



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...

CREST
CREST

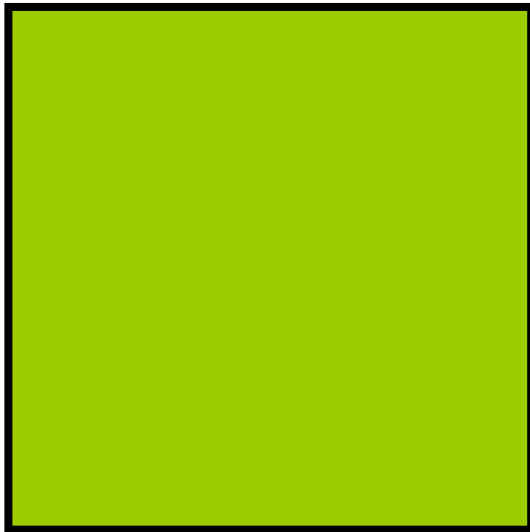
- identify a case of strong effects of collaboration,
- propose an explanation of the gain,
- report a case study of a learning environment with technology support to test the explanation.

$$\frac{3}{4} \times \frac{2}{3} = \frac{1}{2}$$

Task

“Shade $\frac{2}{3}$ of $\frac{3}{4}$ 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.

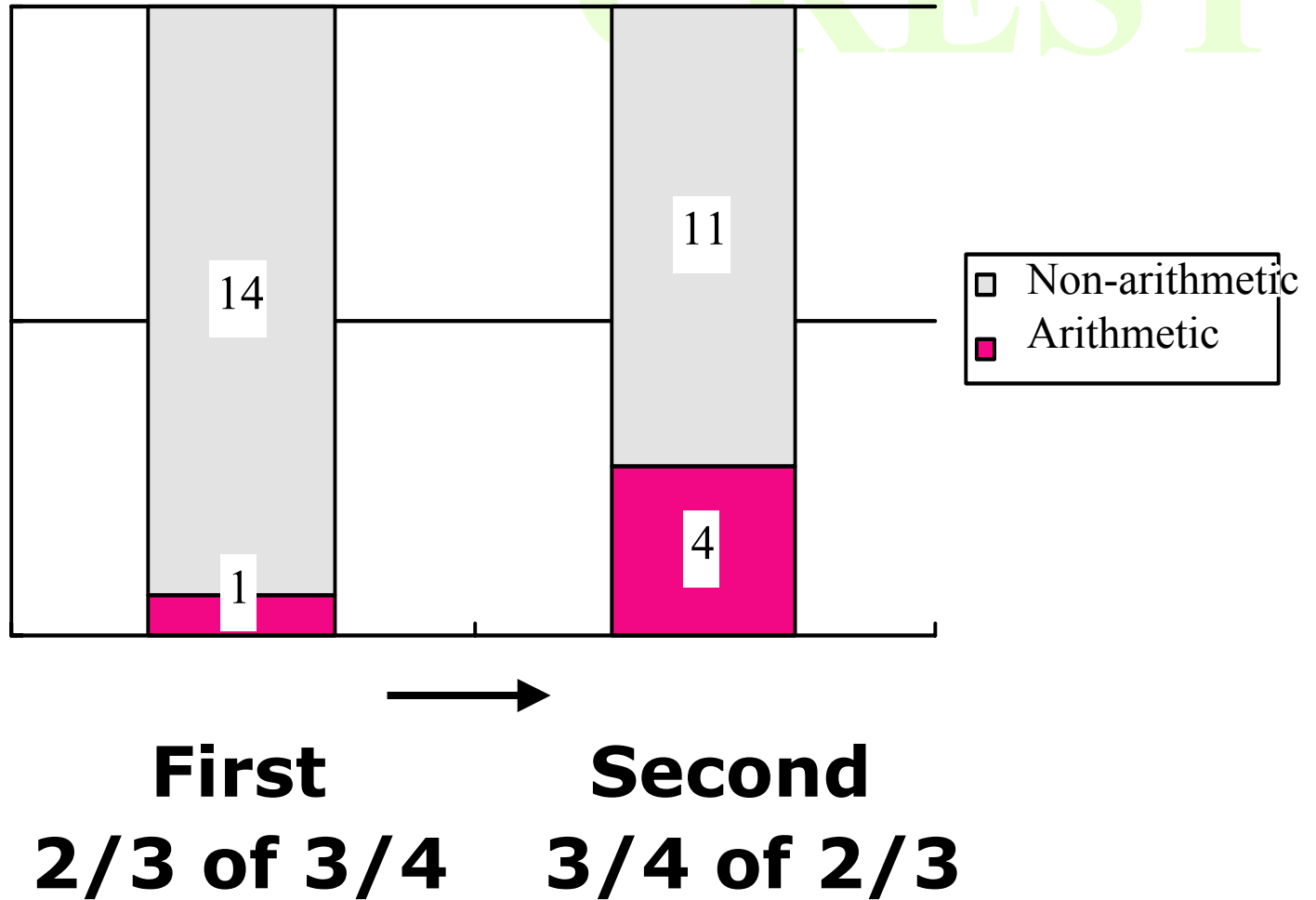
Sequential trials?

