



Institute of Social Psychology, 'Psychology as Social Science'
public lecture

The Cultural Practices of Cognition

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The cultural practices of cognition

Edwin Hutchins

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Bronislaw Malinowski, the father of modern ethnographic methods, in the Trobriand Islands (1916)



Me, a child of ethnographic methods, in the Trobriand Islands (1976)



Four facts

- Humans inhabit bodies of flesh
- The brain is an organ of the body
- Humans are highly social animals
- Humans inhabit culturally organized worlds

Early Cognitive science imagined cognition without...

culture

context

history

affect

the body

the brain

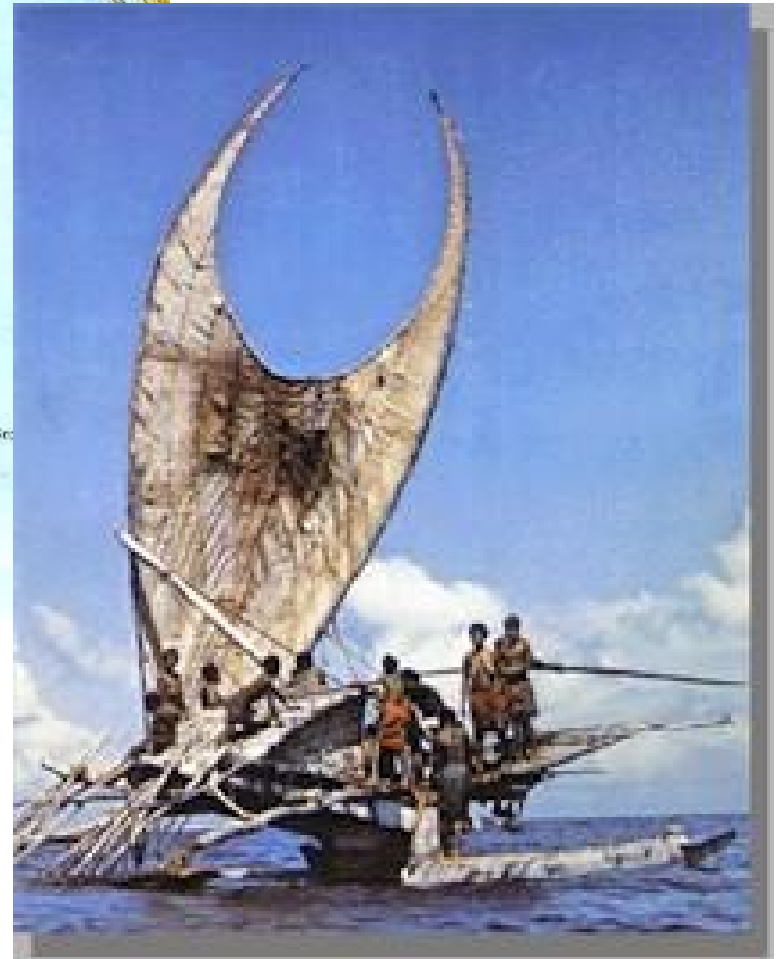
society

Imagining Cognition in the Wild Trobriand Island Land Litigation

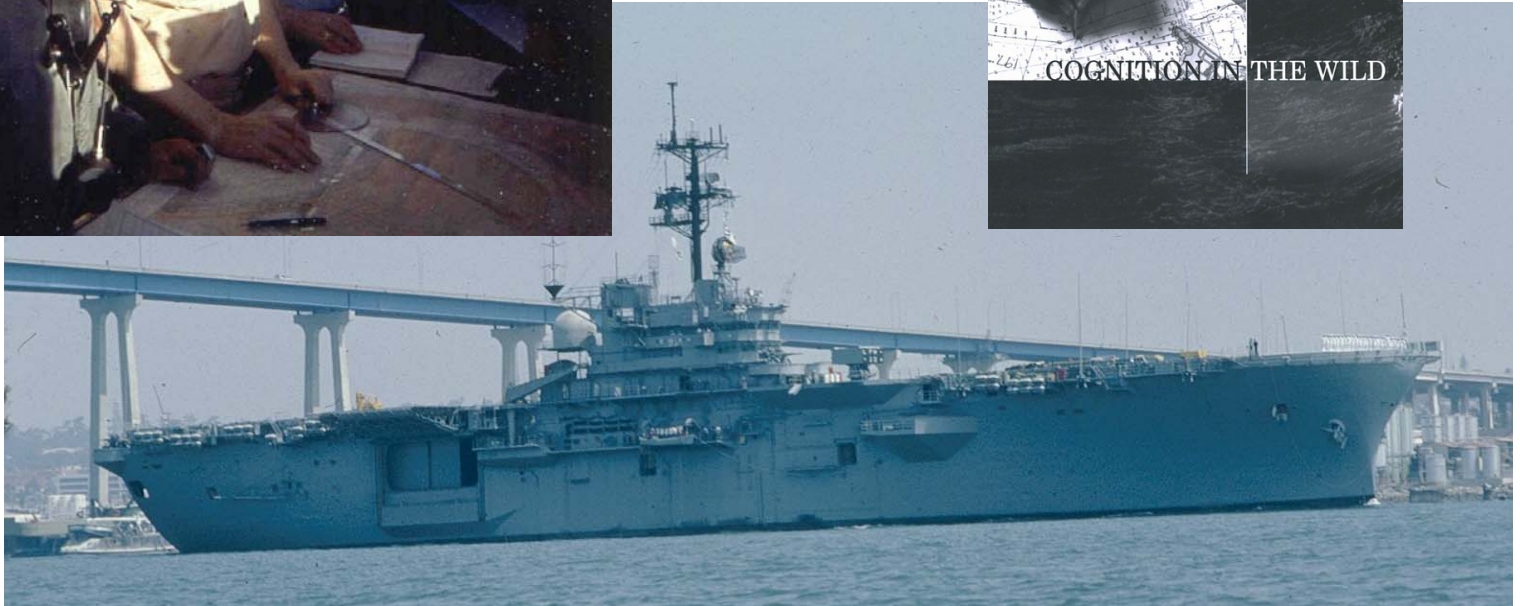
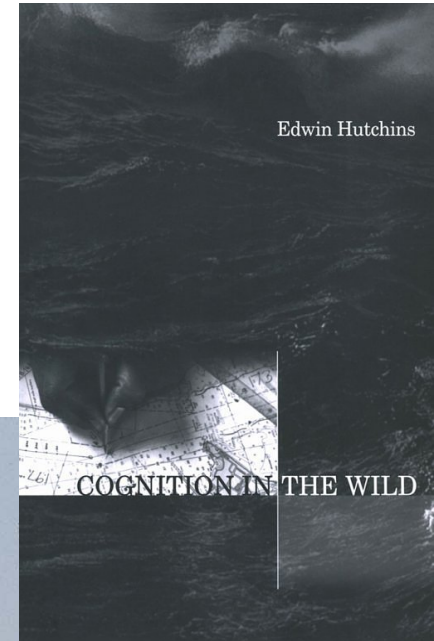


