



# Cognition

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PSYC 2040

L12: Social Cognition

Part 2



# upcoming **review** sessions

- Wednesday (in class)
- Wednesday (Prof. Kumar): 2 - 5 pm
- Thursday (Prof. Kumar): 10 – 4 pm
- [poll for submitting questions](#)

14	Wednesday, April 24, 2024	<a href="#">L12: Social Cognition</a>
14	Friday, April 26, 2024	L12 continued...
15	Wednesday, May 1, 2024	L0-L12 review!
15	Friday, May 3, 2024	<b>Final</b>
16	Wednesday, May 8, 2024	Wrapping up!
16	M: May 13, 2024	<b>Research Reflection due</b>

# a game

TIGER	EXAM	PINE	TRACE
HAND	STORM	SNAKE	ALARM
CLEVER	HOUSE	BIRTH	TEST
EXACT	FRESH	FLOUR	TOWER
PORK	ASH	LION	HELL

# ANIMAL

TIGER	EXAM	PINE	TRACE
HAND	STORM	SNAKE	ALARM
BEAR	HOUSE	BIRTH	TEST
EXACT	FRESH	FLOUR	TOWER
PORK	ASH	LION	HELL

# ANIMAL

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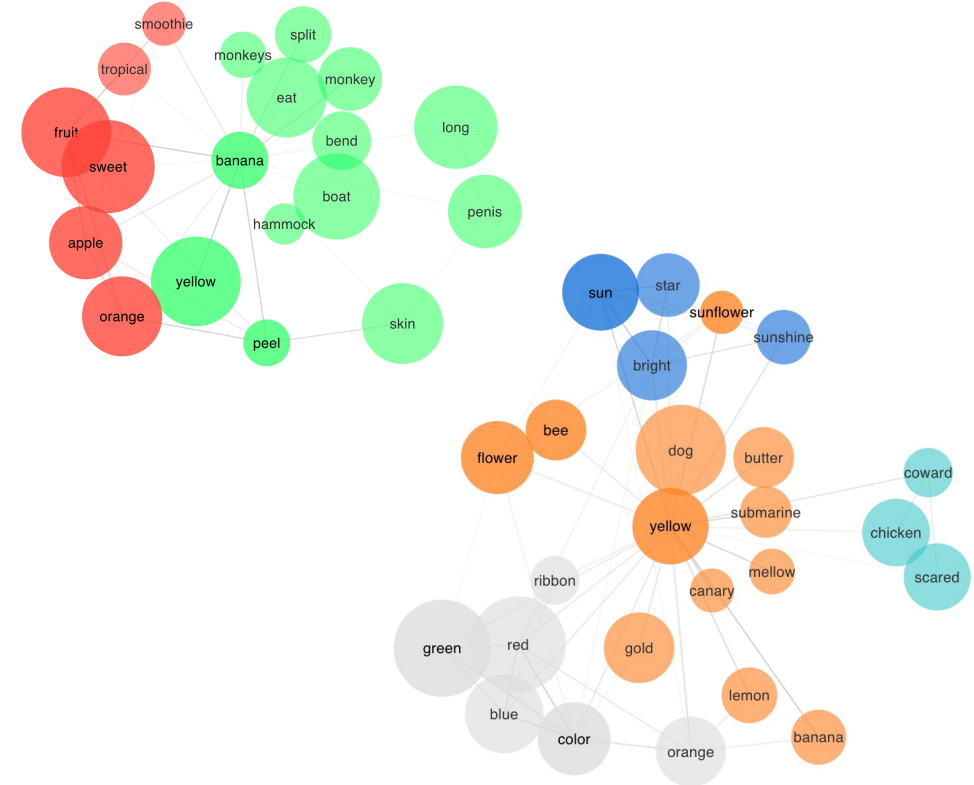
# communication as search + inference

- communication has many constraints:
  - availability
  - task
  - context
- communication involves efficiently searching through what is available and coming up with the best possible utterance

TIGER	EXAM	PINE	TRACE
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# free associations