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

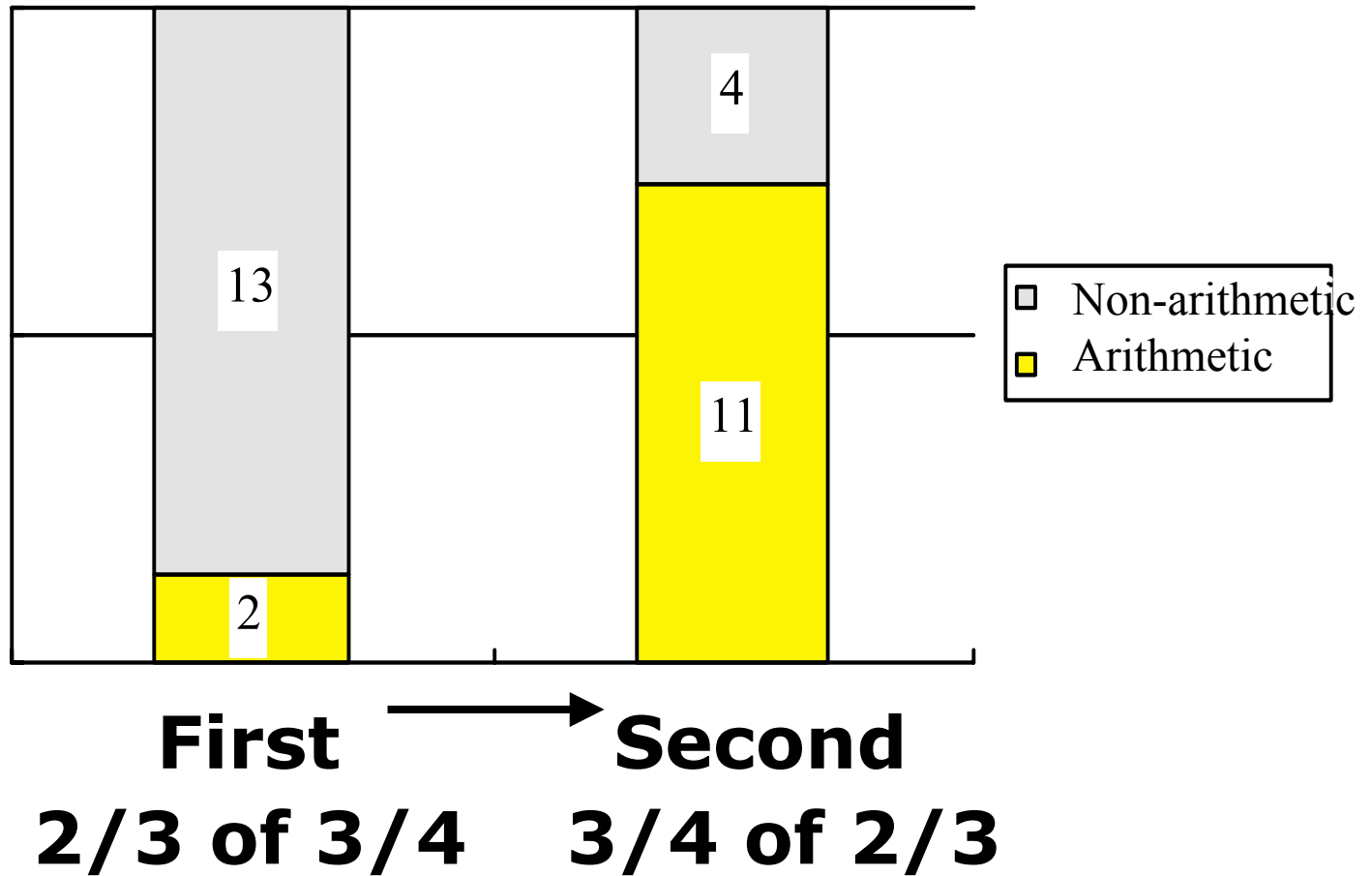


Second trial : **3/4 of 2/3**

Solo subjects



Paired subjects



CREST
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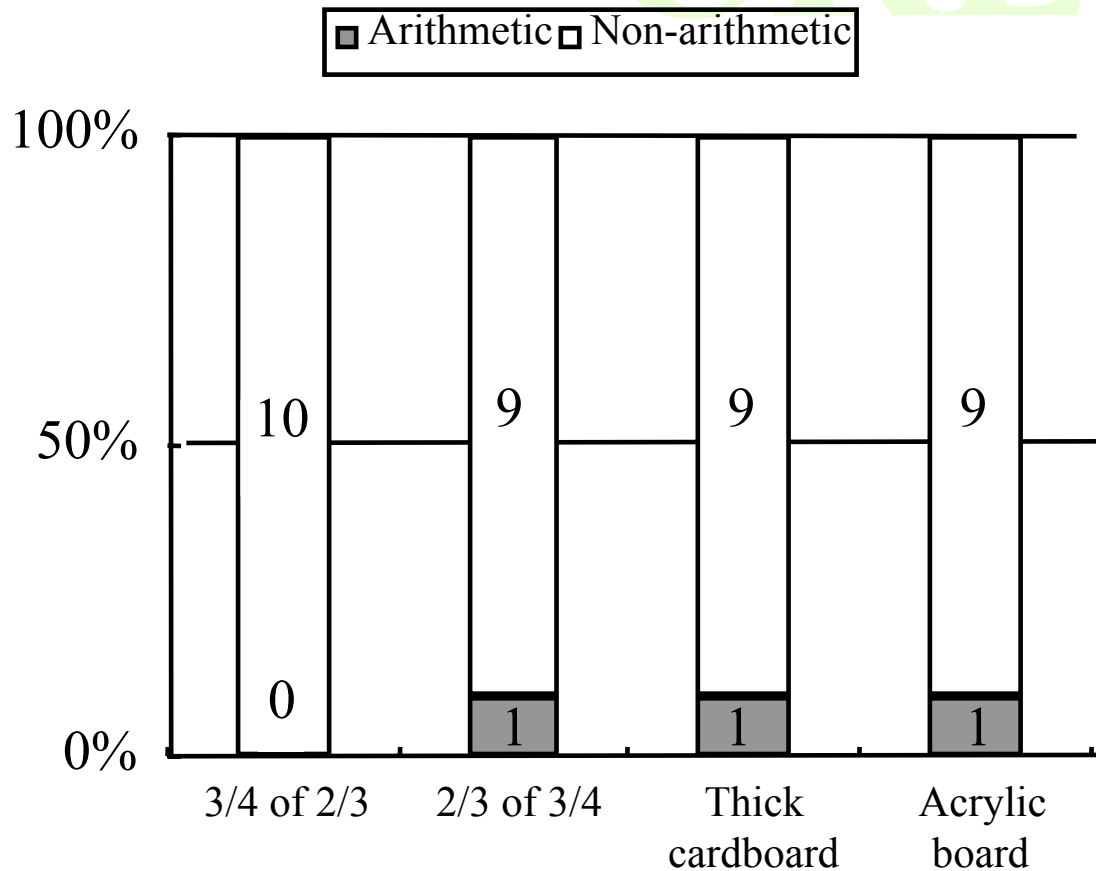
What happens in pairs??

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

What do solos do?

- Would $\frac{2}{3}$ of $\frac{3}{4}$ be different from $\frac{3}{4}$ of $\frac{2}{3}$?
- 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?

