4E Blending in Problem Solving, Collaborative Reasoning, & Teaching

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4E Cognition

(Newen, Gallagher, & DeBruin 2018; Sprevak 2019)

EMBODIED – Cognition depends on the physical nature of our bodies (internal sense [Johnson, 1987] & external sense)	**ENACTED** – Cognition consists in a looping interaction between perception and action
EMBEDDED – Cognition is integrated with the environment when we solve certain problems	**EXTENDED** – Some cognitive states or processes include states or processes in the environment

Strong version: Cognition is *partially constituted* by (body, environment, etc.)

Weak version: Cognition is *causally dependent* on (body, environment, etc.)

Topics of debate:

- What marks a process as cognitive?
- Are these instances of causal coupling or constitution?
- How do we avoid overextension or 'cognitive bloat'?

Theoretical Framework

Distributed Cognition

(Hutchins, 2001)

All cognition is distributed.

Cognitive processes may:

- be distributed across members of a social group;
- involve coordination between internal and external structure; and
- be distributed through time, such that products of earlier events transform the nature of later events.

Cultural practices shape conceptual models, artifacts, and forms of coordination in evolving cognitive ecologies.

=> emphasis on *coordination*

Conceptual Blending

(Fauconnier & Turner, 2002)

Conceptual blending is a general cognitive capacity.

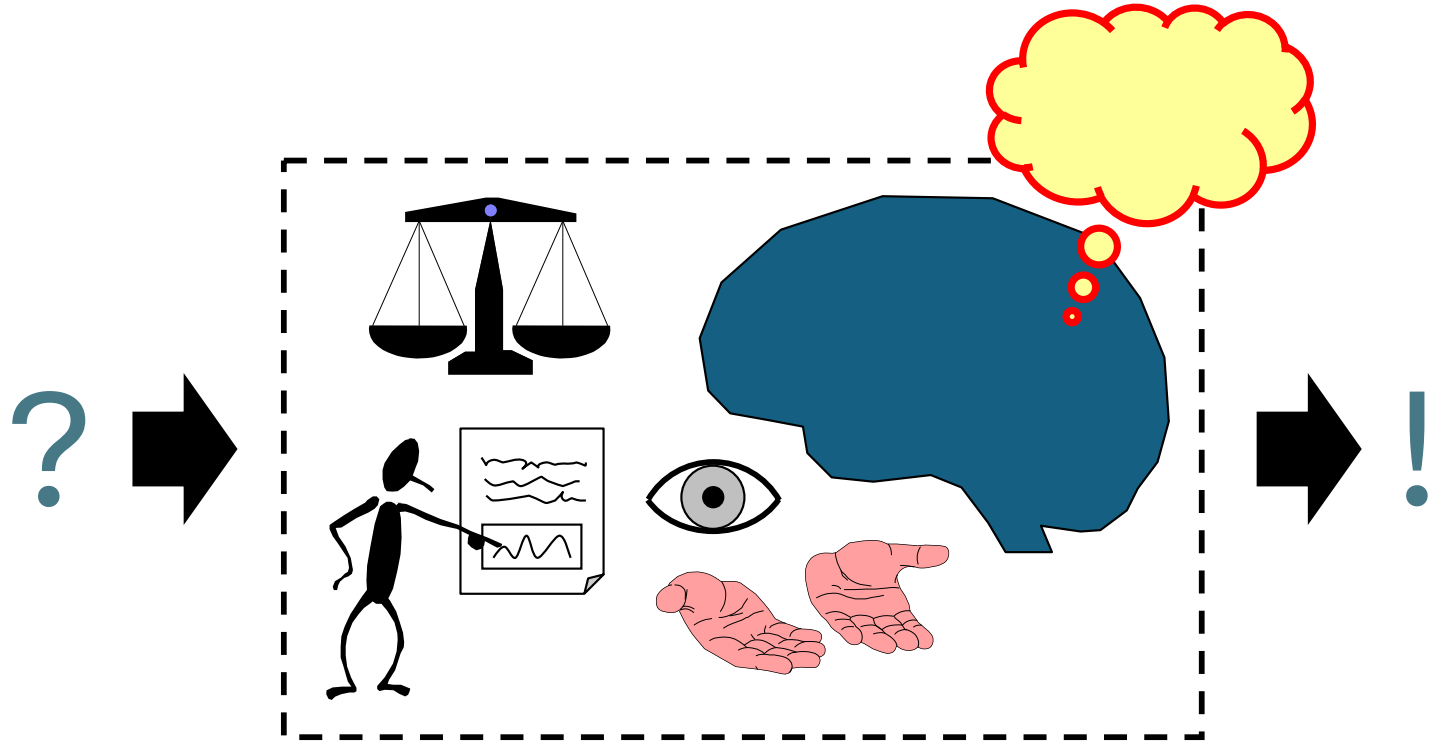
Meaning is constructed in conceptual integration networks.

