CogSci2002

Understanding and Scaffolding Constructive Collaboration

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Collaborative situations

- …as promising knowledge-building environments in learning science research.

- Cases with radical gains are rare

but

- Style and nature of learning and teaching changes.

In this talk…

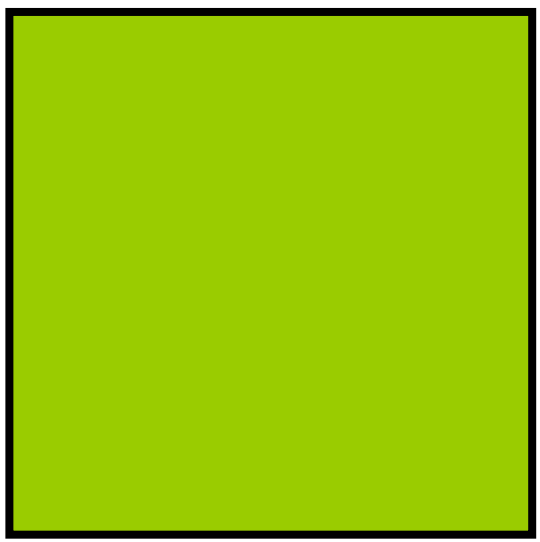
- identify a case of strong effects of collaboration,
- propose an explanation of the gain,
- report a case study of a learning environment with technology support to test the explanation.

Task

$3/4 \times 2/3 = 1/2$

"Shade 2/3 of 3/4 of the *origami* paper with oblique lines."

(Shirouzu, Miyake, & Masukawa, 2002
Cognitive Science, 26, (4))



People do not calculate, they tend to use *origami* to find the answer.

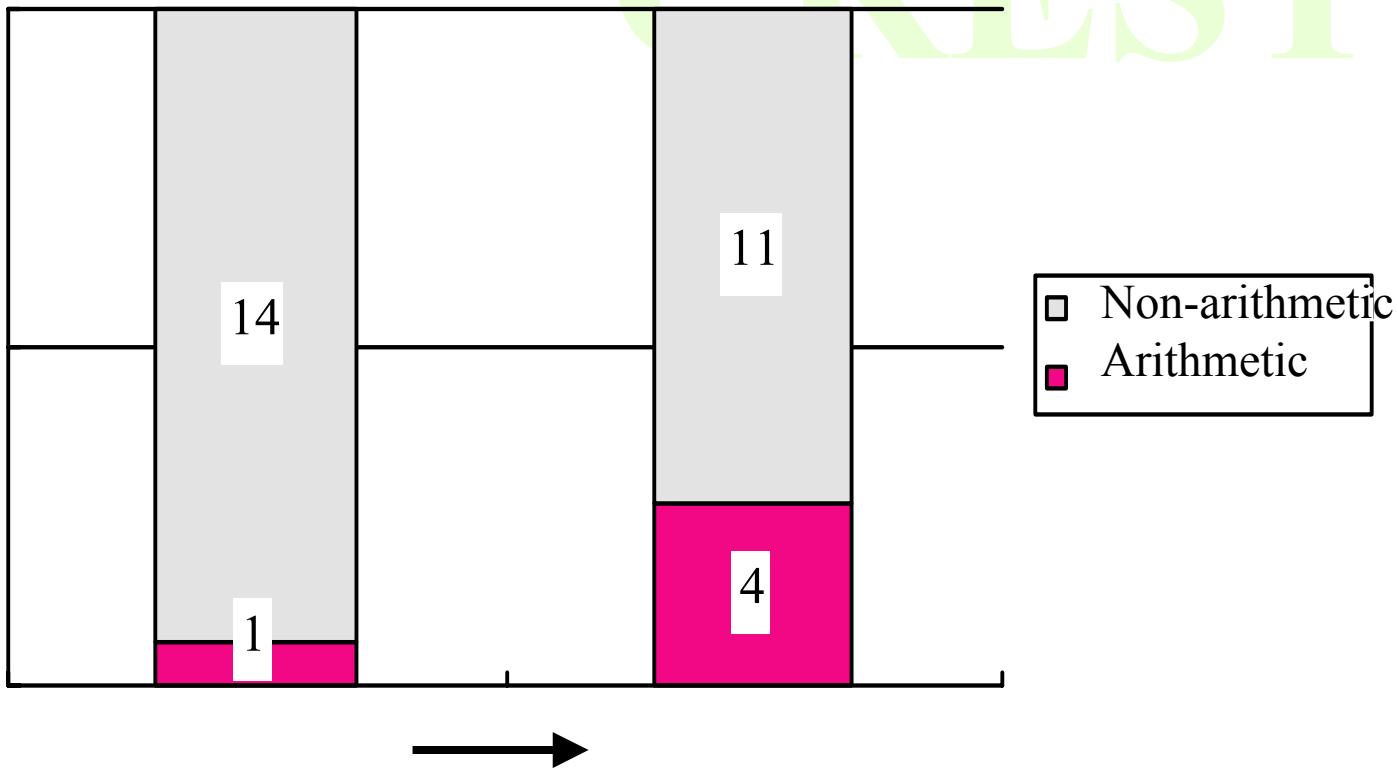
Sequential trials?