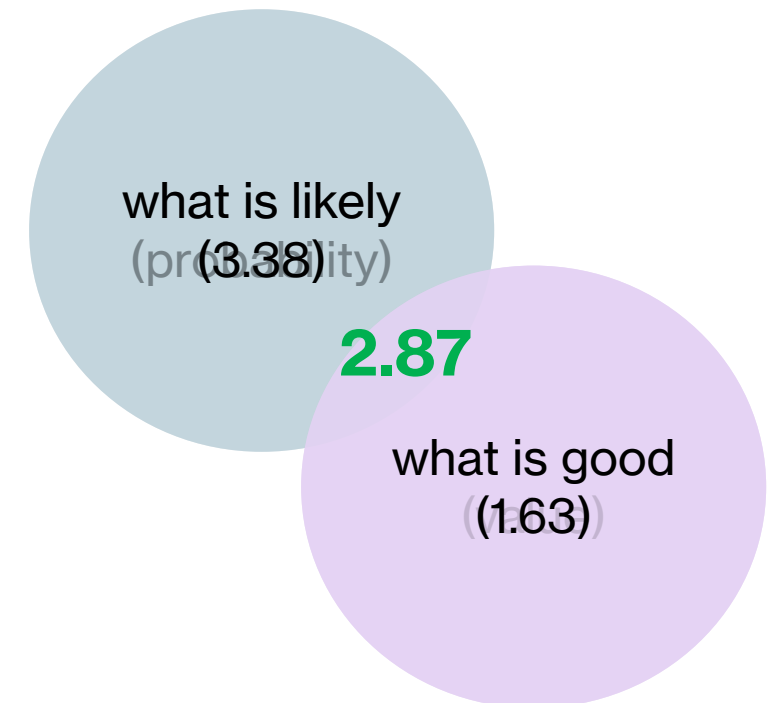
- word associations tend to resemble a “small-world” network (Steyvers & Tenenbaum, 2005; De Deyne & Storms, 2008)
  - highly clustered neighborhoods
  - short distances between concepts
- when a word comes to mind, it “activates” other words close to it (“spreading activation mechanism”, Collins & Loftus, 1975)
- word associations are likely a combination of many factors: relatedness of concepts, frequency, imagery, emotion, etc.



# what comes to mind?

- Bear et al., 2020 have recently investigated this question
- “what comes to mind” depends on:
  - what is most likely (probability)
  - what is generally good (value)

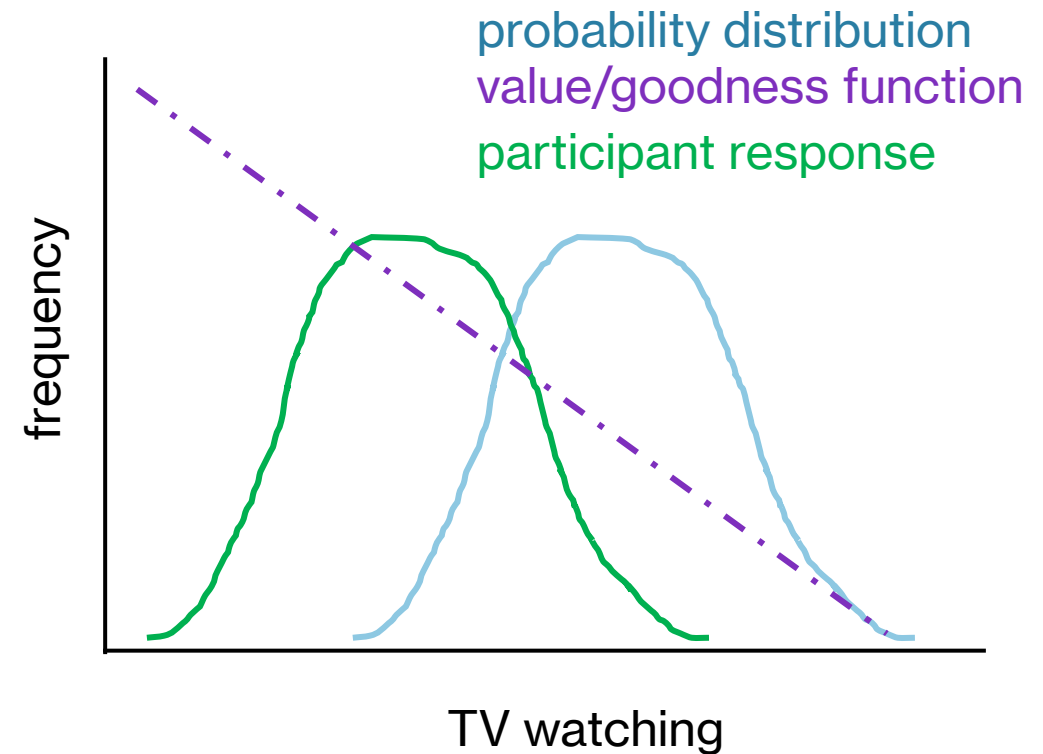
amount of TV watching in a day





# what comes to mind?

- Bear et al., 2020 have recently investigated this question
- “what comes to mind” depends on:
  - what is most likely (probability)
  - what is generally good (value)
- a multiplicative function



