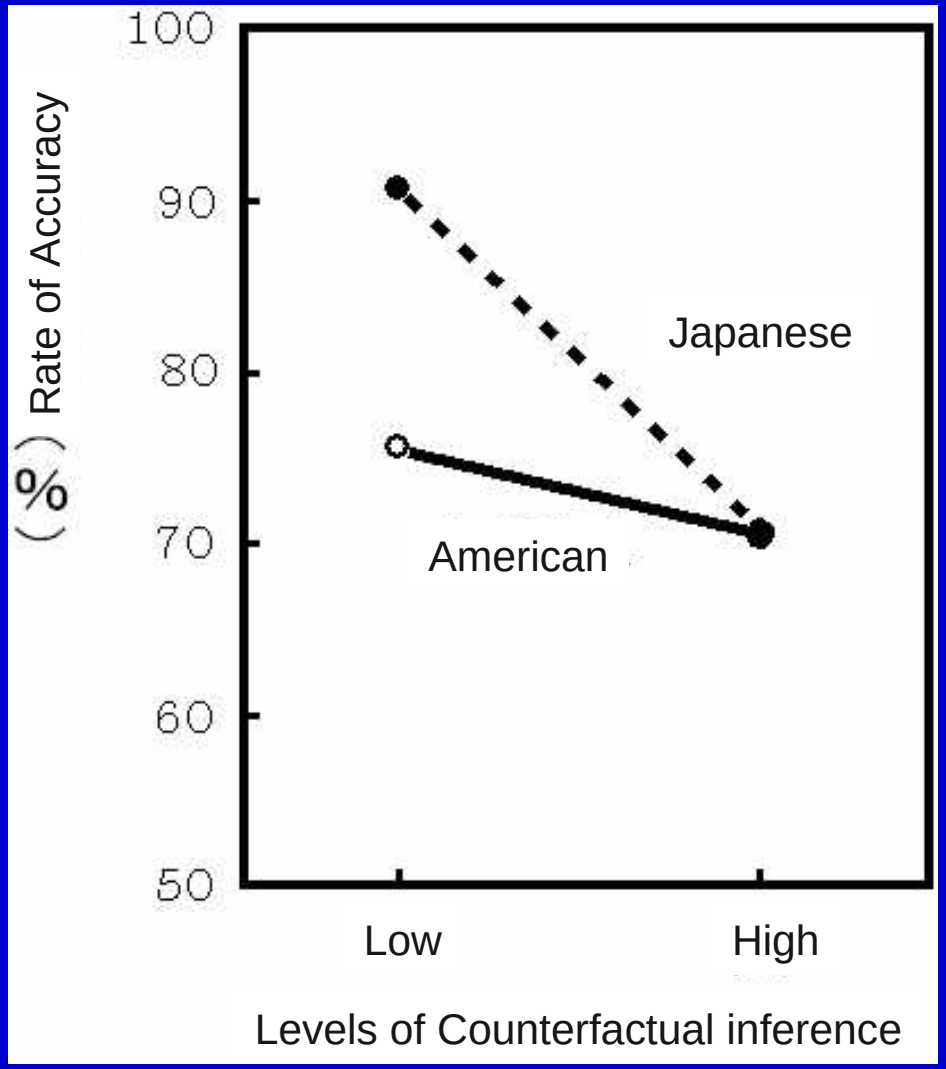
× American subjects

Replication

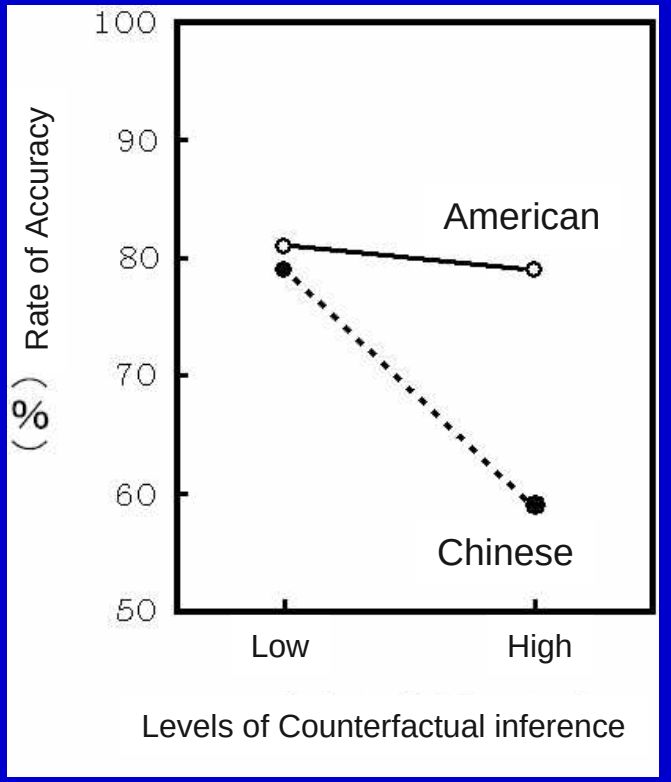
- American subjects
  - ＝ Cornell University
    Students of “Cultural Psychology”

- Japanese subjects
  - ＝ the University of Tokyo（Komaba Campus）
    Students of “Psychology” (2 classes)