First trial: **2/3 of 3/4**

↓

Second trial : **3/4 of 2/3**

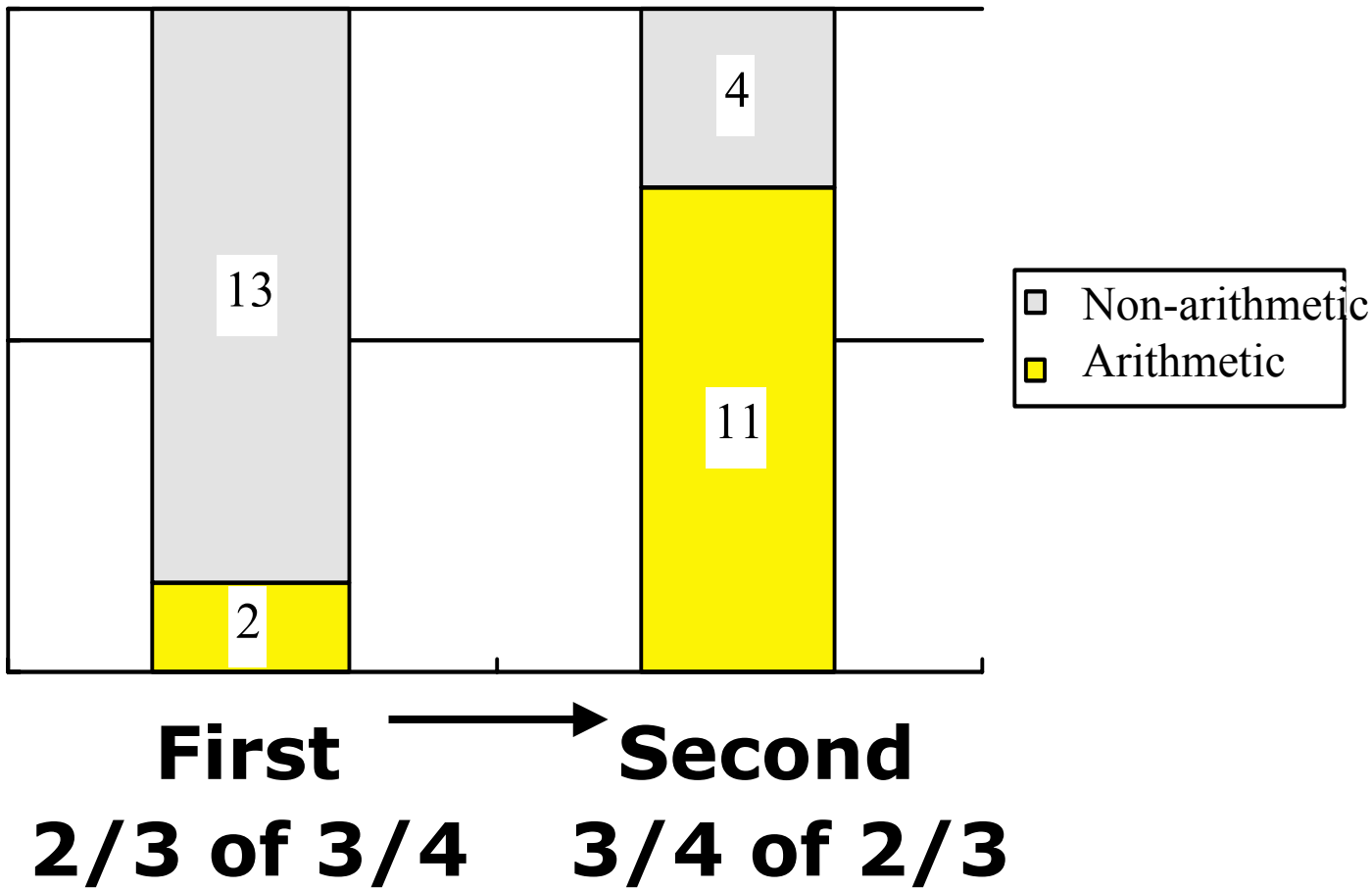
Solo subjects



First
2/3 of 3/4

Second
3/4 of 2/3

Paired subjects



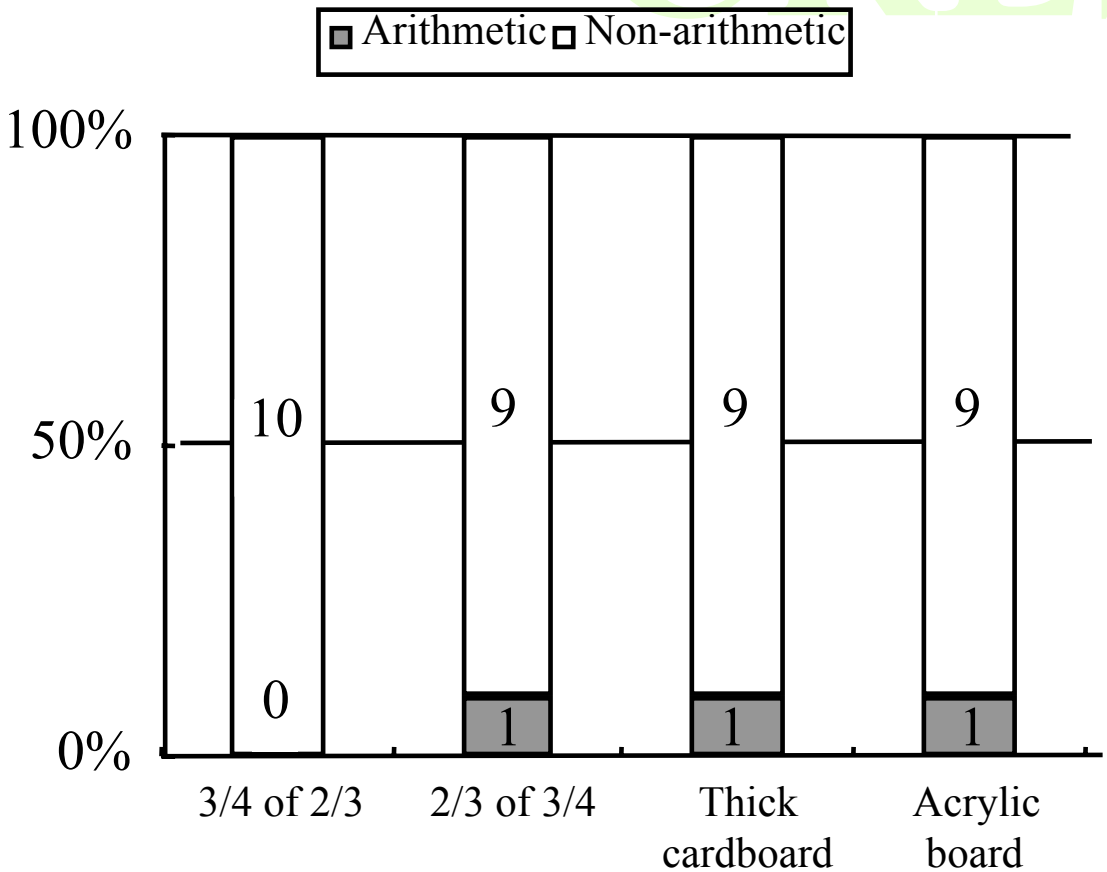
What happens in pairs??