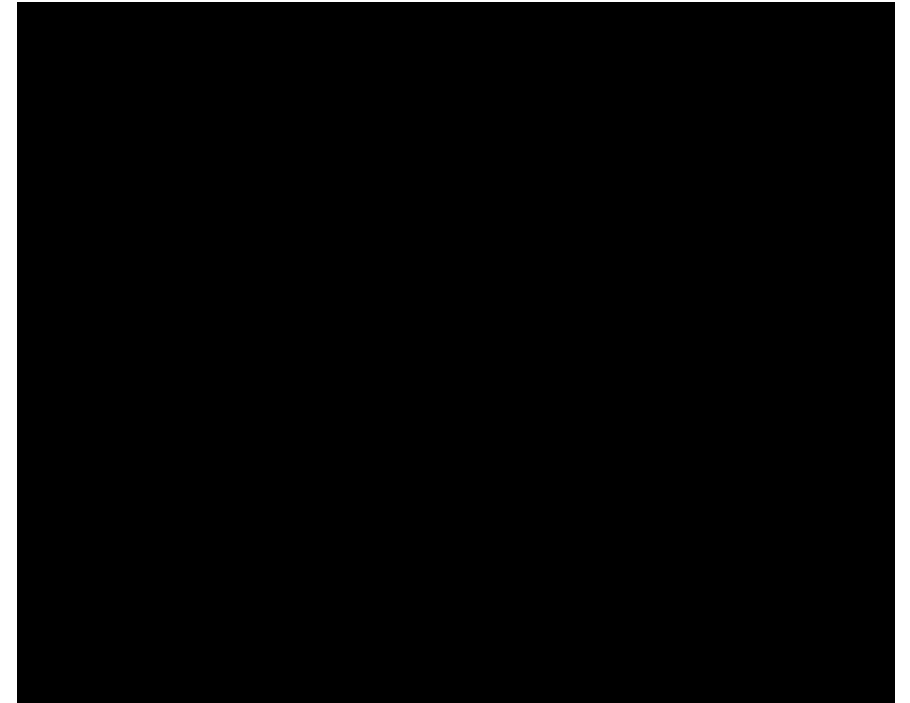
# what comes to mind?

- “what comes to mind” depends on:
  - what is most likely (probability)
  - what is generally good (value)
- what is most likely?
- what is good?
- biases + editing + utility!

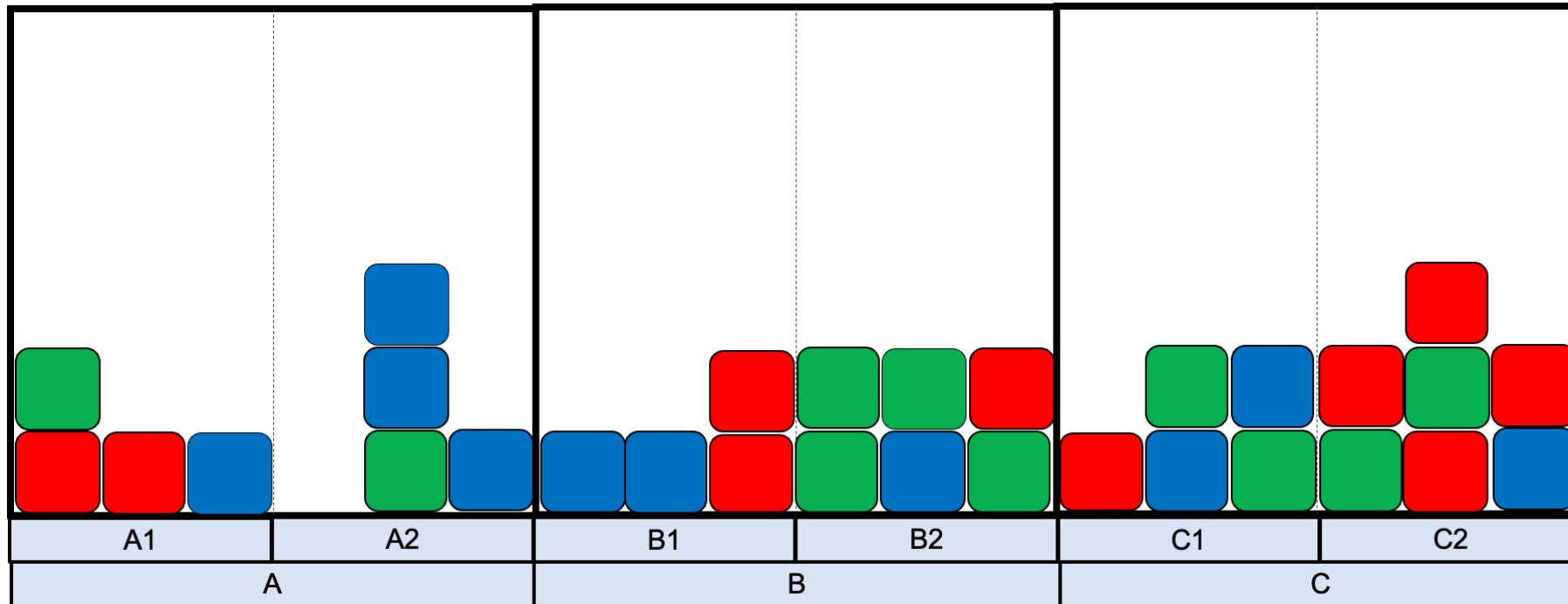
TIGER	EXAM	PINE	TRACE
HAND	STORM	SNAKE	ALARM
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# helping