Imagining Cognition in the Wild

Micronesian Navigation



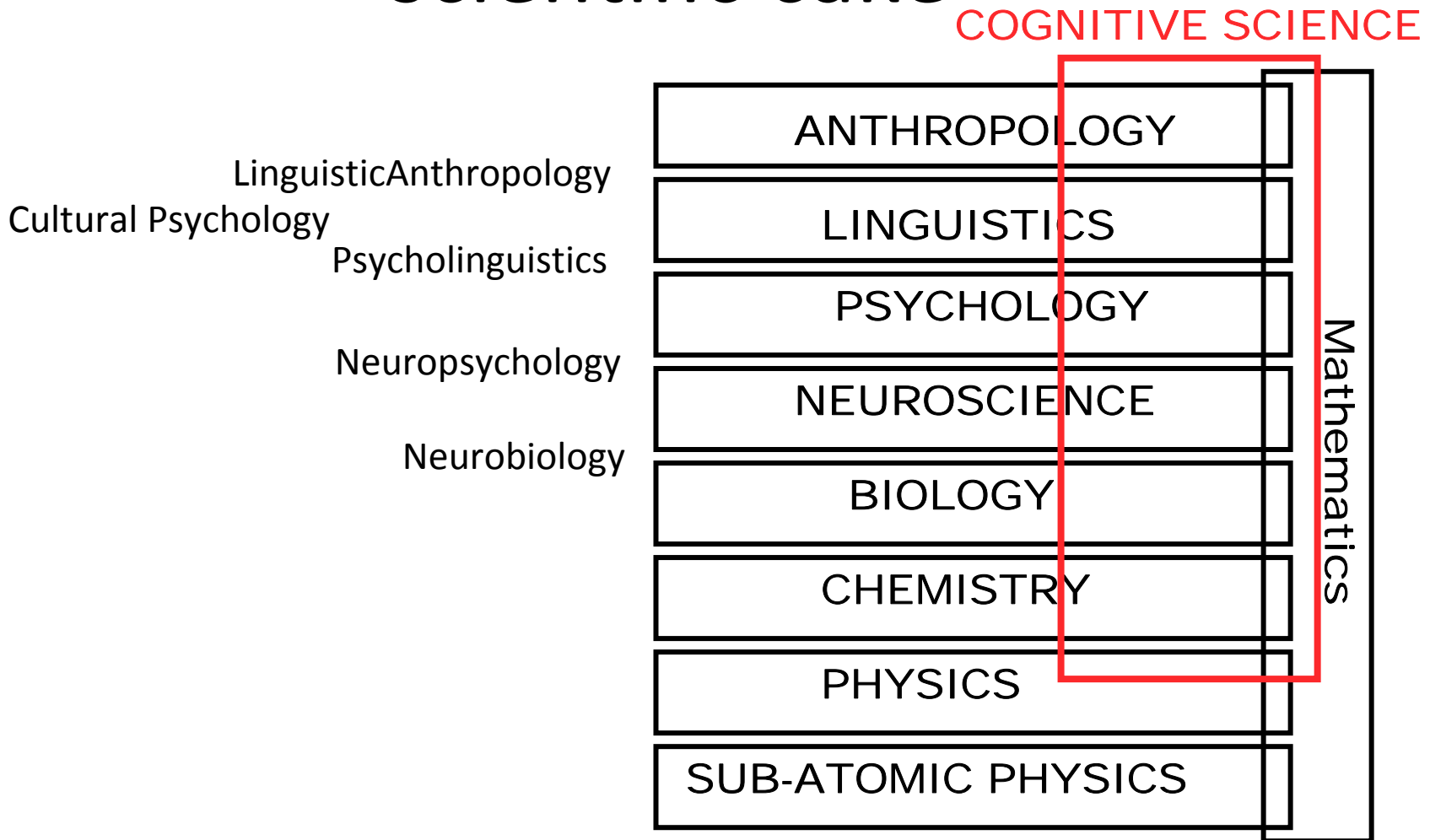
Imagining Cognition in the Wild Ship Navigation



Imagining Cognition in the Wild Commercial Airline Flight Operations



Cognitive science as a slice of scientific cake

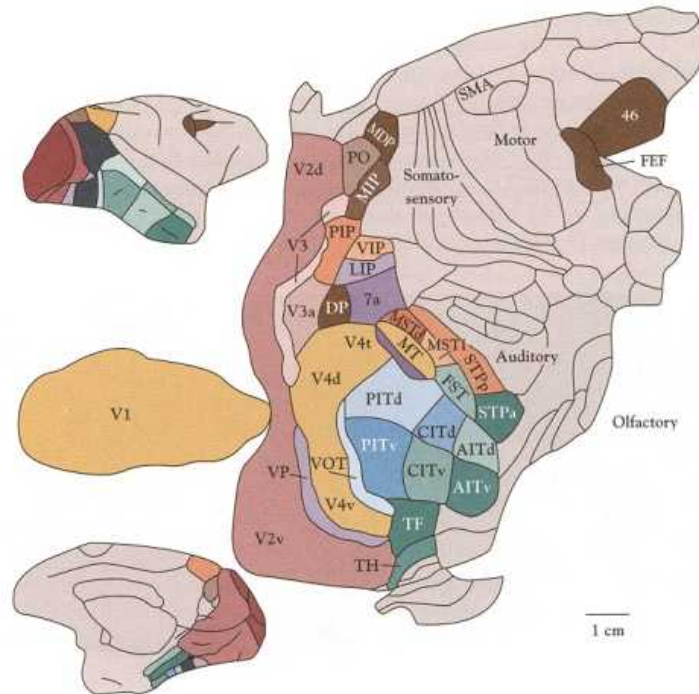


Imagine cognition...distributed

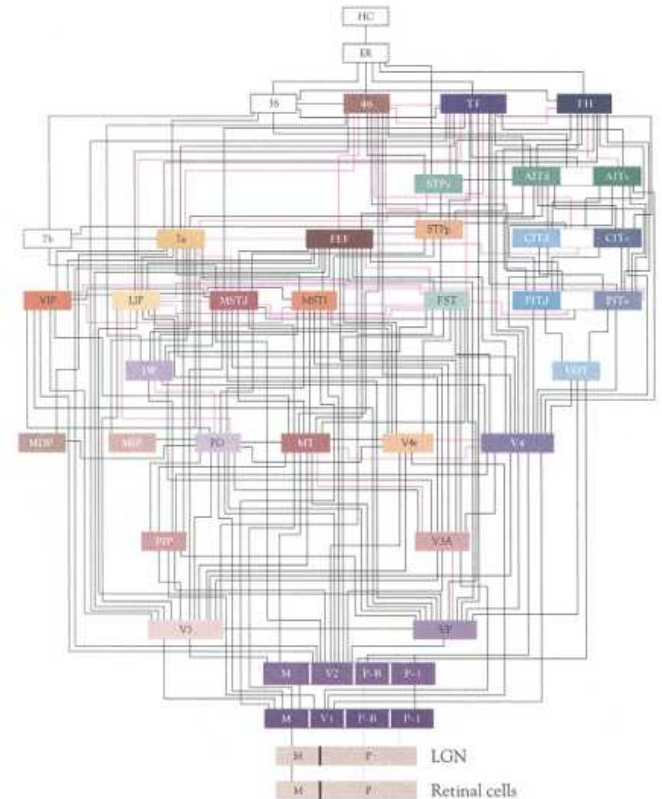
Systems have different (cognitive) properties from their parts.