What do *solos* do, in the first place??

What do solos do?

- Would 2/3 of 3/4 be different from 3/4 of 2/3?
- What if not origami paper but thick construction paper, or acrylic board?
- When they fold, how do they use *origami*?
- Do they notice that the answer is one-half after shading?

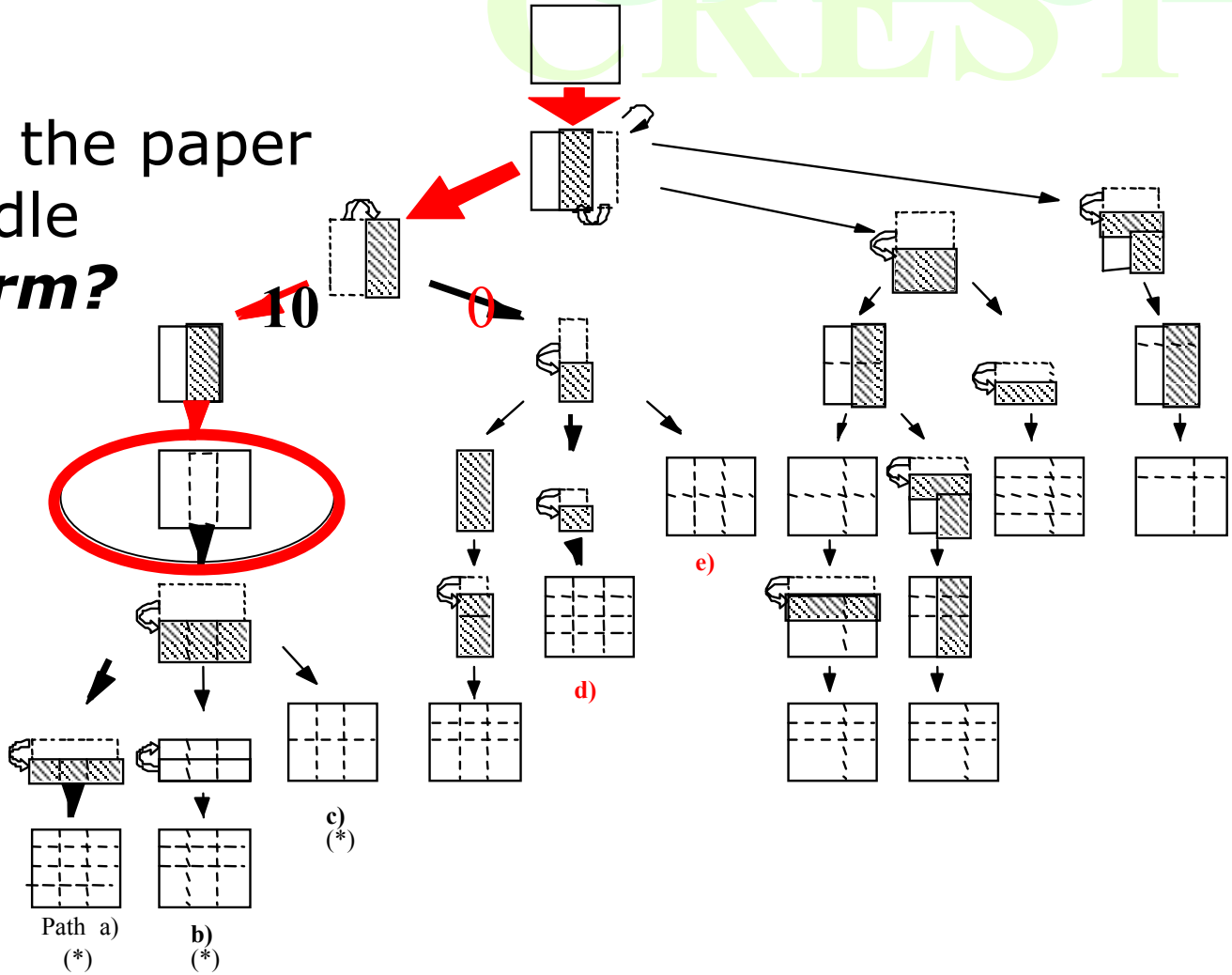
Less than 10% calculate



Not blindly react to what's out there.