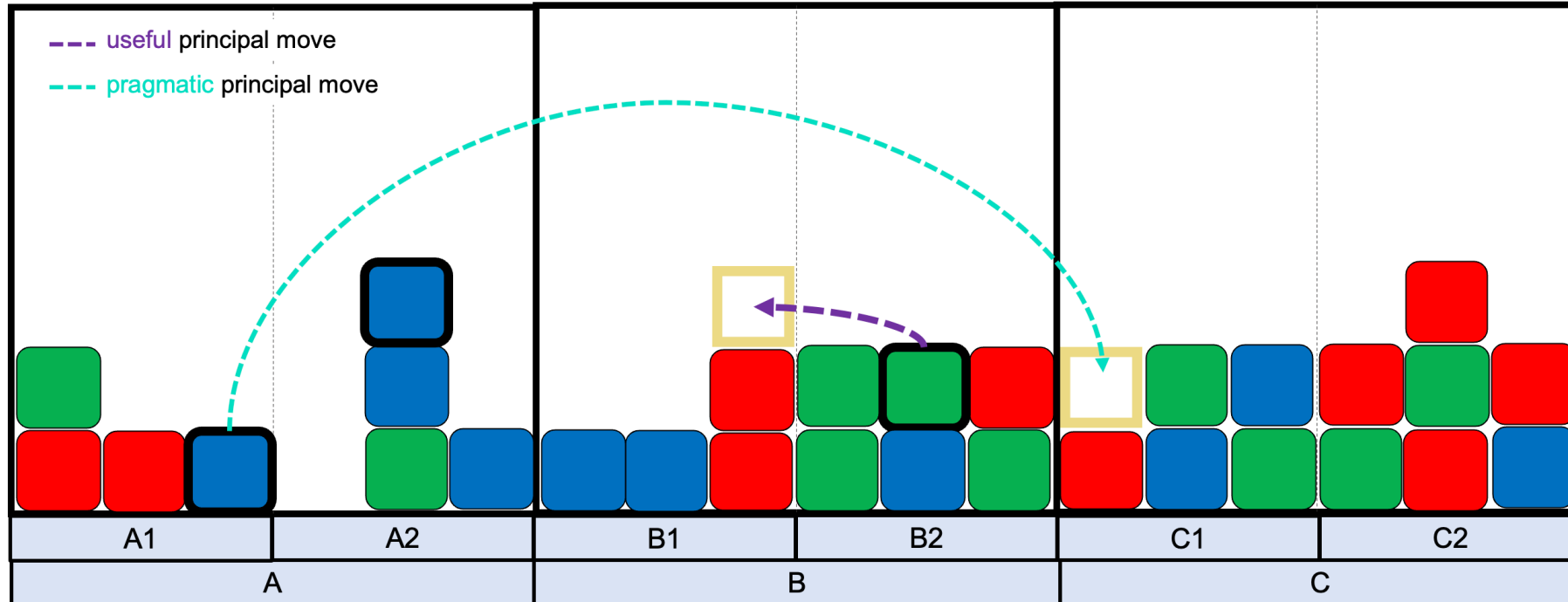
- helping has inherently cognitive roots
- infants (and animals) appear to help without any extrinsic reward
- what **cognitive mechanisms** underlie wanting help or being helped?