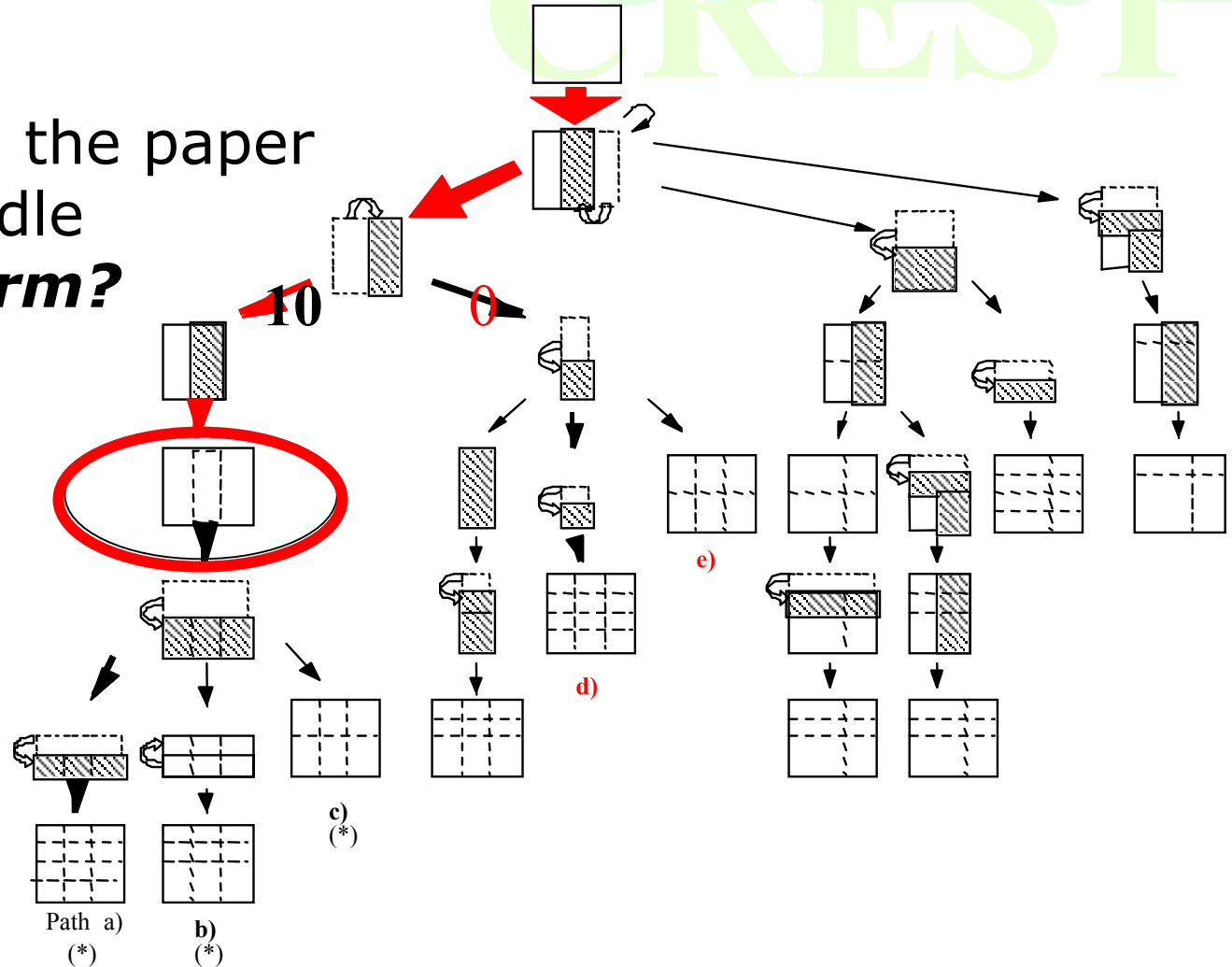
Less than 10% calculate



Not blindly react to what's out there.

Process analysis

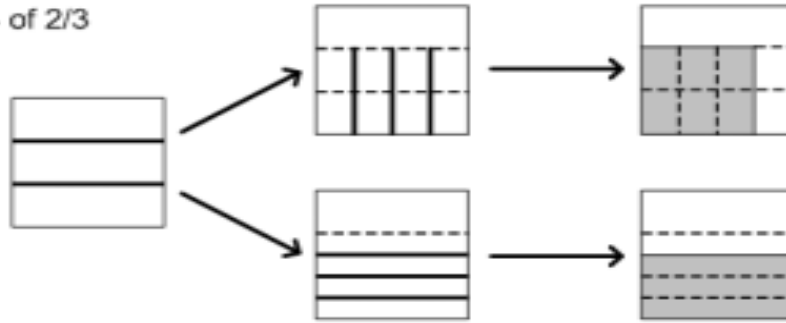
They open the paper
in the middle
...*to confirm?*



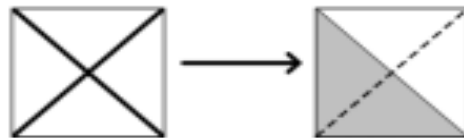
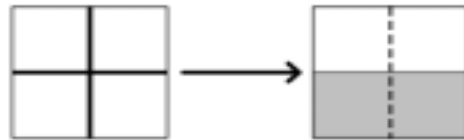
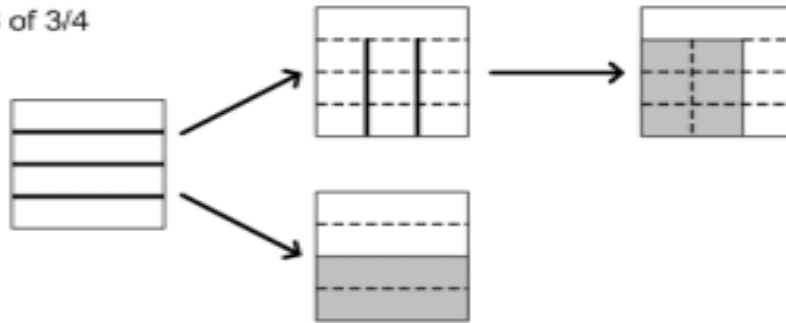
Schematic Solution Steps

Non-Arithmetic Strategies

$3/4$ of $2/3$



$2/3$ of $3/4$



When asked
 “What’s the answer?”
 they do not always
 answer “One-half.”

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.

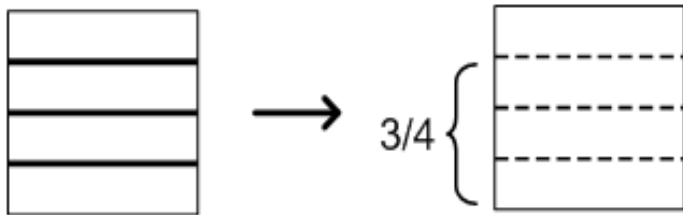
In a paired situation?