What information goes where, when, and in what form?

within a brain



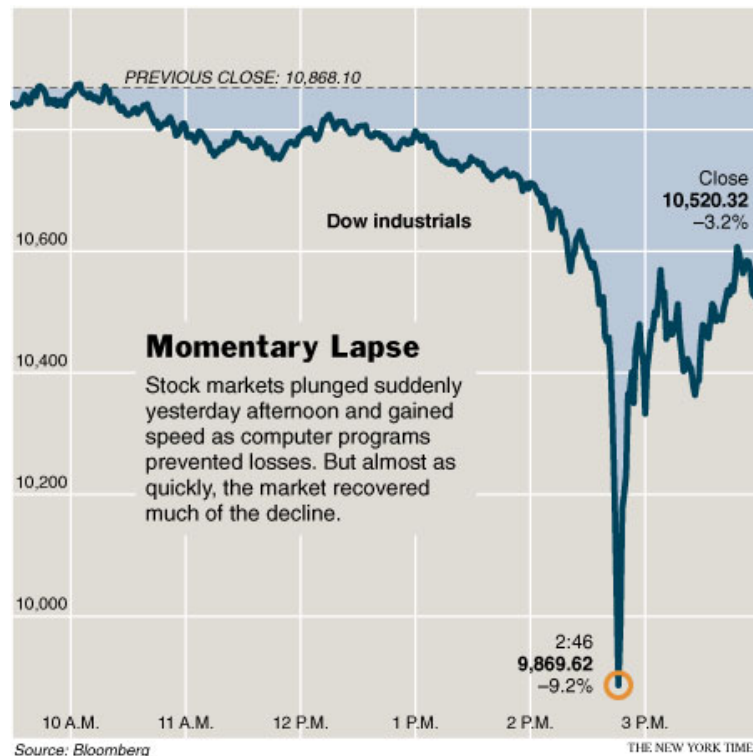
(Van Essen Lab)



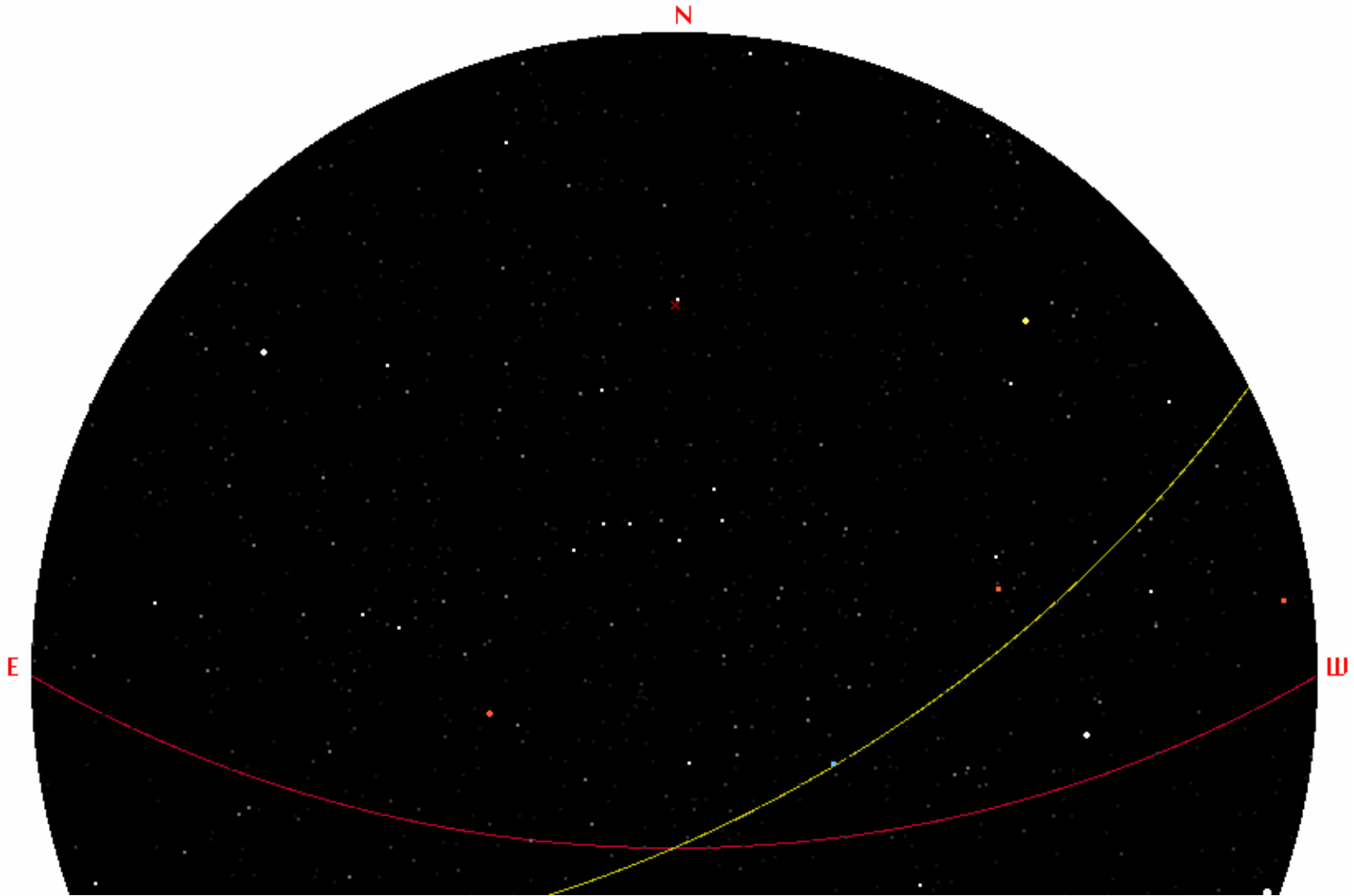
Understanding cognition is largely understanding the **dynamic flow of information** through the system