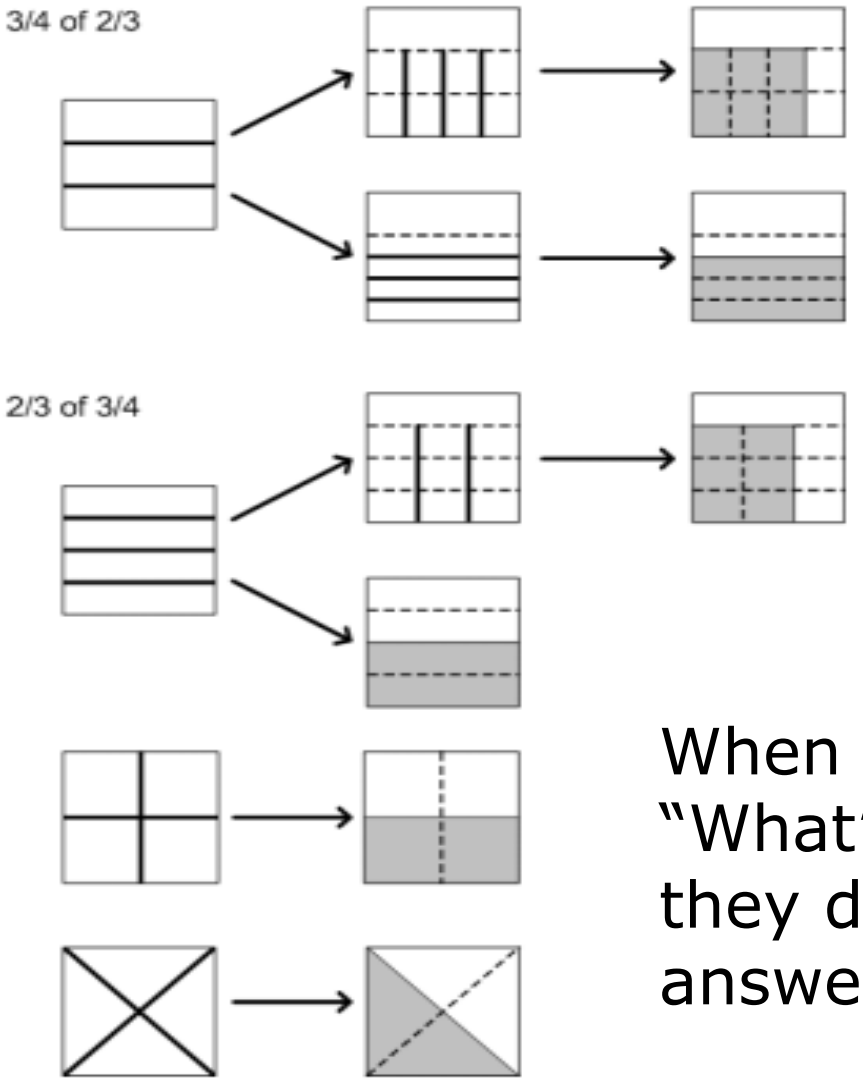
Process analysis

They open the paper
in the middle
…***to confirm?***



Schematic Solution Steps

Non-Arithmetic Strategies



When asked "What's the answer?" they do not always answer "One-half."

Arithmetic Strategy

What could this all mean?

- People are active users of external resources, with a proto-plan to first take care of the first fraction, confirm, and then proceed.

- So far as this works, there is no need to change.

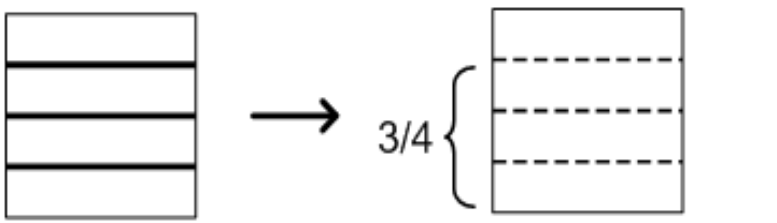
In a paired situation?

- Each individual is an active solver.
- They take turns: while one solves the problem as **a task-doer**, the other **monitors**.
- The monitor does not share the doer's proto-plan, but interprets the situation from somewhat a broader perspective.

Getting 2/3 of 3/4 (1)

Person 1

Task-doing



i) Original ii) 1st Re-interpretation

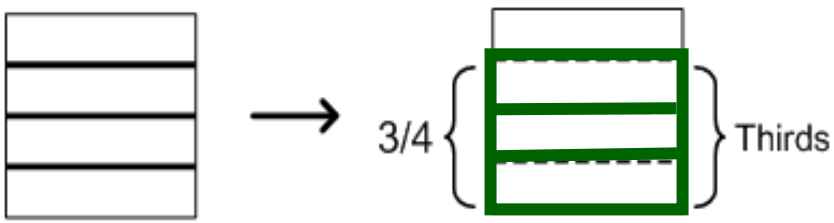
Monitoring

Person 2

Getting 2/3 of 3/4 (2)