- selective projection
- composition
- completion
- elaboration (‘running the blend’)

Blended spaces have emergent structure that supports inferences.

=> emphasis on *conceptualization*

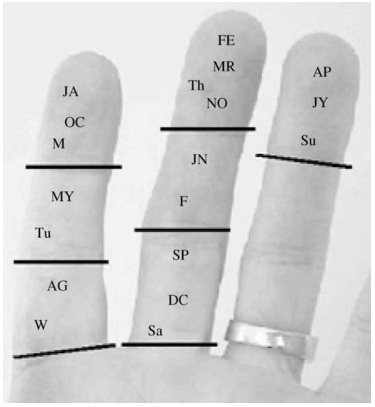
Distributed Cognitive “Functional Systems”



Coordination ⟺ Conceptualization

Material Anchors for Conceptual Blends

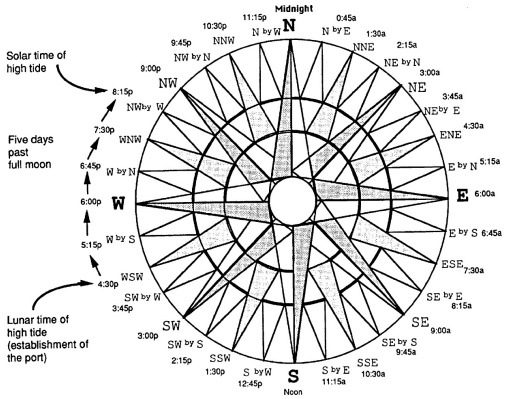
(Hutchins 2005)



Reasoning processes require **stable representation of constraints**.

Two principal ways to achieve stability:

1. familiar cultural models
2. associating conceptual structure with material structure



In a **materially anchored conceptual blend**, conceptual elements are mapped onto a material pattern such that relations among material elements are seen as relations among conceptual elements.

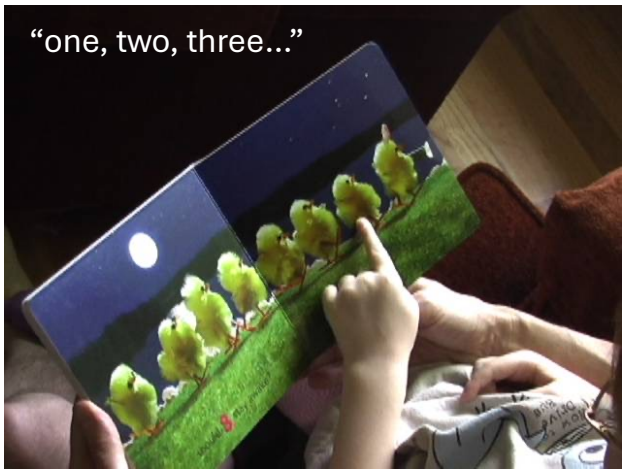
[cf. Fauconnier & Turner (2002): "objects that prompt for elaborate conceptual integration networks" (p. 214)]