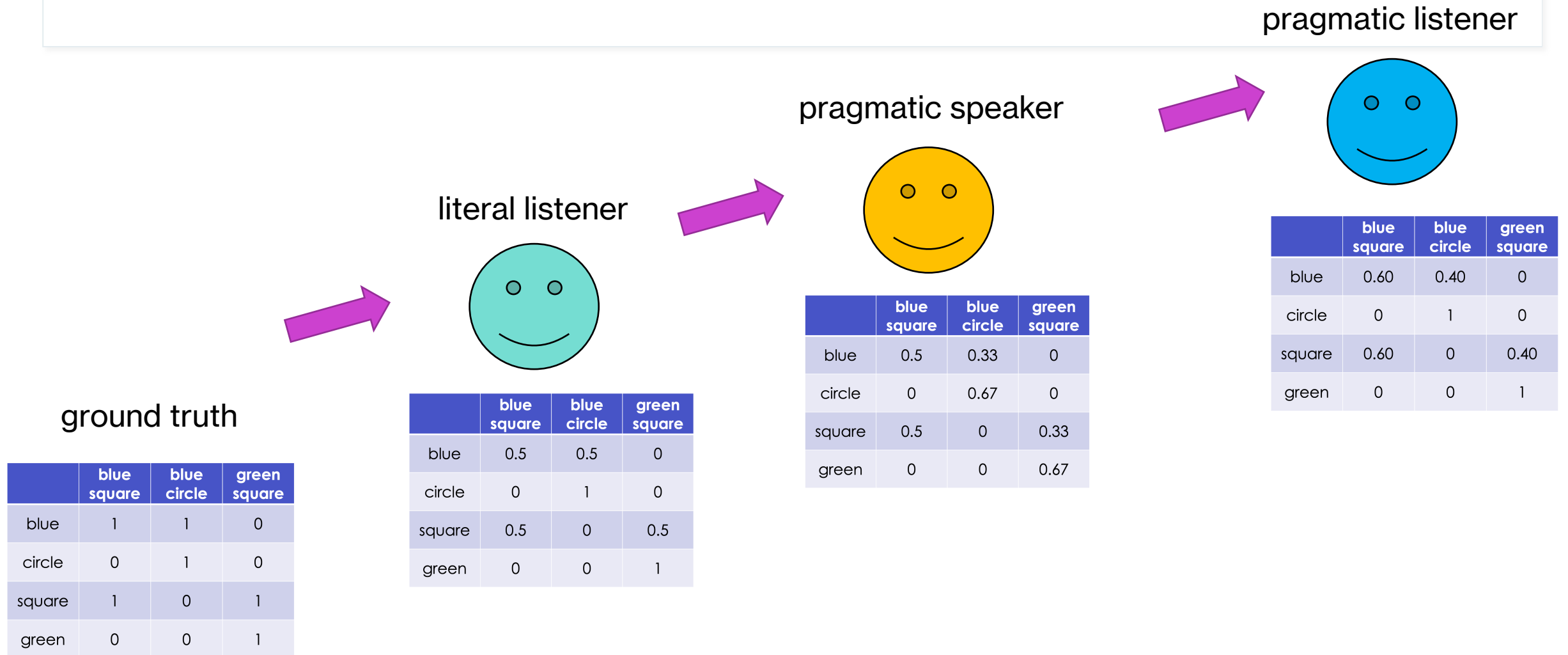
# goal: move blue blocks to room C



# goal: move blue blocks to room C



# inference = recursive thinking



# helping as inference

pragmatic architect

pragmatic helper

literal architect

ground truth

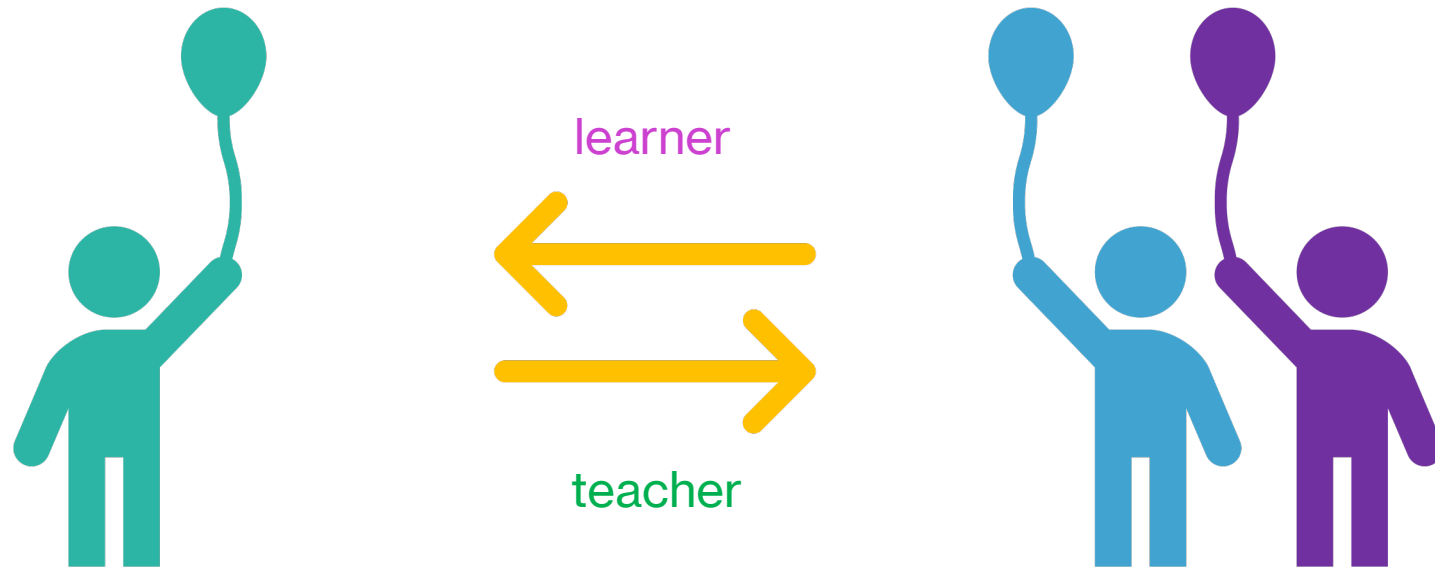
	goal 1	goal 2	goal 3
move 1	0	0	1
move 2	1	1	0
move 3	0	1	0
move 4	1	0	1