- 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

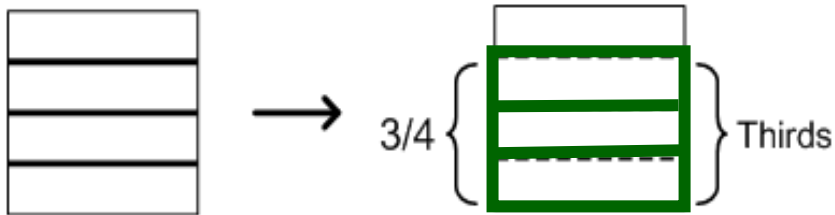
Monitoring

Person 2

Getting 2/3 of 3/4 (2)

Person 1

Task-doing



i) Original

ii) 1st Re-interpretation

Monitoring

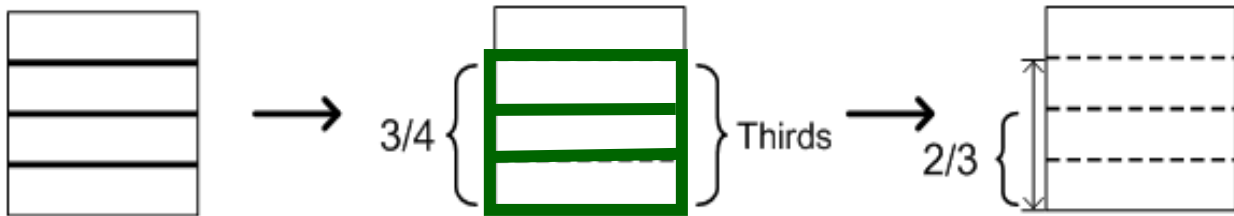


Person 2

Getting 2/3 of 3/4 (3)

Person 1

Task-doing → **Monitoring**



i) Original

ii) 1st Re-interpretation

Monitoring

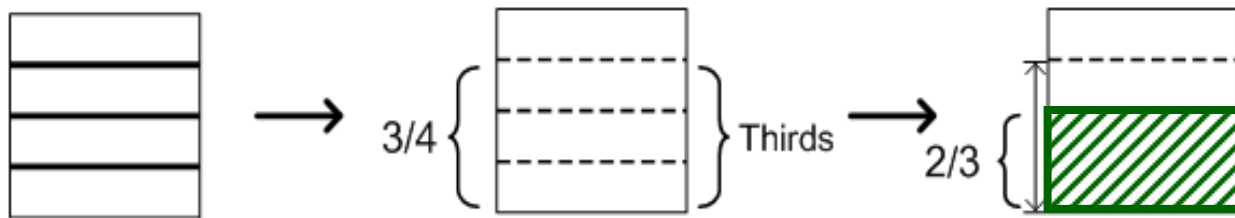
Task-doing →

Person 2

Getting 2/3 of 3/4 (4)

Person 1

Task-doing → **Monitoring**



i) Original

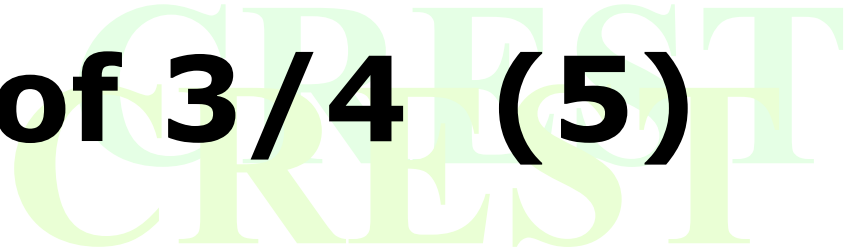
ii) 1st Re-interpretation

Monitoring

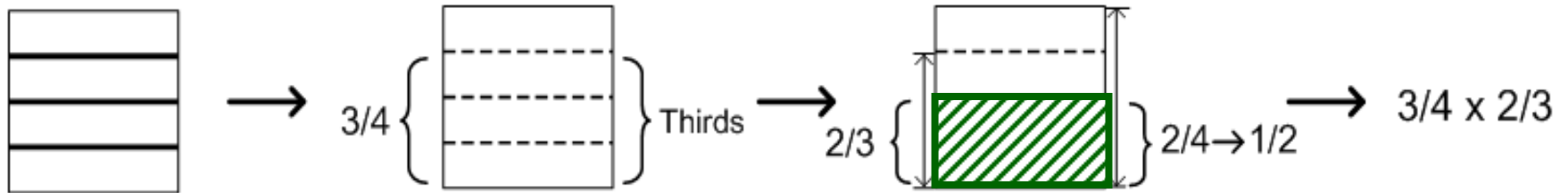
Task-doing →

Person 2

Getting 2/3 of 3/4 (5)



Person 1



i) Original

ii) 1st Re-interpretation

iii) 2nd Re-interpretation

iv) Calculation

Monitoring



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).