Interactions in the social world

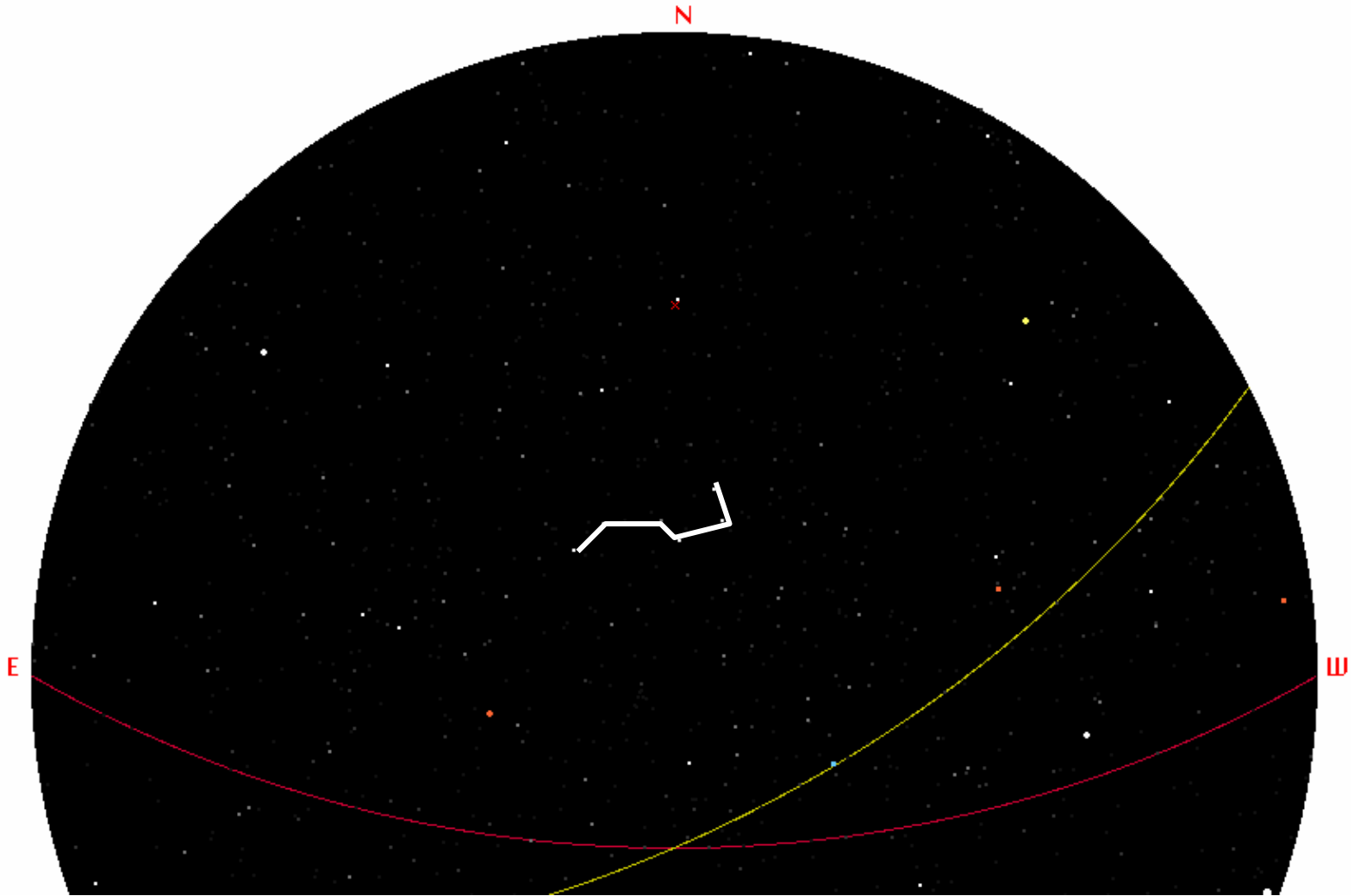
- Jury decision making
- Social psychology
- *Wisdom of crowds, Networks, Infotopia*
- Markets



The natural material world



Seeing stars as constellations

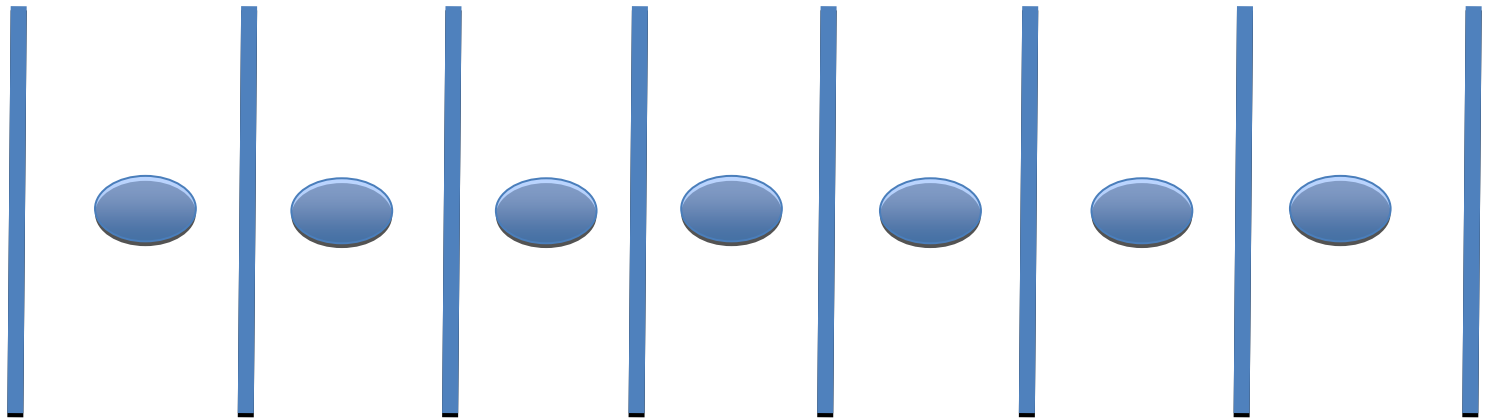


Seeing a queue



Imagining the cultural practices
of mathematical cognition

Moving a partition through a set



A sequence of number names

‘one’, ‘two’, ‘three’,

Counting

one

two

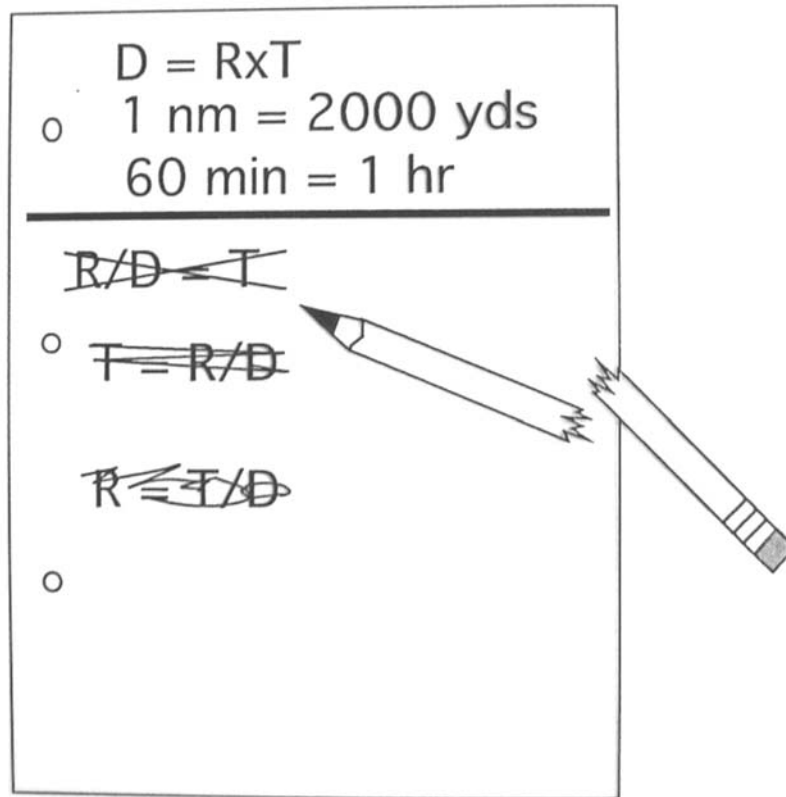
three



A common navigation problem

A ship travels 1500 yards in three minutes. What is the speed of the ship in nautical miles per hour?