	goal 1	goal 2	goal 3
move 1	0	0	1
move 2	0.5	0.5	0
move 3	0	1	0
move 4	0.5	0	0.5

	goal 1	goal 2	goal 3
move 1	0	0	0.67
move 2	0.5	0.33	0
move 3	0	0.67	0
move 4	0.5	0	0.33

	goal 1	goal 2	goal 3
move 1	0	0	1
move 2	0.60	0.40	0
move 3	0	1	0
move 4	0.60	0	0.40

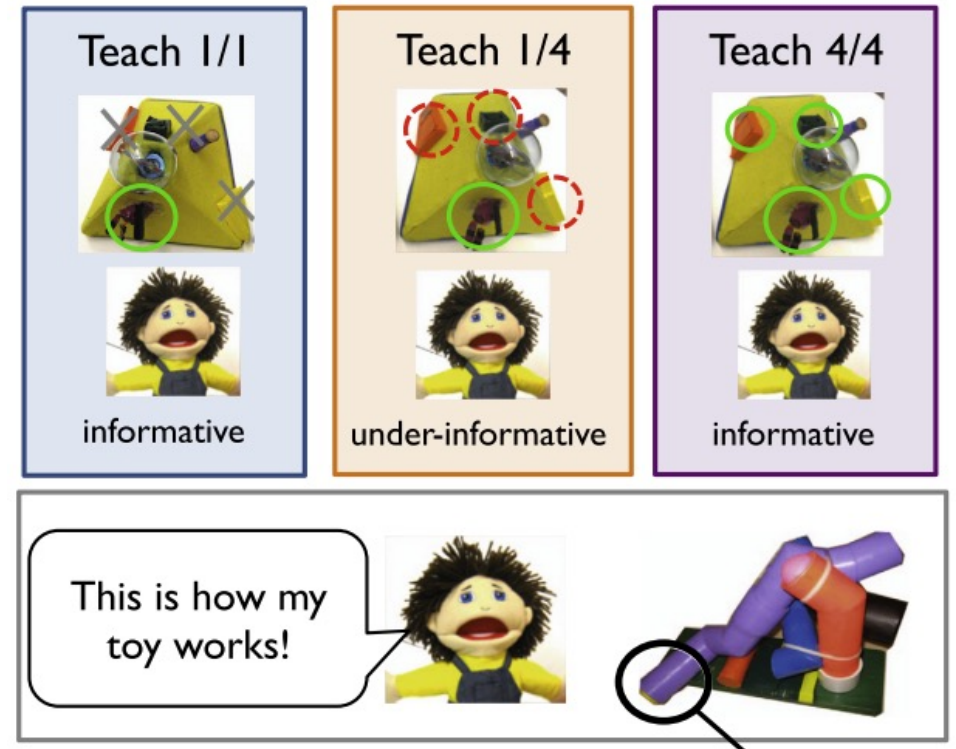
# social learning as inference





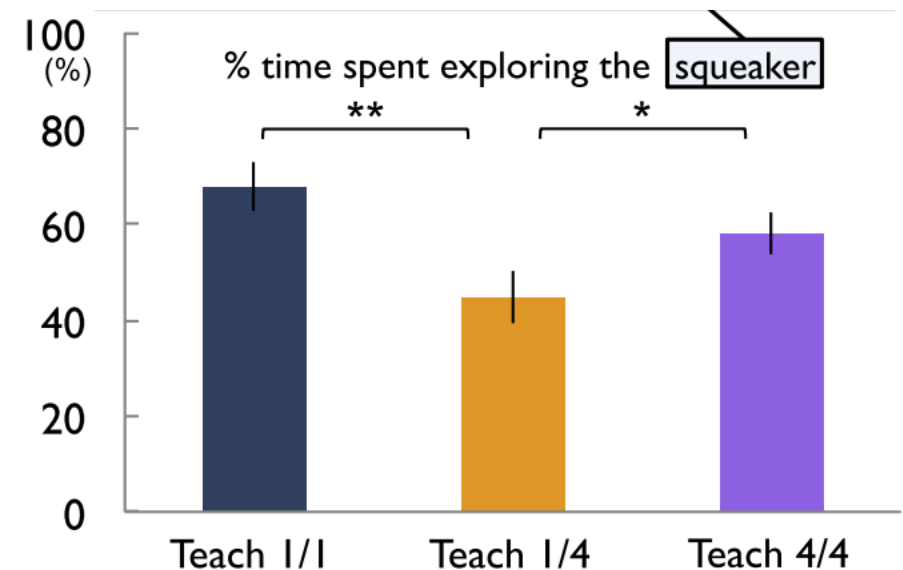
# child as learner: evaluating evidence

- Gweon et al. (2014) evaluated whether children (6-7yo) can evaluate and compensate for **under-informative** teaching