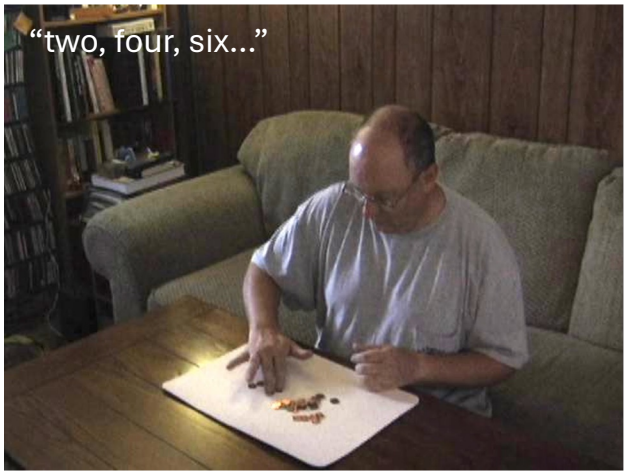
Solving Everyday Problems

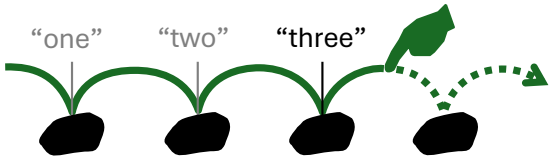
Determining:

Quantity	**Order of Service**	**Presence / Absence**
How many?	*Who's next?*	*Who's (not) here?*

Determining Quantity: Coordination
(Williams, 2013)

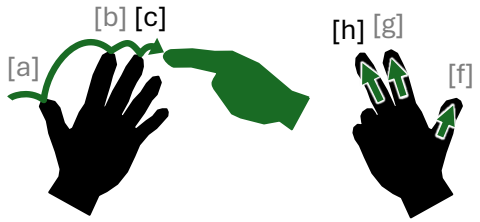






sequential touching

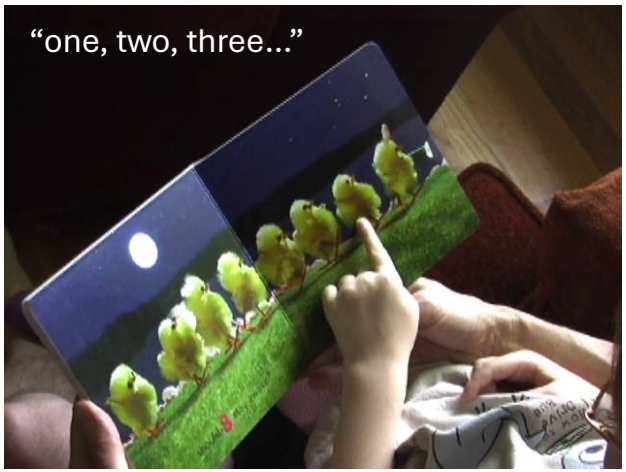
moving objects

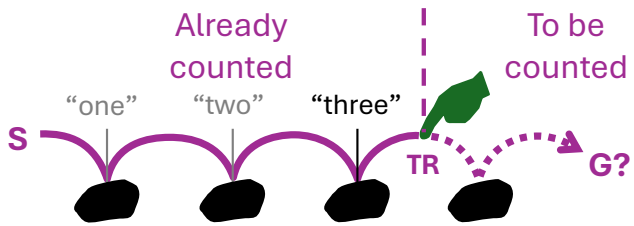


using finger proxies

Determining Quantity: Conceptualization

(Williams, 2013)





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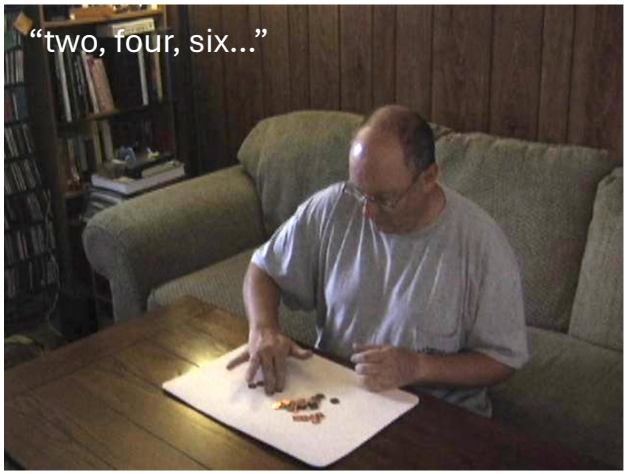
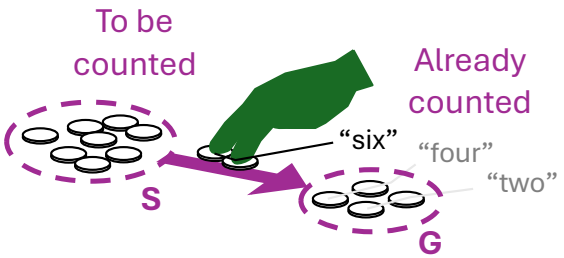
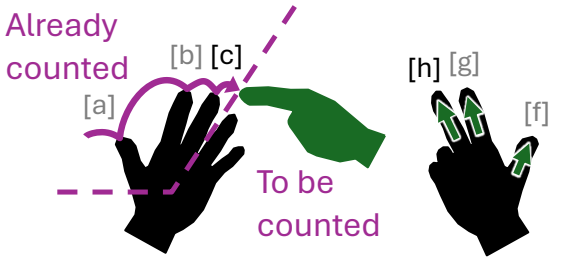