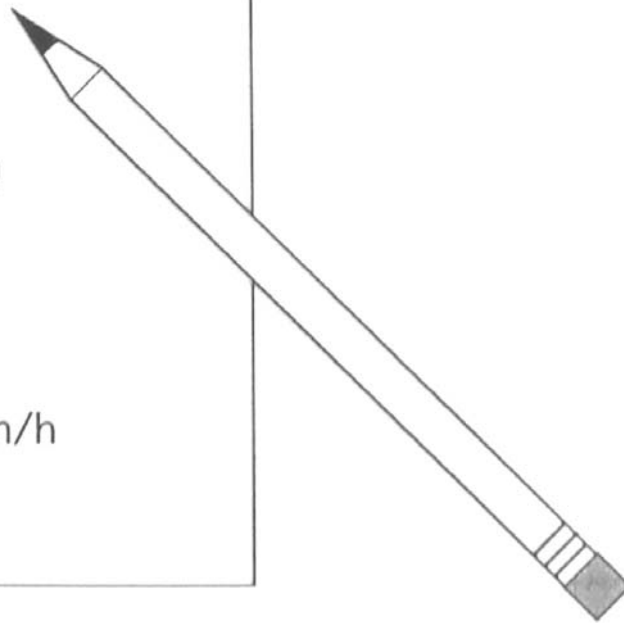
Paper and Pencil Solution



Paper and Pencil Solution

$$\begin{aligned} D &= R \times T \\ \circ \quad 1 \text{ nm} &= 2000 \text{ yds} \\ 60 \text{ min} &= 1 \text{ hr} \end{aligned}$$

$$\cancel{R = D/T}$$
$$\begin{aligned} \circ \quad R &= D/T \\ &= \frac{1500/2000 \text{ nm}}{3/60 \text{ h}} \\ &= \frac{3/4 \text{ nm}}{1/20 \text{ h}} \\ \circ \quad &= 3/4 \times 20 \text{ nm/h} \\ &= 15 \text{ nm/h} \end{aligned}$$



Calculator Solution

$$D = R \times T$$

$$1 \text{ nm} = 2000 \text{ yds}$$

$$60 \text{ min} = 1 \text{ hr}$$

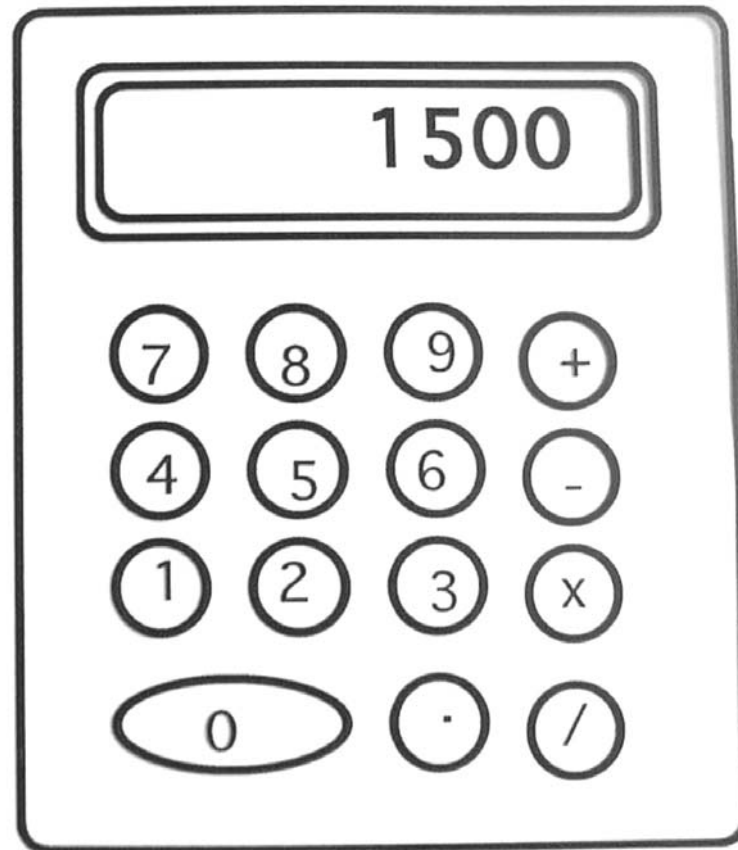
~~$$R = T/D$$~~

$$R = D/T$$

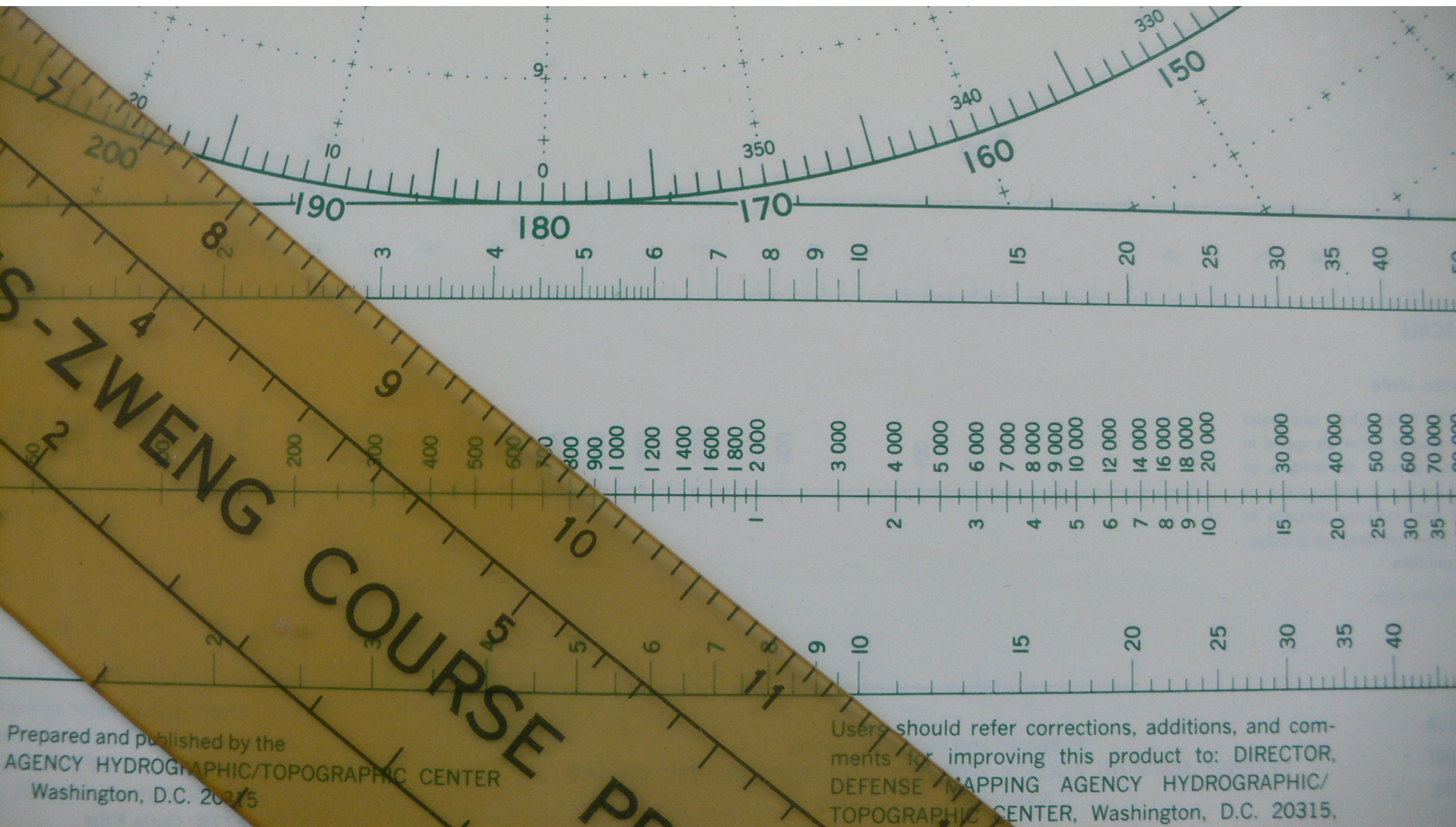
$$\frac{1500/2000 \text{ nm}}{3/60 \text{ h}}$$