Person 1

Task-doing



i) Original ii) 1st Re-interpretation

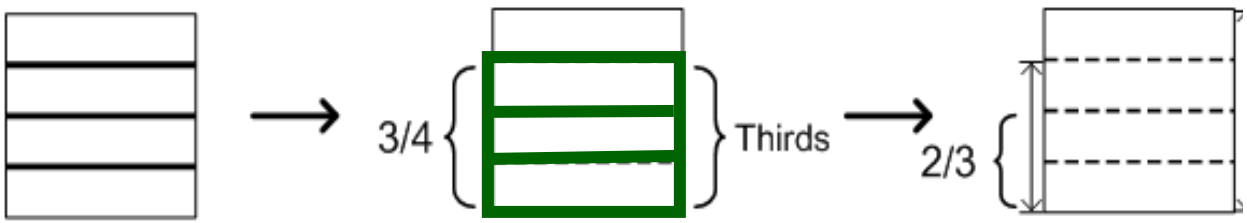
Monitoring

Person 2

Getting 2/3 of 3/4 (3)

Person 1

Task-doing → Monitoring



i) Original ii) 1st Re-interpretation

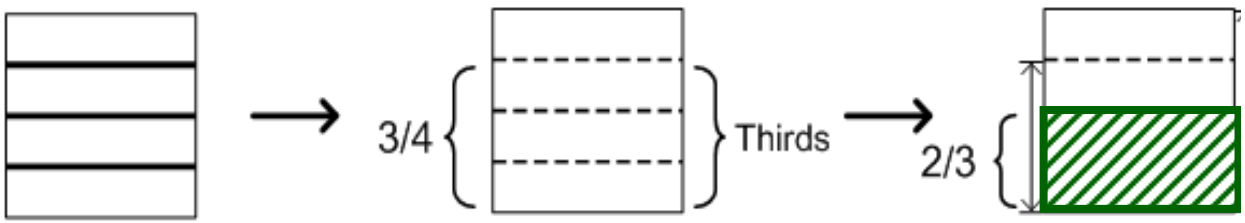
Monitoring → Task-doing

Person 2

Getting 2/3 of 3/4 (4)

Person 1

Task-doing → Monitoring



i) Original ii) 1st Re-interpretation

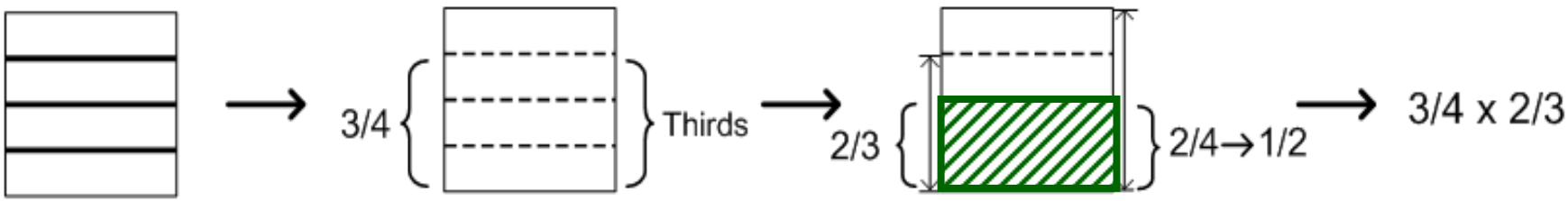
Monitoring → Task-doing

Person 2

Getting 2/3 of 3/4 (5)

Person 1

Task-doing → Monitoring → Task-doing →



Monitoring → Task-doing → Monitoring

Person 2

Collaboration works because…

- Variations of solutions differing in the degree of abstraction, *which could create a "ladder" for subjects to climb up the levels.*
- Abstraction process involves language use (for a conceptual schema formation).