- teacher first provided under-informative or fully-informative demonstrations of a toy, and then demonstrate one function of a new toy
- recorded time spent exploring the squeaker part of the toy

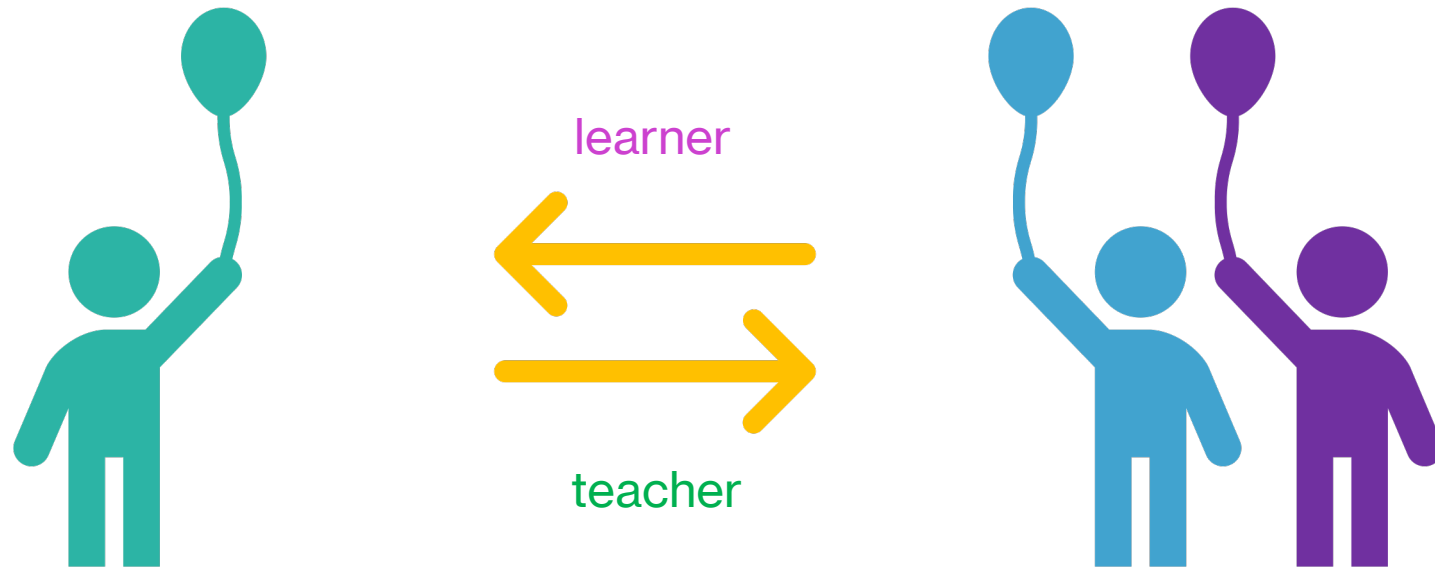


# child as learner: evaluating evidence

- children spent less time on the squeaker and **more time on other parts** when the teacher was under-informative, vs. when the teacher was fully-informative



# social learning as inference





# activity

- half of the class will close their eyes (last names A-L)
- the other half will be explained something
- they will then try to communicate this to the “naïve” agents