$$= \frac{.75 \text{ nm}}{.05 \text{ h}}$$

$$= 15 \text{ nm/h}$$



3-scale nomogram



Using the Three Minute Rule

1 500 yds in 3 minutes

15⁰⁰ knots

100 yds = 1/20 nautical mile

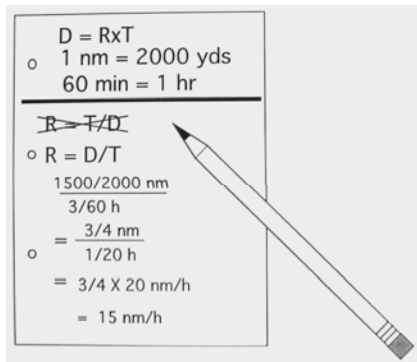
3 minutes = 1/20 hour

100 yds in 3 minutes = 1 nautical mile per hour

N x 100 yds in 3 minutes = N knots

Functional Systems

- Each method implies a different functional system.
- Each functional system uses a different arrangement of representational structures and a different set of cognitive processes.



Handwritten calculation on a notepad with a pencil:

$$D = R \times T$$

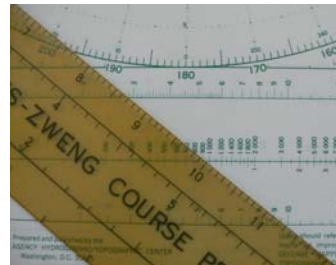
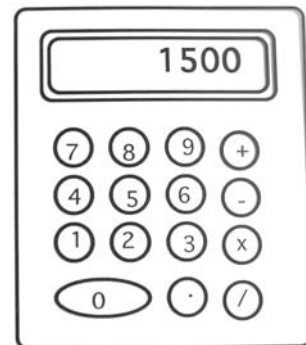
o 1 nm = 2000 yds
60 min = 1 hr