moving objects

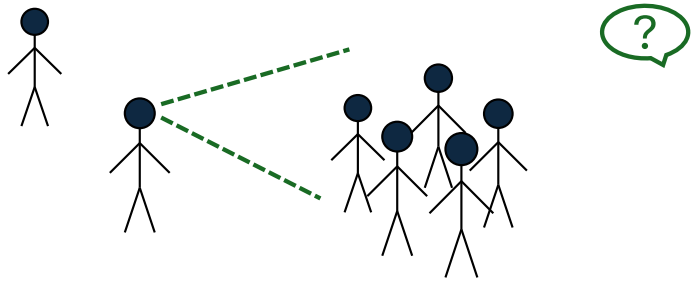


using finger proxies

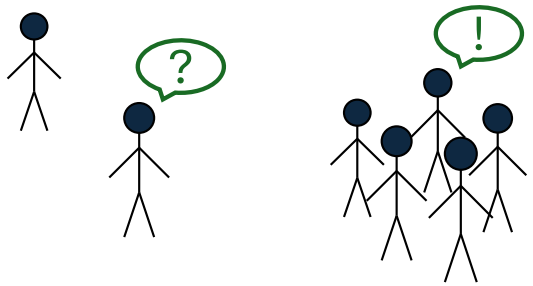
Determining Order of Service: Coordination

(based on order of arrival)

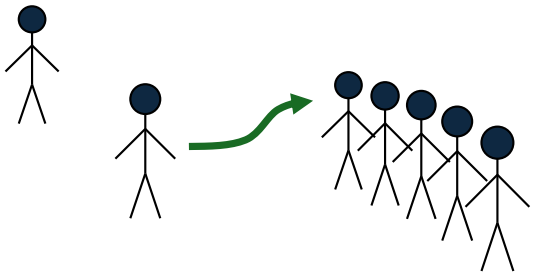
Noting those present



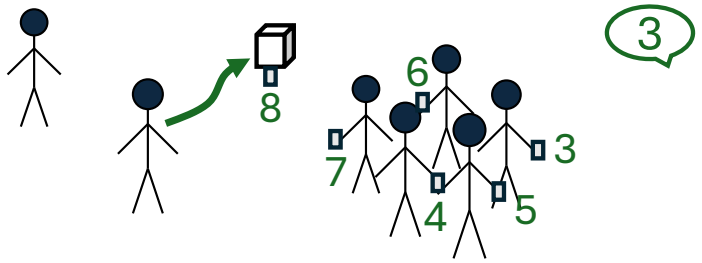
Noting the prior arrival



Queueing (standing in line)



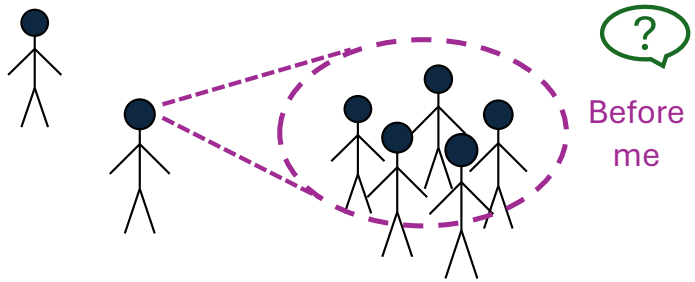
Taking a token



Determining Order of Service: Conceptualization

(based on order of arrival)