Designing collaboration for fostering understanding

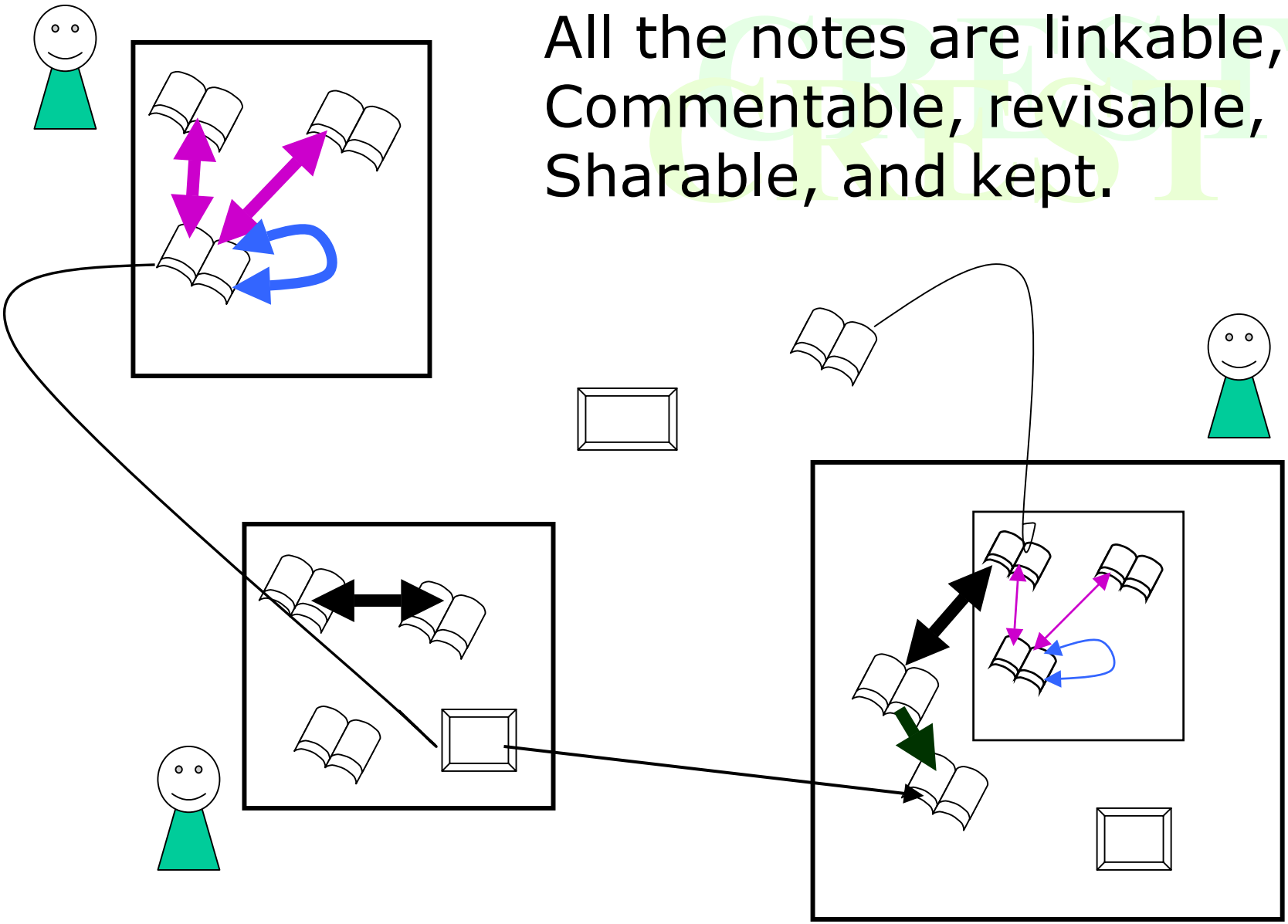
1) Encourage externalization
2) Solicit multiple re-interpretations

3) Iterate re-interpretation efforts
4) Support integration of different solutions/re-interpretations.

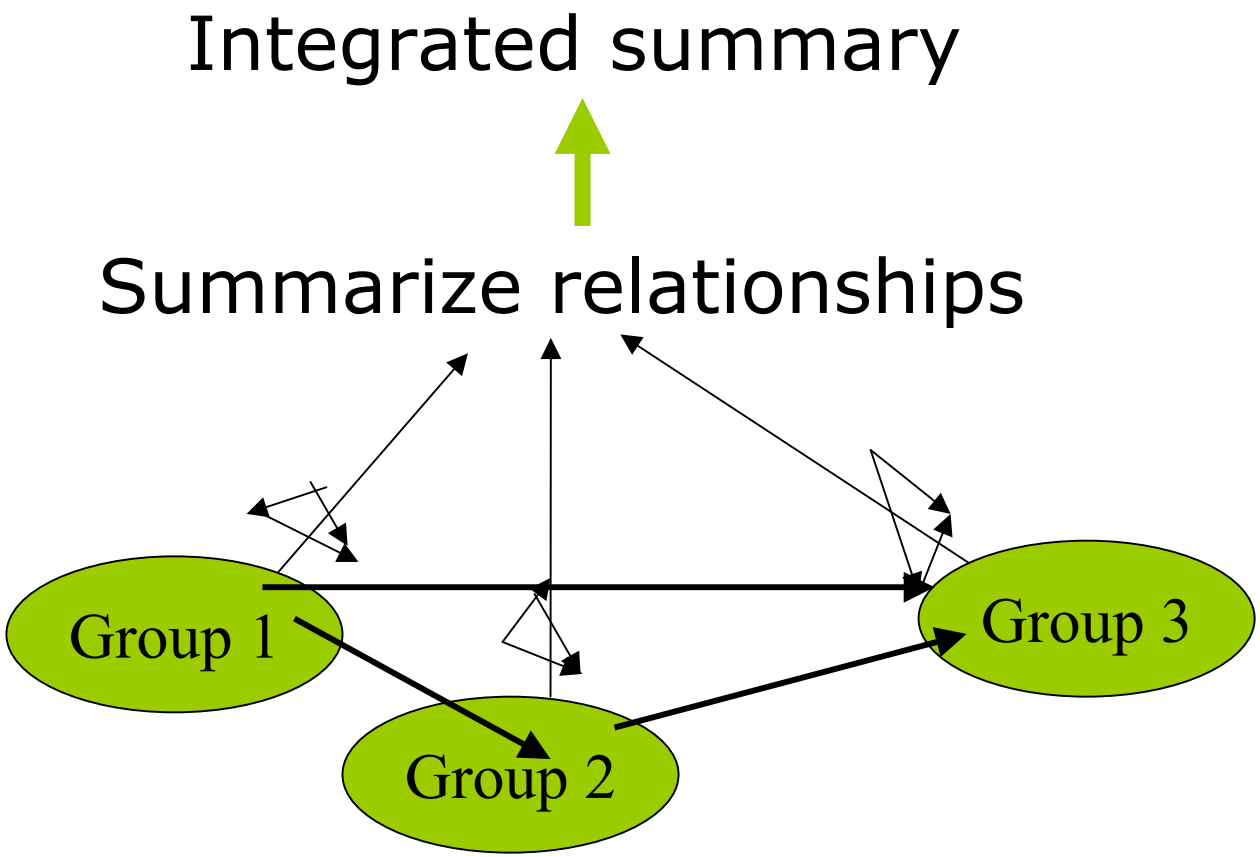
Context

- Teaching cognitive and learning sciences to undergraduates
- Goal: Have them integrate different research findings to come up with theory-like understanding, "applicable" to their real life.