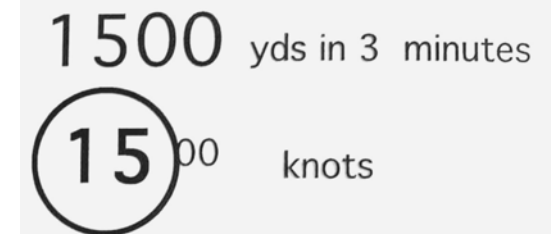
~~R = T/D~~

o $R = D/T$

$$\frac{1500}{3/60 \text{ h}} = \frac{3/4 \text{ nm}}{1/20 \text{ h}}$$

o $= 3/4 \times 20 \text{ nm/h}$
 $= 15 \text{ nm/h}$

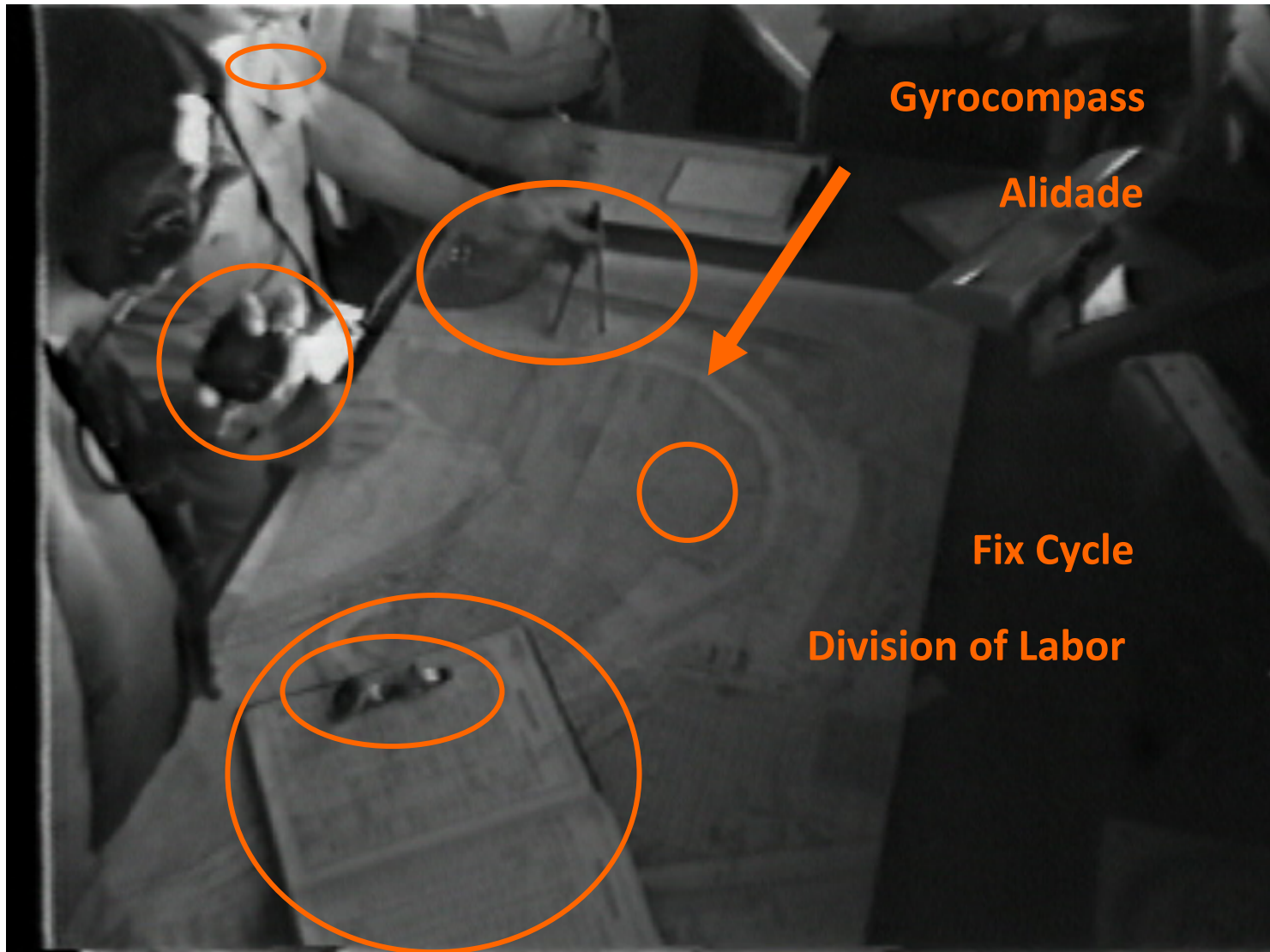




1500 yds in 3 minutes

15⁰⁰ knots

The social and material ecology



Cognitive Implications

- Three minute rule substitutes robust perceptual processes for complex conceptual processes. You “see” the answer by “looking” at the problem statement in a particular way.
- You do not have to know why the three minute rule works in order to use it.
- You do not have to know why it works in order to discover it.

Perceptual Practices of Algebra

$$D = R \times T$$

- 1 nm = 2000 yds
- 60 min = 1 hr

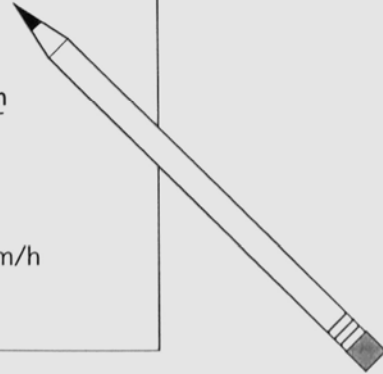
 ~~$R = T/D$~~

- $R = D/T$

$$\frac{1500/2000 \text{ nm}}{3/60 \text{ h}}$$

$$= \frac{3/4 \text{ nm}}{1/20 \text{ h}}$$

- $= 3/4 \times 20 \text{ nm/h}$
- $= 15 \text{ nm/h}$



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R. L. Goldstone, D. H. Landy, J. Y. Son/Topics in Cognitive Science 2 (2010)

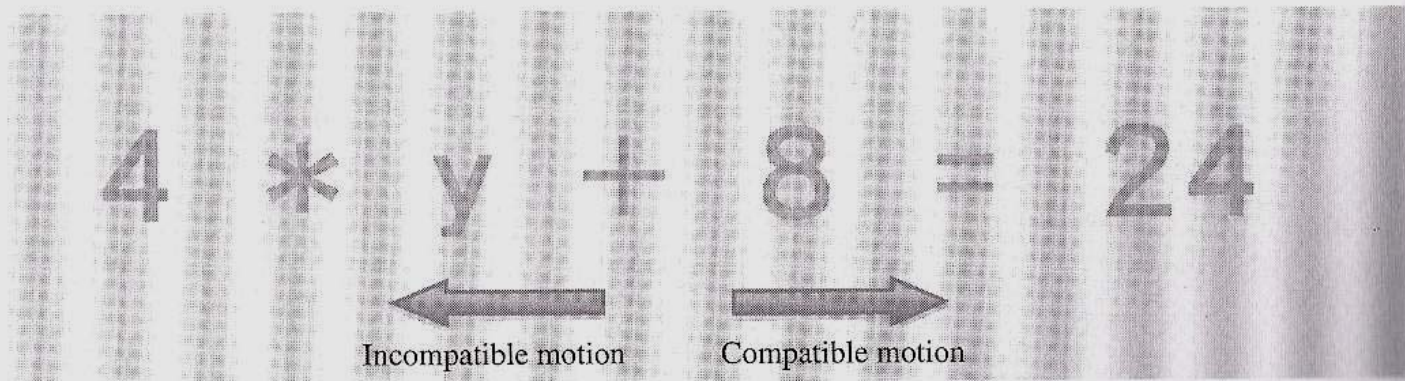


Fig. 7. As participants solved for the variable in equations like the above, a vertically oriented grating continuously moved either to the left or to the right. Although irrelevant for the task, when the movement of the grating was compatible with the movements of the numbers required by transposition, participants were more accurate.

Cultural practices organize
distributed cognitive systems

Imagining scientific cognition in interactions among brain, body and world



Amaya Becvar



CONCEPTUALIZING SPATIAL RELATIONS IN FLIGHT TRAINING

Edwin Hutchins & Will Newsome



Christina Middleton



National Science Foundation
WHERE DISCOVERIES BEGIN

Situation Awareness

- “the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future” (Endsley, 2000).
- Situation awareness is often conceived of as an internal “mental” phenomenon.

Methods

- We partner with a local flight training center
- To examine the construction of representations of spatial relations (elements of SA) in ongoing flight training conducted in a light jet.

Subjects

- 11 pilot trainees
- 5 Korean, 2 French, 1 Japanese, 3 American
- Age range from 24 years to 60 years
- Experience levels vary from 200 hrs total time (0 in jets) to 20,000 hours total time (18,000 in jets)

Three Subjects Analyzed

S #	Nationality	Age	Role	Total Hours	Jet Experience
1	Korean	30	Cadet	250	None
2	French	28	CFI	1935	None
3	American	60	Captain	20,000	18,000

Instructors wearing the HatCam



Audio and Video Recorders



Observer Position



HatCam Views



Coding categories

- Primary Author
 - Student or instructor
- Referent of the representation
 - Performance target or geographic feature
- Resources used to create the representation
 - Verbal, non-verbal, displays, outside objects
- Gesture type
 - indexical or iconic

Many representations of spatial relations are created in flight training

Table 1. <i>The flights.</i>					
Flight #	Student #	Instructor	Aircraft	Representations	Duration
1	1	F	CE-500	189	64
2	2	M	CE-525	412	87
3	3	M	CE-500	240	75
4	3	F	CE-500	312	40
Total				1153	266

Most representations of spatial relations are **multimodal**

Verbal Only



"Hold it there."

Verbal and Nonverbal

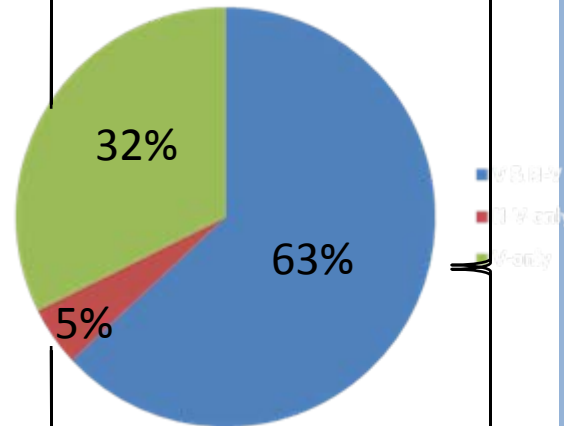


"Don't rely on just that"

Nonverbal Only



"Max Power"

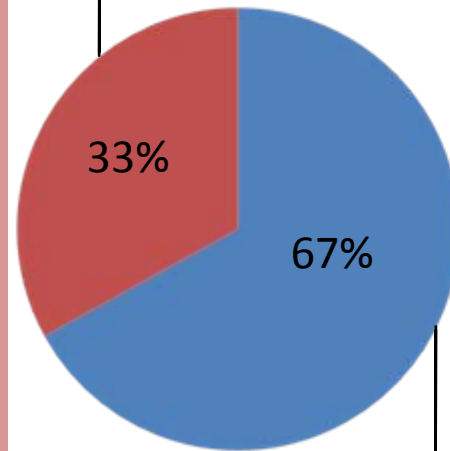


Most representations of spatial relations are **embodied**

Using the body, but
NOT embodying a
spatial relation



"This is OK."