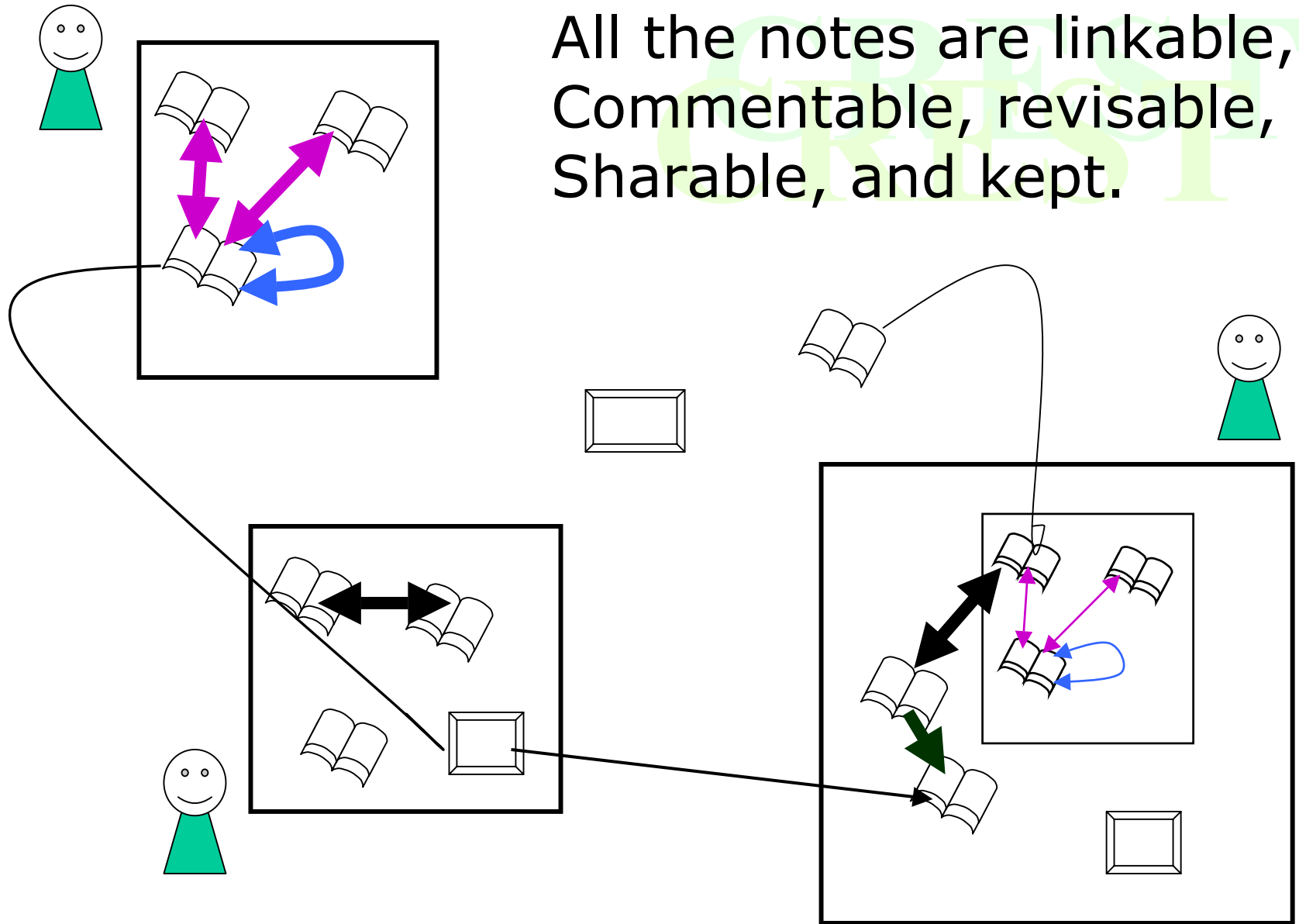
Designing collaboration for fostering understanding

- 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.