Results of the Replication



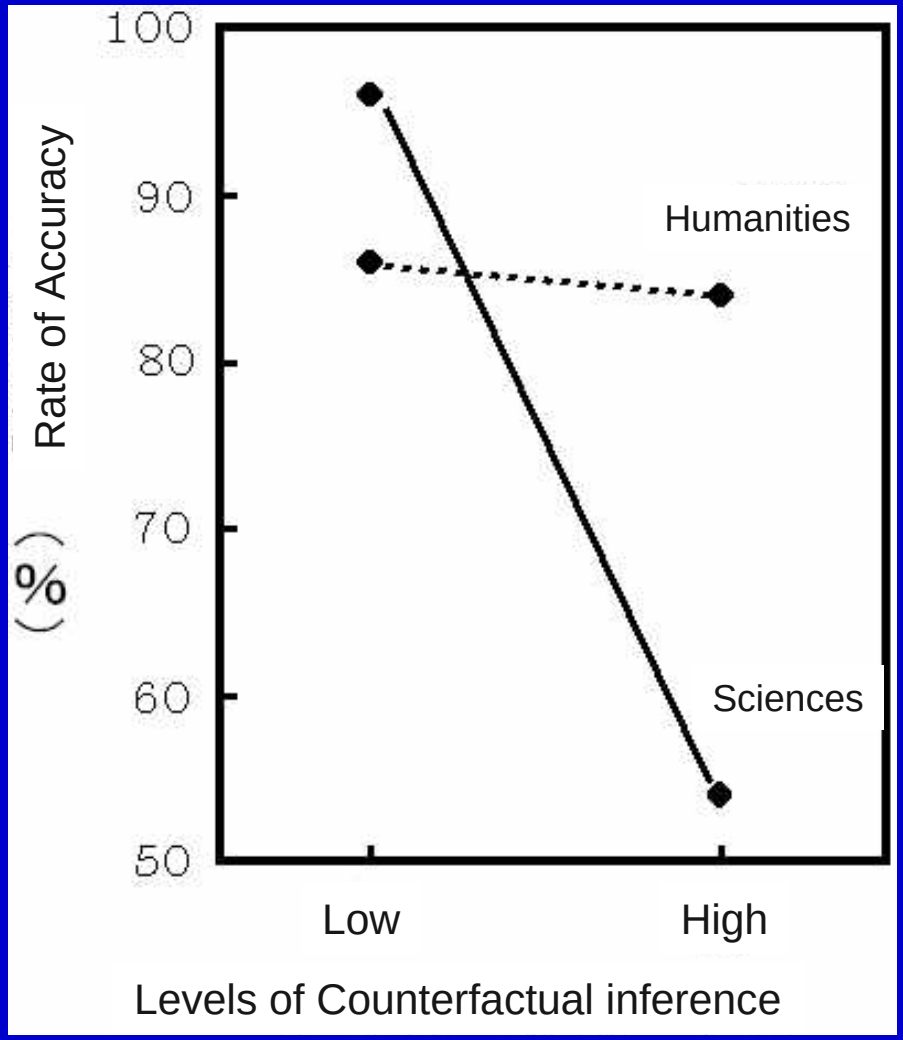
Paragraph 1　Paragraph 2



（Bloom, 1981）

Replication： basically successful

Results of Japanese Students: Humanities and Sciences



Paragraph 1　Paragraph 2

（Takano, *Cognition*, 1989）

Hypothesis

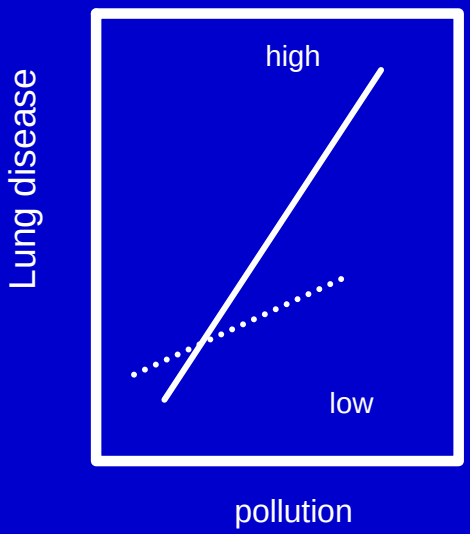
An extraneous variable ＝ Knowledge of function

- Humanities students： little knowledge of function

  Paragraph 2 — interpreted with a common functional relation