The body as a resource
for spatial reasoning.



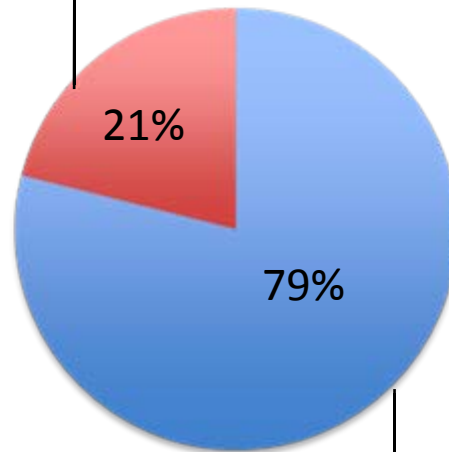
*"Imagine that centerline
running through the
middle of your chest."*

Most representations of spatial relations are **situated**

Representation not coupled to the local environment



"We're real close to Bravo."



Representation coupled to the local environment



"Look inside, then outside; inside, outside."

Findings

- Fight instructors and students make extensive use of their bodies and the relations of their bodies to surrounding space while constructing, remembering, and reasoning about the situation of the airplane.

Discussion

- The notion that Situation Awareness is primarily a “mental factor” is NOT an empirical finding.
 - It is an artifact of a particular way of looking for SA.



Imagine cognitive ecosystems in
which cultural practices
orchestrate the coordination of
resources (including the body and
social and material patterns) in
ways that produce cognitive
accomplishments

The Cultural Practices of Cognition

So what?

- cognitive capabilities are determined by patterns of information flow: what information goes where when in what form?
- as orchestrated by cultural practices
- embodiment brings our attention to new pathways
 - within the body
 - between body and world
 - between bodies

Things that once seemed obvious are now seen as obviously wrong

- Because all high-level cognitive performances are mediated by cultural practices, it is not possible to infer individual cognitive capacities directly from ...
 - societal level of technological advancement
 - everyday activity
 - performance in an experiment or test

A measure of
cultural practices that shape
cognition?

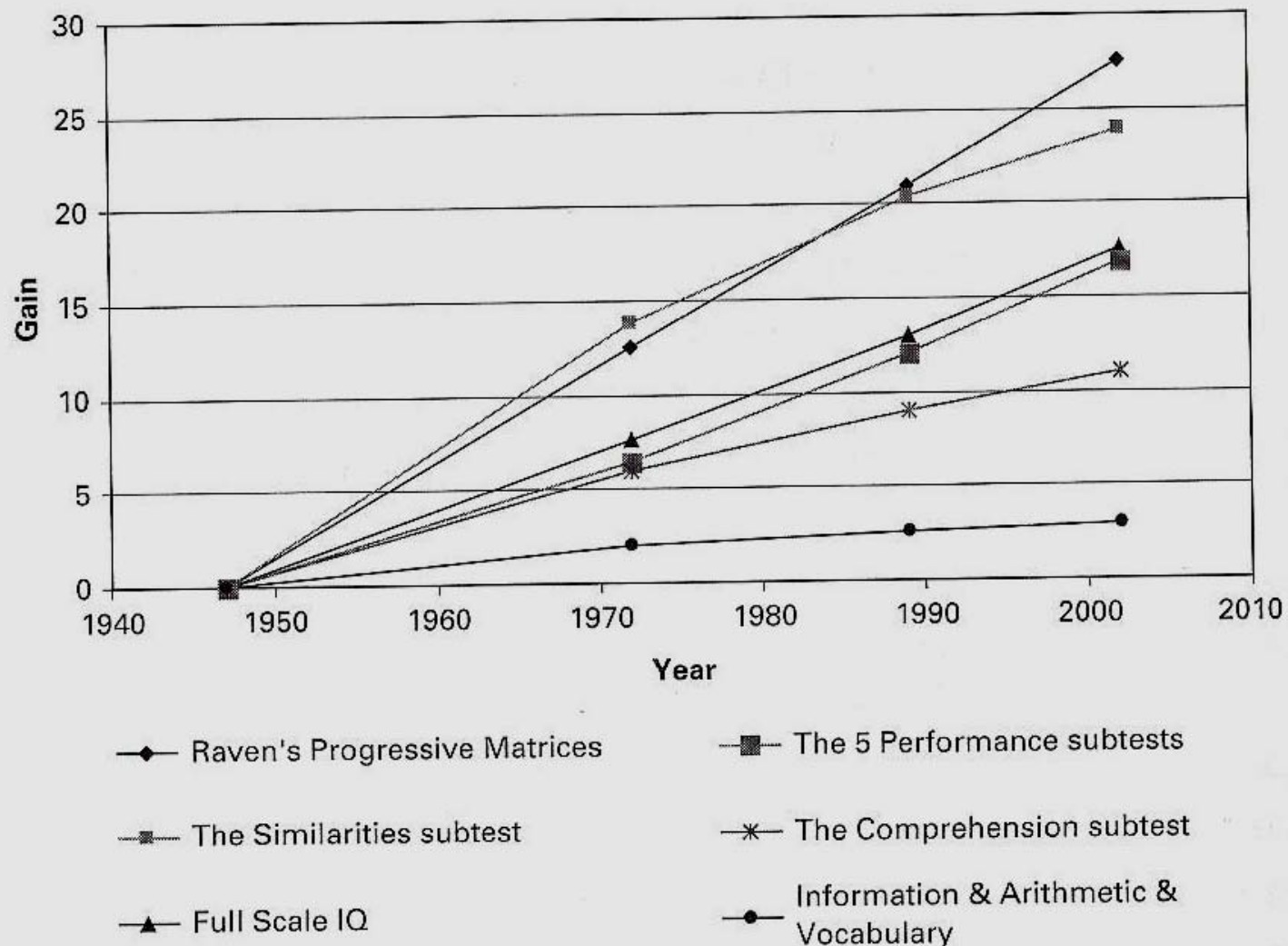


Figure 1 This figure shows WISC IQ gains starting in 1947-1948 and running through 2002. The test was updated three times, which means we get estimates of gains over three periods of 13 to 25 years. All gains are measured in IQ points (with SD set at 15). See Appendix I

Where do we look for cognition?

What do we expect to see?



Thanks

- The students, instructors, and management of



- Award #0729013 DHB: A Multiscale Framework for Analyzing Activity Dynamics
-
- Boeing Commercial Airplane Company
 - Barbara Holder, Director Flight Deck Concepts Center
- UCSD DCOG-HCI lab



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