Noting those present



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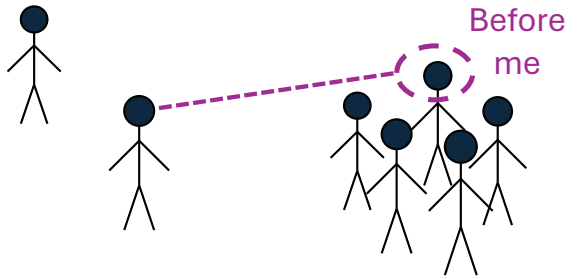

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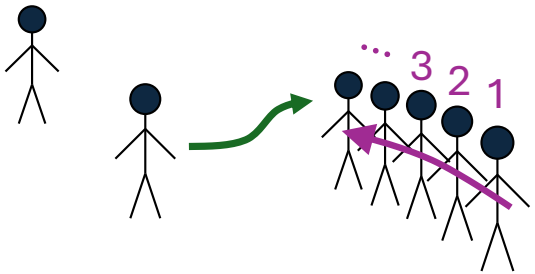
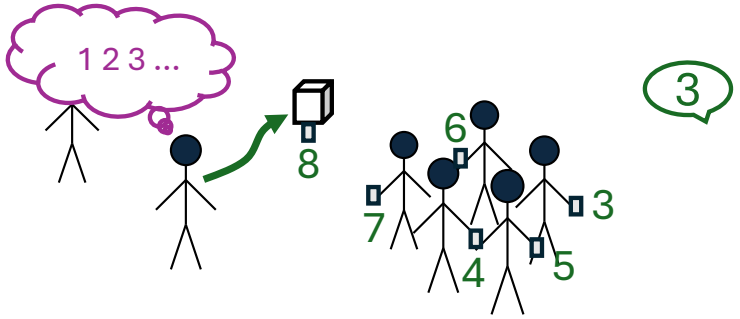
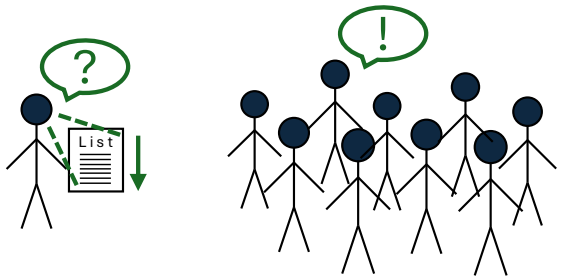