  ∴ they chose “C”

  ⇒ a high percentage gave the correct answer



Hypothesis

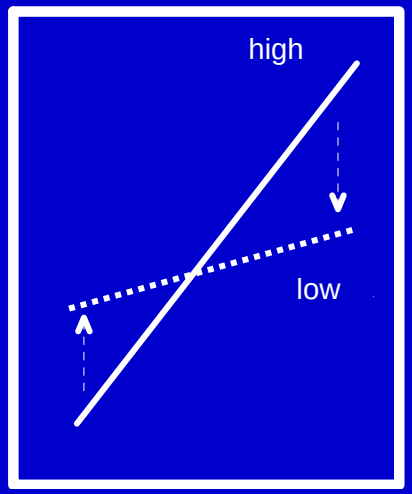
An extraneous variable ＝ Knowledge of function

- Science students： good knowledge of function

  Paragraph 2 — gave thought to various functional relations

  ∴ Many of the subjects chose “D”

  ⇒ a low percentage gave the correct answer



Corroboration

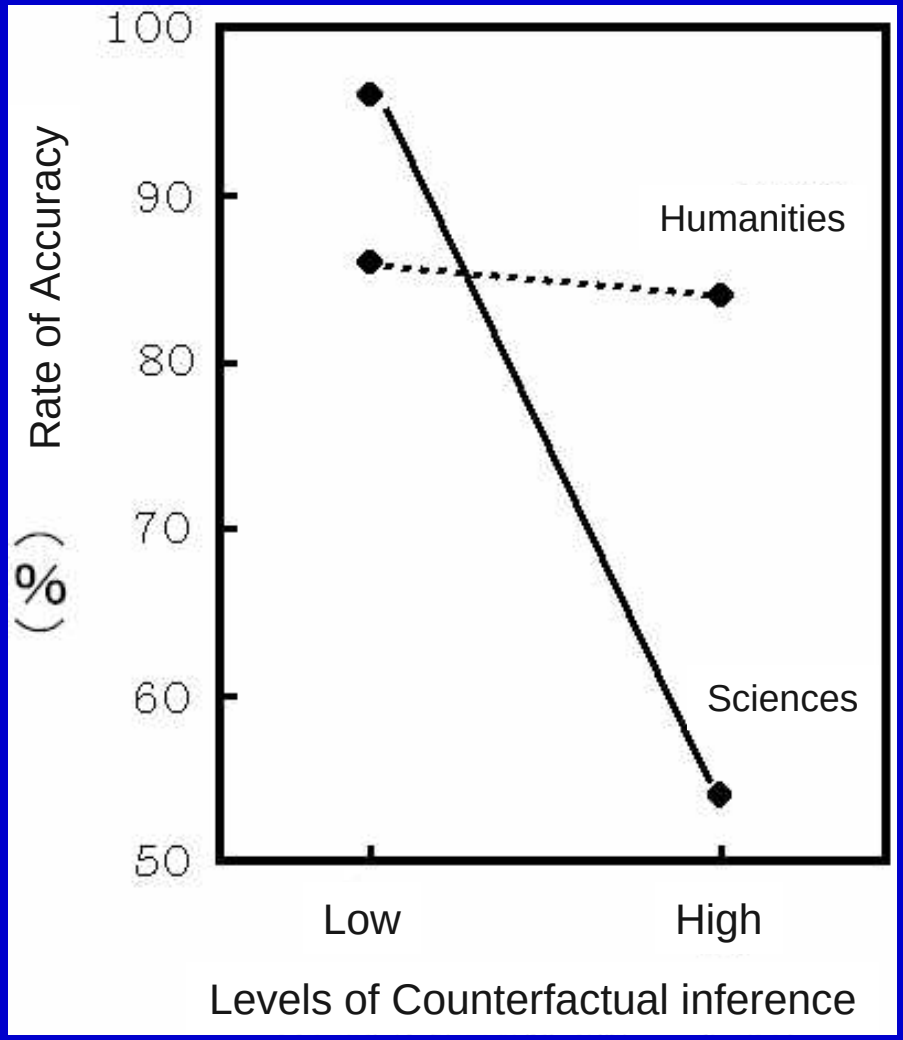
1） American subjects in the replication ＝ humanities