All the notes are linkable, Commentable, revisable, Sharable, and kept.



Integration of research results

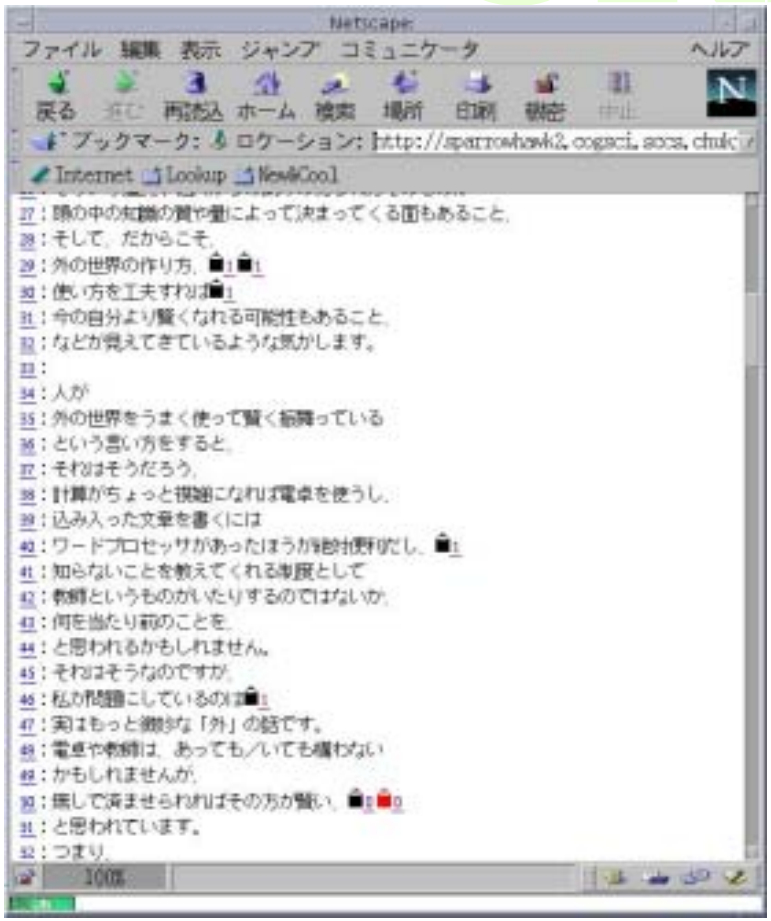


Iteration of making summaries

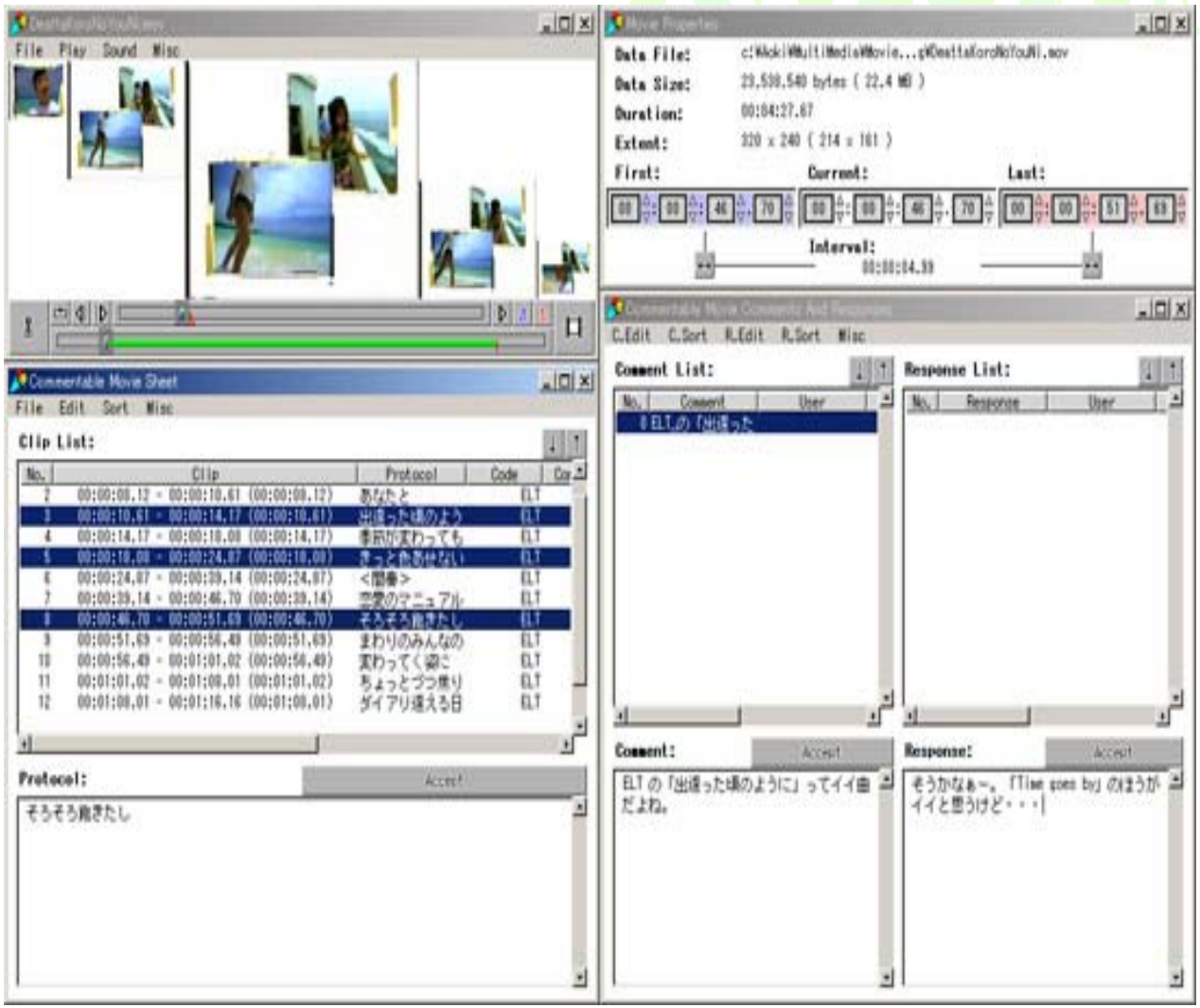
e.g. “What could we make out of series of research done on the ‘Wason selection task’?”