Taking a token

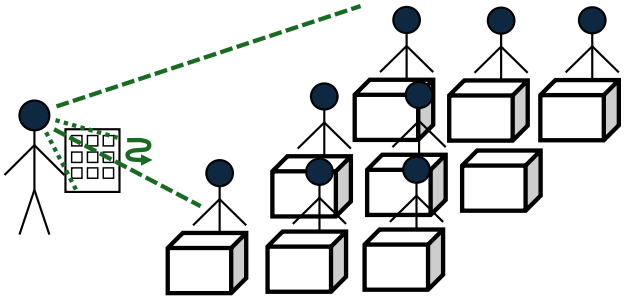


Determining Presence/Absence: Coordination

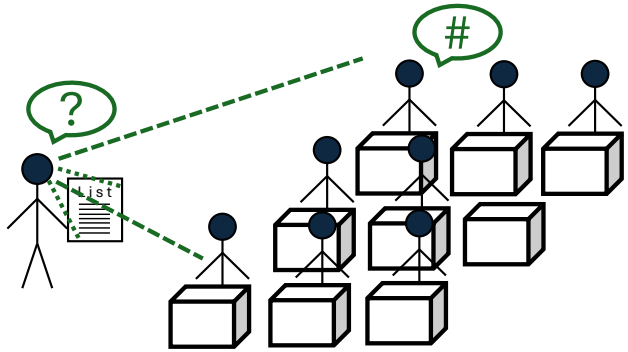
Calling roll



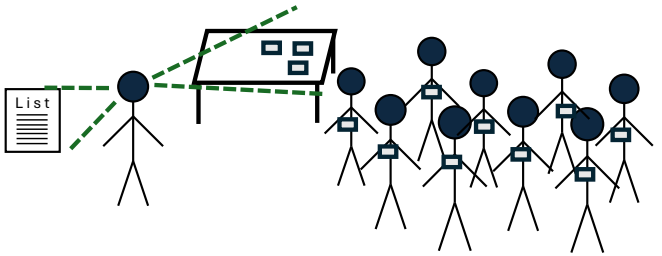
Viewing a seating chart



Asking group who's missing

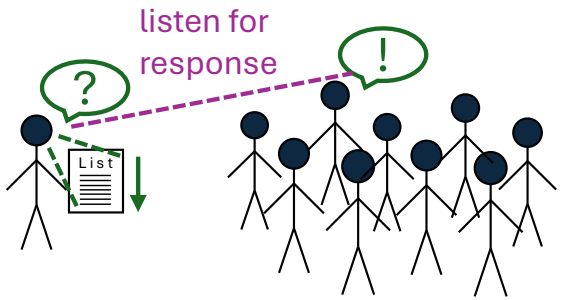


Retrieving name tags



Determining Presence/Absence: Conceptualization

Calling roll



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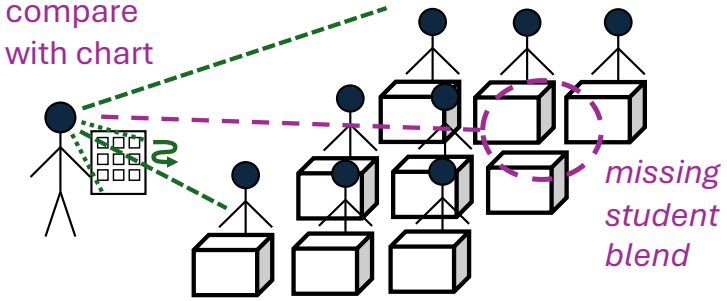

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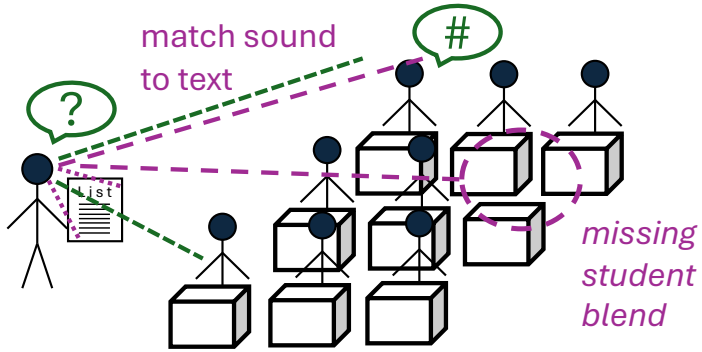

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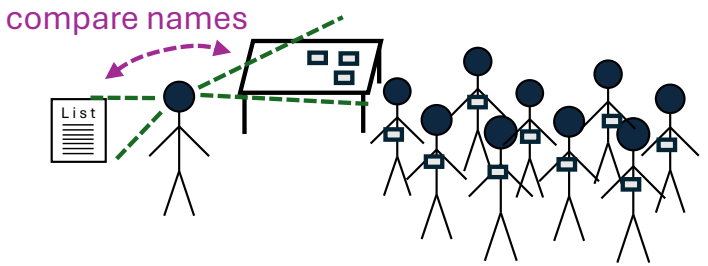
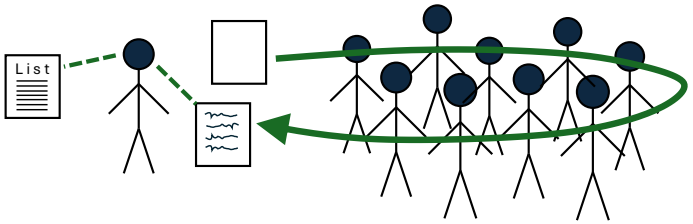
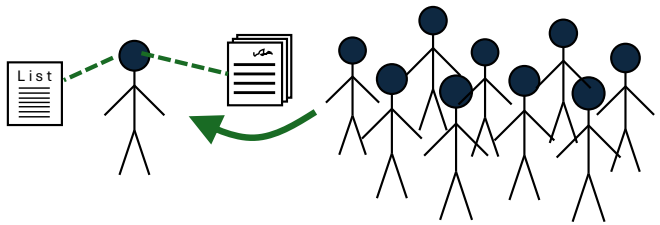