2） American subjects in Bloom’s experiment ＝ humanities
（students in psycholinguistics）

3） Chinese subjects in Bloom’s experiment＝
humanities ＋ sciences

4） The percentage of correct answers to paragraph 1：
sciences ＞ humanities

Results of Japanese Students: Humanities and Sciences



Paragraph 1　Paragraph 2

（Takano, *Cognition*, 1989）

Prediction

If the hypothesis is correct

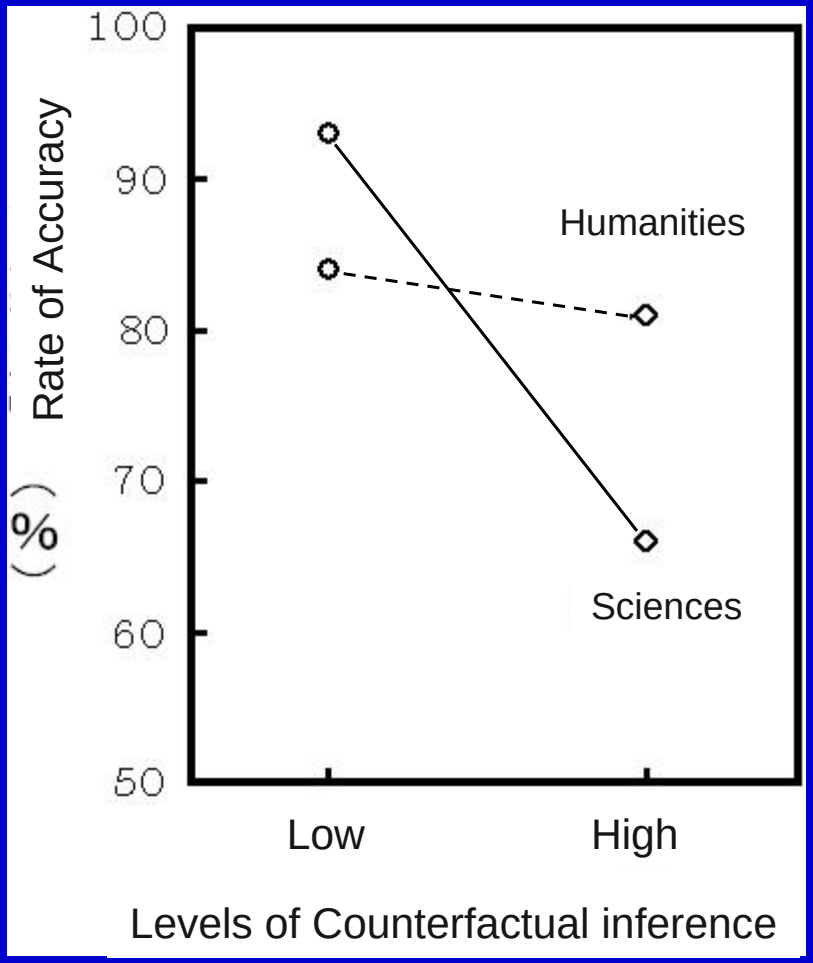
→ for American students as well,
the percentage of correct
answers to paragraph 2
humanities — high
sciences — low