- Seven groups of 4 to 5 students work on seven pieces of research
- “Theorize” and explain varying results.
- Iterate presentation for three times.

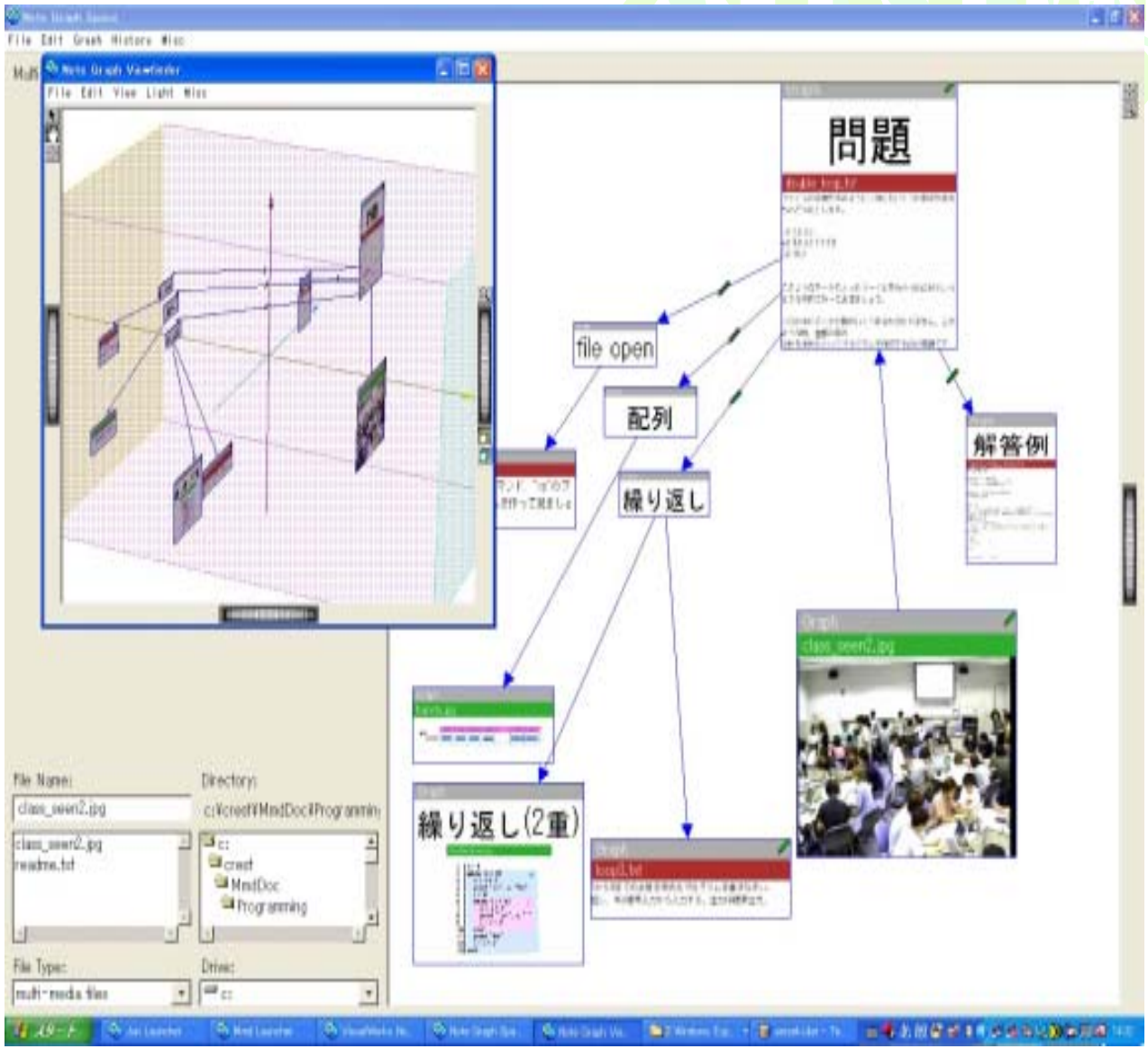
Interactive Query Raiser



CMS—Commentable Movie Sheet



MDS--Multimedia Document System



From basic research to application

- Real classrooms are a rich test-bed for many cognitive theories.
- Some theories are starting to have impacts on classrooms.

There is a lot more we can do…