Determining Presence/Absence: Coordination

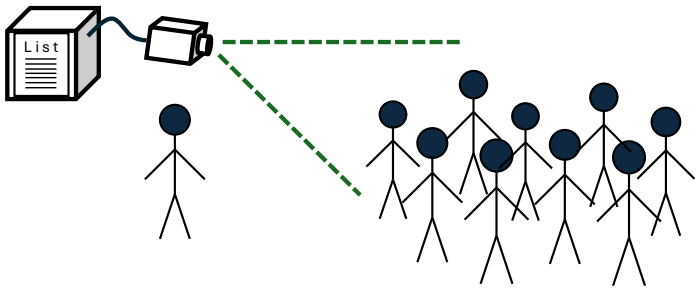
Using a sign-in sheet



Collecting items with names



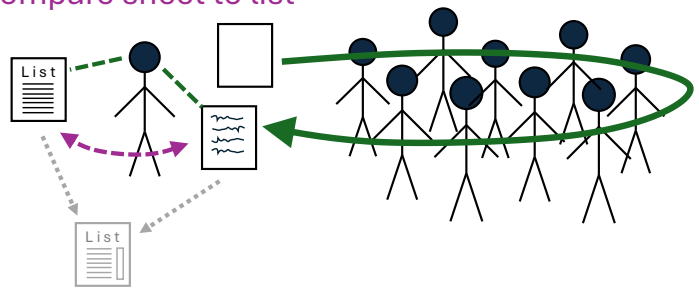
Using facial recognition technology



Determining Presence/Absence: Conceptualization

Using a sign-in sheet

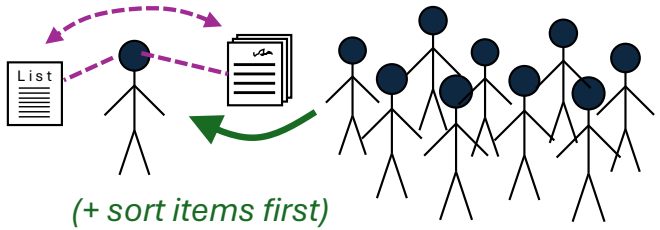
compare sheet to list



(+ use list for sign-in)

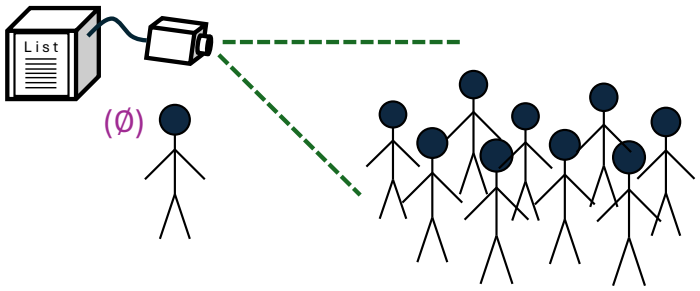
Collecting items with names

compare names to list



(+ sort items first)

Using facial recognition technology



Problem Solving: Preliminary Findings

Advantage of a DCog perspective:

- Using a broader unit of analysis allows us to examine/compare equivalent systems—those that solve the same cognitive problem in different ways.

*Cognition is **embodied**, **embedded**, and **enacted**:*

- We use our bodies to bring internal and external structures into functional coordination to accomplish the cognitive task.

*Cognition is **distributed, not 'extended'**:*

- The head is not a boundary across which cognition "sometimes spills" into the world (Sprevak, 2009).
- Cognizers organize their internal (and bodily) processes in accordance with cultural practices and the material setting; they may also modify the setting to facilitate the coordination.

Anchored Blends in Collaborative Reasoning

(Williams, 2022)

tilt of the earth's axis

"Why is it hot in summer and cold in winter?"