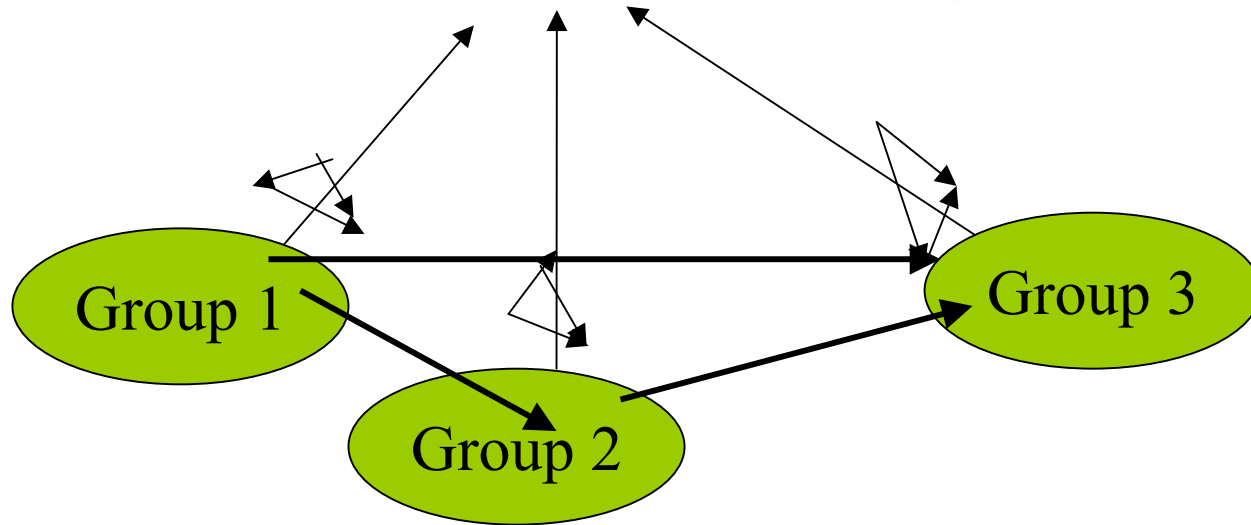
Integration of research results



Integrated summary



Summarize relationships



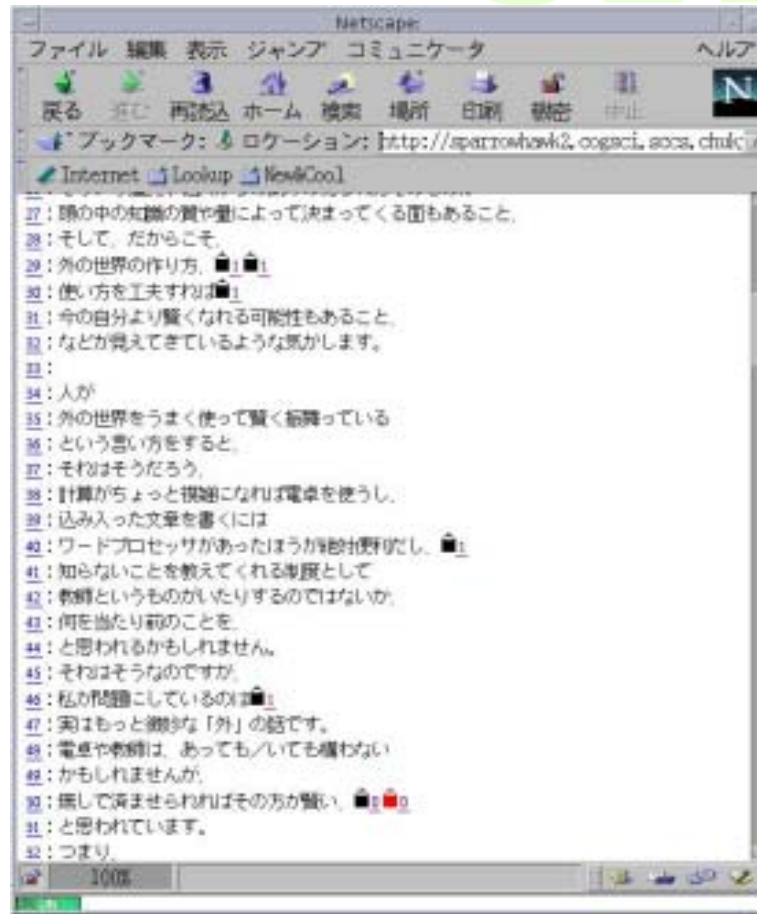
Iteration of making summaries



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

Movie Properties

Data File: c:\Wd\Wd\it\Media\Movie...gDesttafordkofouli.sov
Data Size: 23,539,540 bytes (22.4 MB)
Duration: 00:04:27.67
Extent: 320 x 240 (214 x 161)

First: [00:00:00] Current: [00:00:46] Last: [00:00:51]
Interval: 00:00:04.59

Commentable Movie Comment And Response

C.Edit C.Sort R.Edit R.Sort Misc

Comment List:

No.	Comment	User
1	ELTの「出戻った	

Response List:

No.	Response	User
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Commentable Movie Sheet

