

## Research Questions

- 科学的発見における協同の効果
  - 協同して問題を解決したり, 科学的活動を行うことには効果があるのか。
  - 創発
- 効果があるとすれば, どのような条件においてそのような効果が現れるのか。

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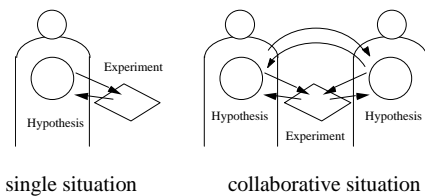
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## Criterion of effects of collaboration

- Weak (sham) effect
  - single situation < collaborative situation



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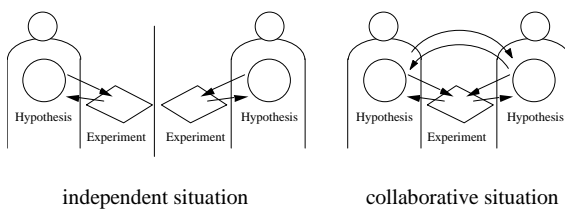
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## Criterion of effects of collaboration

- Strong (real) effect
  - independent situation < collaborative situation



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## 実験的アプローチ

	Laughlin (1985)	Laughlin (1986)	Laughlin (1991)	Laughlin (1998)	Freedman (1992)	Okada (1997)
# of group members	4	4	4	4	4	2
task	New Elusis	New Elusis	New Elusis	New Elusis	2-4-6 task	simulated molecular genetics laboratory
single	0.15	0.19	0.06 0.13 0.15 0.16	0.16	0.33 0.08	1.7
independent	0.47	0.57	0.2 0.3 0.38 0.3 0.41	0.38	0.80 0.28	2.1
collaborative	0.35	0.34	0.0 0.1 0.2 0.1 0.41	0.34	0.83 0.67	2.9

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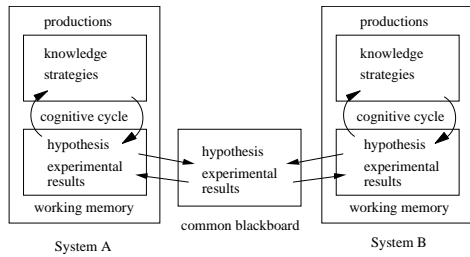
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## Interactive Production System Architecture




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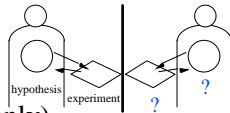
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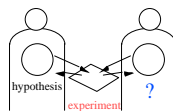
## Three stages of collaboration

- Independent situation



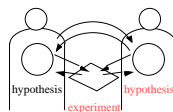
- Collaborative situation (E. only)

- Only experimental results are shared



- Collaborative situation (E. & H.)

- Both hypotheses and experimental results are shared




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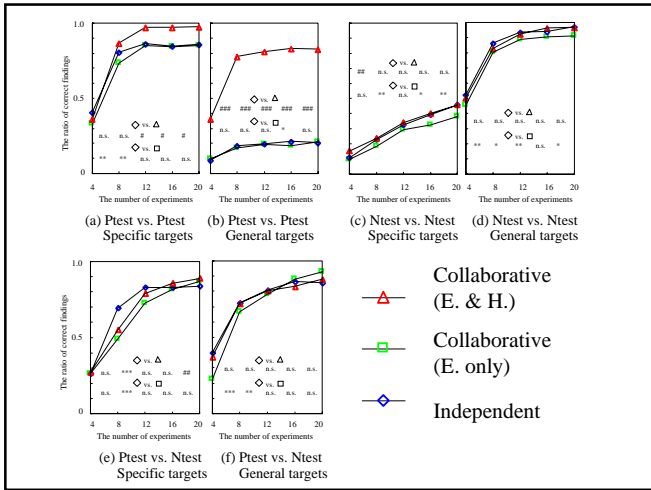
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### Three stages of collaboration

- Single situation
- Independent situation
  - theoretically calculated the single situation
- Collaborative situation (E. & H.)

The diagram shows three stages of collaboration. 1. Single situation: A single person icon with a 'hypothesis' box and an 'experiment' box connected by an arrow. 2. Independent situation: Two person icons, each with their own 'hypothesis' and 'experiment' boxes, connected by a vertical line. 3. Collaborative situation (E. & H.): Two person icons with 'hypothesis' and 'experiment' boxes, connected by a double-headed arrow between their hypothesis boxes and a double-headed arrow between their experiment boxes.

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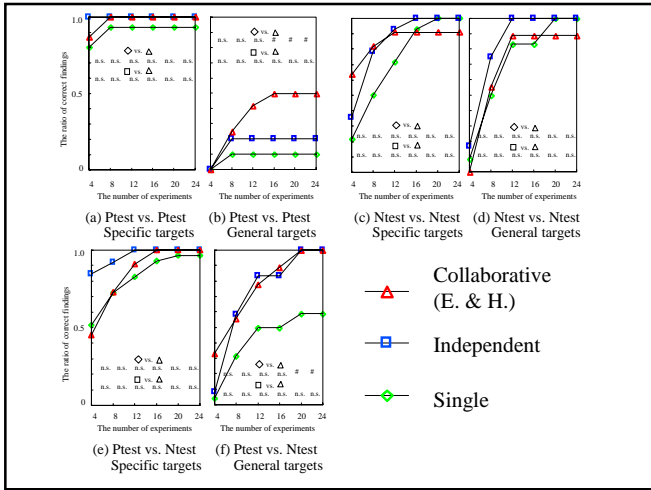
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