The Verification Experiment

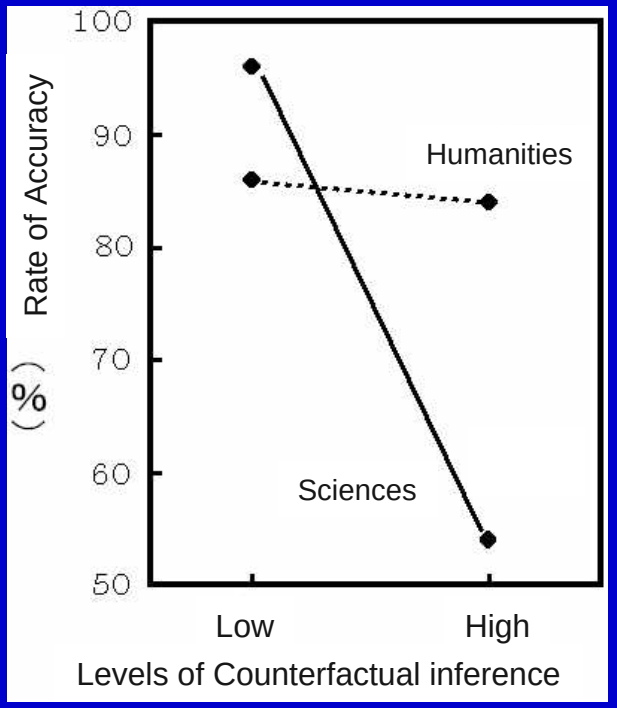
Subjects ＝ undergraduates at Cornell University

- Humanities ＝ students of “Cultural Psychology” (already mentioned)
- Sciences ＝ students in the Department of Physics （have studied calculus）

Experimental Results in America



Paragraph 1　Paragraph 2



（The results of Japanese students）

Takano’s hypothesis – supported

（Takano, *Cognition*, 1989）

A Common Question

“Eating a lot of fatty foods”

is harmful to one’s health

∴ alternative A, B, C ≠ correct

∴ the correct answer = alternative D

（“Crazy question.”）

The Answer

"Fatty foods" can be harmful to one's health

— Everyone knows this

∴ it affects all subjects equally

∴ The differences between { Americans / Chinese, Japanese } / { humanities / sciences } } cannot be explained

Experimental Results: Conclusions

The difference between (Americans / Chinese, Japanese) found in Bloom's Paragraph 2

— observed (among Japanese / among Americans) as well

∴ The difference in performance cannot be attributed to the difference in native language.

Conclusions

1） Experiments in hypostatization

(Difference in language
Difference in familiarity with functions) were confounded

2） Experiments in hypostatization ⇏ Proving Bloom's hypothesis

3） Bloom's other experiments — uninterpretable

（∵ the lack of control conditions）

4）The Japanese language ⇏ lower ability in abstract scientific thinking

The Linguistic Relativity Hypothesis：Review

The influence of language on thought（verified）

○ Minor influence

ex.: Basic color terms help improve memory for ambiguous colors by a few percent.

× Major influence

ex.: People who speak different languages cannot understand each other.

ex.: Speakers of a certain language have lower thinking ability.

Serendipity

Serendipity

＝ Accidental discoveries in science

Serendipity：Ex.1

Koichi Tanaka（The Nobel Prize in Chemistry, 2002）

：Ionization of protein molecules

“．．．I tested both specimens, but neither of them, with high molecular weight, ionized individually. Then I mixed the specimens by accident. Thinking that it was a waste to just throw it away, I measured the mixture and found that it was ionized.”

（The Asahi Shimbun　October 11, 2002）

Serendipity：Ex.2

Hideki Shirakawa（The Nobel Prize in Chemistry, 2000）

：The discovery of conductive polymers

Dr. Kazuo Akagi of University of Tsukuba, who collaborated on research with Dr. Shirakawa, says, “a thousand times too much catalyst was added by mistake, and the result of this error took the form of a film.” Dr. Shirakawa observed that the film had metallic luster, and that was the starting point for this research.

（The Asahi Shimbun　October 11, 2000）