File Edit Sort Misc

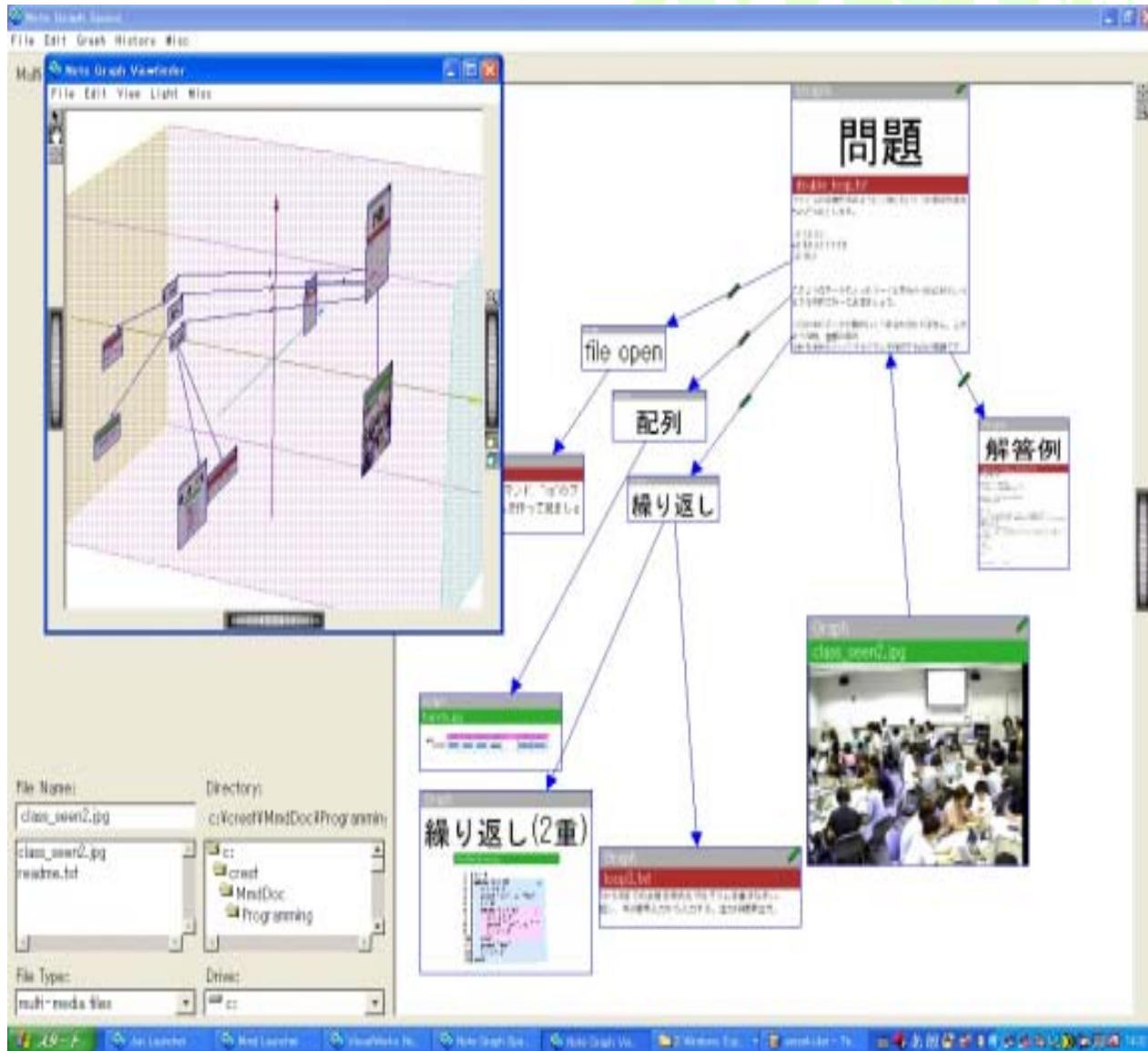
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No.	Clip	Protocol	Code
2	00:00:08.12 - 00:00:10.61 (00:00:08.12)	あなたと	ELT
3	00:00:10.61 - 00:00:14.17 (00:00:10.61)	出戻った頃のように	ELT
4	00:00:14.17 - 00:00:19.00 (00:00:14.17)	季節が 바뀌っても	ELT
5	00:00:19.00 - 00:00:24.07 (00:00:19.00)	きっとあきらめない	ELT
6	00:00:24.07 - 00:00:30.14 (00:00:24.07)	<間奏>	ELT
7	00:00:30.14 - 00:00:46.70 (00:00:30.14)	恋愛のニュースアル	ELT
8	00:00:46.70 - 00:00:51.69 (00:00:46.70)	そろそろあきたし	ELT
9	00:00:51.69 - 00:00:56.49 (00:00:51.69)	まわりのみんなの	ELT
10	00:00:56.49 - 00:01:01.02 (00:00:56.49)	実わってく姿に	ELT
11	00:01:01.02 - 00:01:09.01 (00:01:01.02)	ちょっとづつ作り	ELT
12	00:01:09.01 - 00:01:16.16 (00:01:09.01)	ダイヤリ送える日	ELT

Comment:
そろそろあきたし

Response:
そうかなあー。「Time goes by」のまうが
イイと思うけど・・・

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...