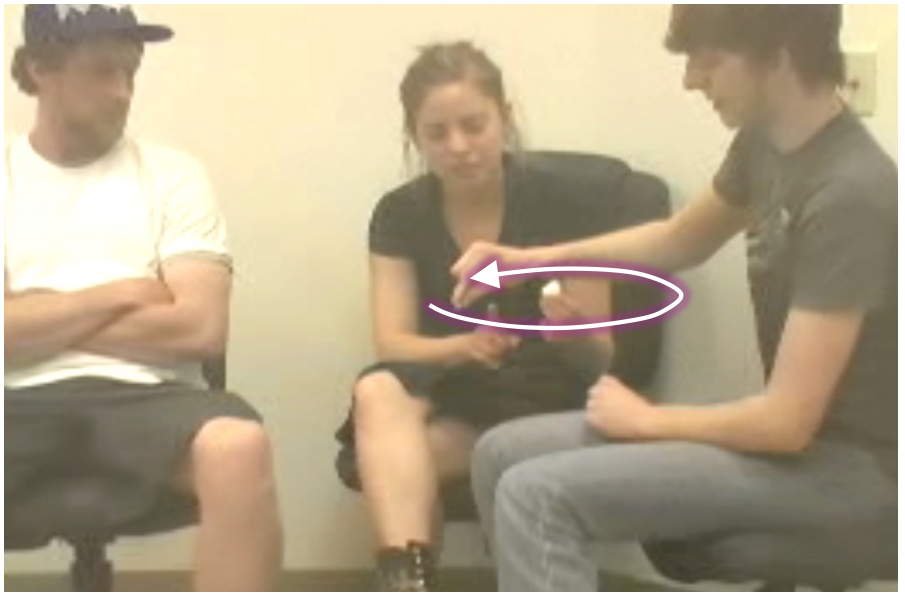
orbit of the earth around the sun

Anchored Blends in Collaborative Reasoning

(Williams, 2022)

tilt of the earth's axis

"Why is it hot in summer and cold in winter?"

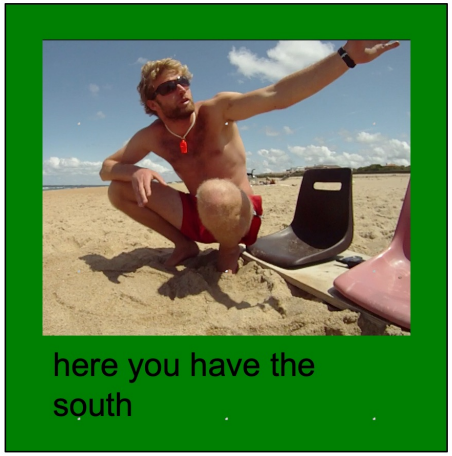


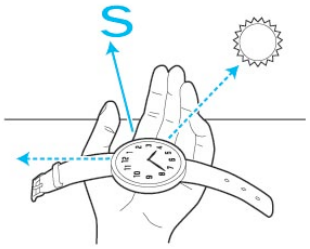
orbit of the earth around the sun

Anchored Blends in Teaching

(Williams & Harrison, 2014; Williams, 2019)

Finding direction from a wristwatch and the sun

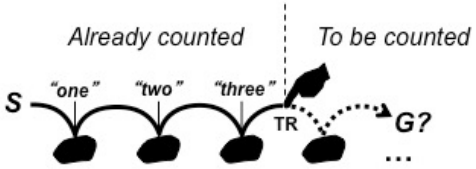




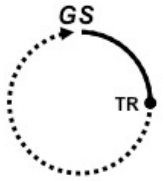
Reading a clock

okay, so I'd count [one-two-three-four-five-six-seven-eight-nine-ten]$_1$ [and it would go all the way—you think you would end]$_2$ up at sixty?

Count by Ones



Minute-Hand Cycle



Questions and Tentative Answers

What marks a process as cognitive?

- First: Let's abandon the idea of 'necessary and sufficient conditions.'
- Maybe: A class of activities (reasoning, decision-making, etc.) that engage conceptual processes in their performance (not fully automatic).

Are these instances of causal coupling or constitution?

- The cognitive processes are carried out by functional coordinations of internal and external structure; with experience, external structure may be imagined. *Why would we categorize these differently?*
- The functional coordinations depend on the activity of one or more cognizers.

How do we avoid overextension or 'cognitive bloat'?

- We draw the unit of analysis around elements that play an essential role in the cognitive process—that are coordinated to produce the result.
- Conversely: *How do we avoid over-attributing internal structure?*
  We start with the broader functional system and work "outside in" to determine what must be happening in the individual.

References

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