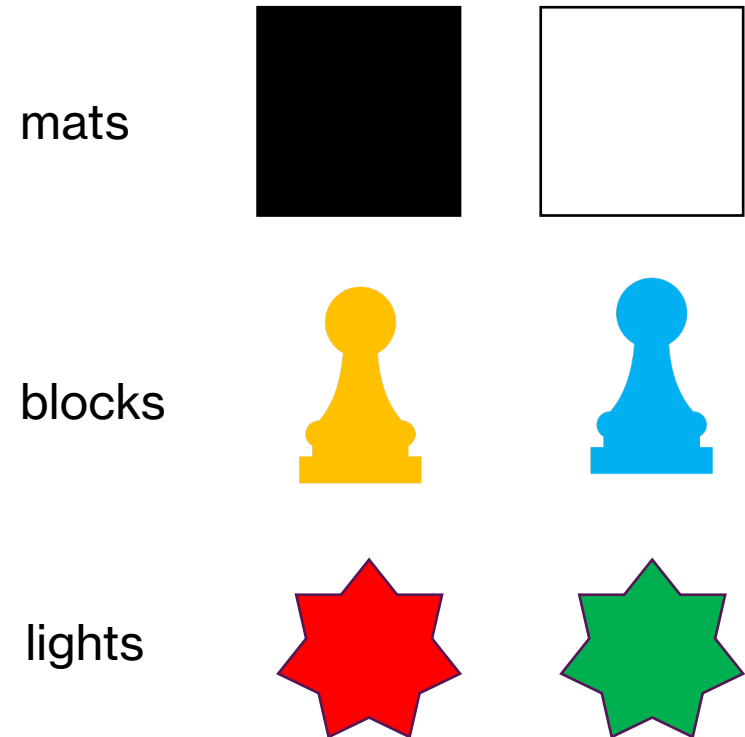


# naive agents

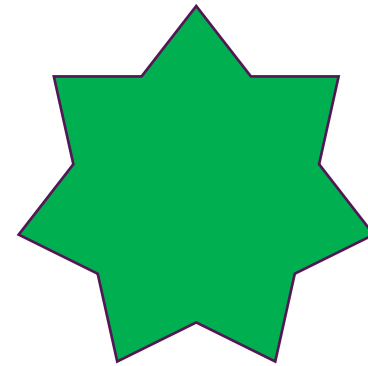
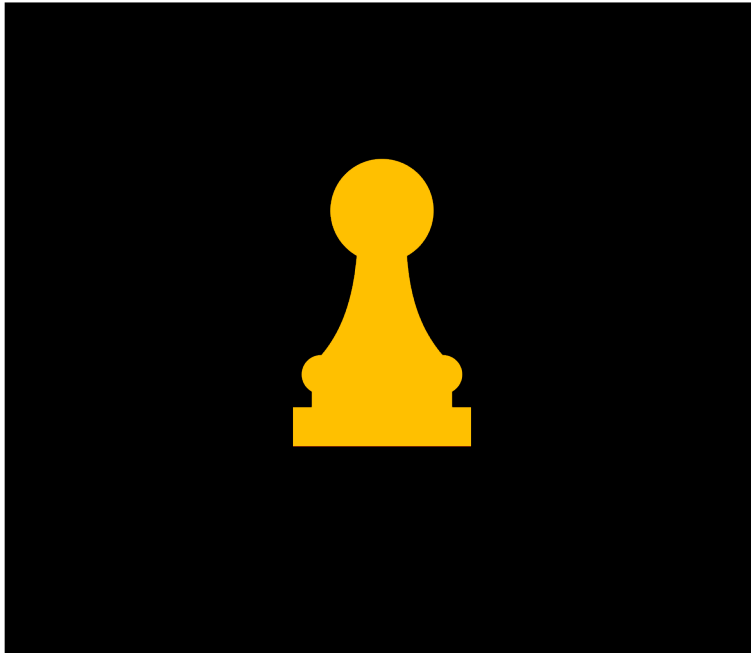
- close your eyes!

# demonstration

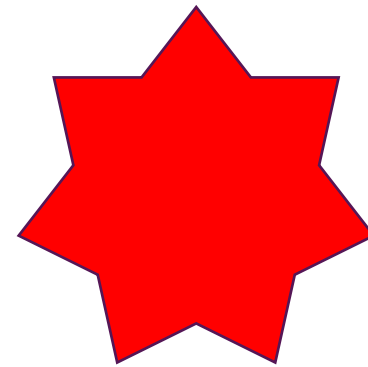
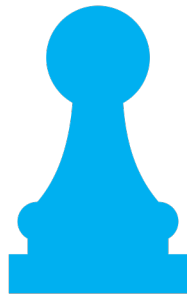
- I will perform some actions using mats, blocks, and lights
  - mats can be **black** or white
  - blocks can be **yellow** or **blue**
  - lights can be **red** or **green**
- you have to figure out what turns the **red** and **green** lights on



# demonstration 1

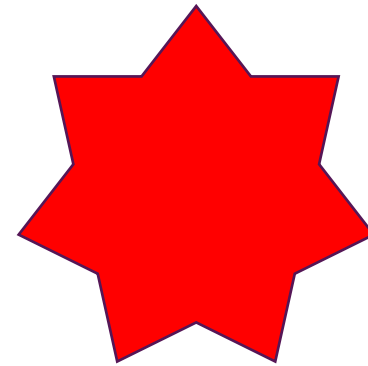
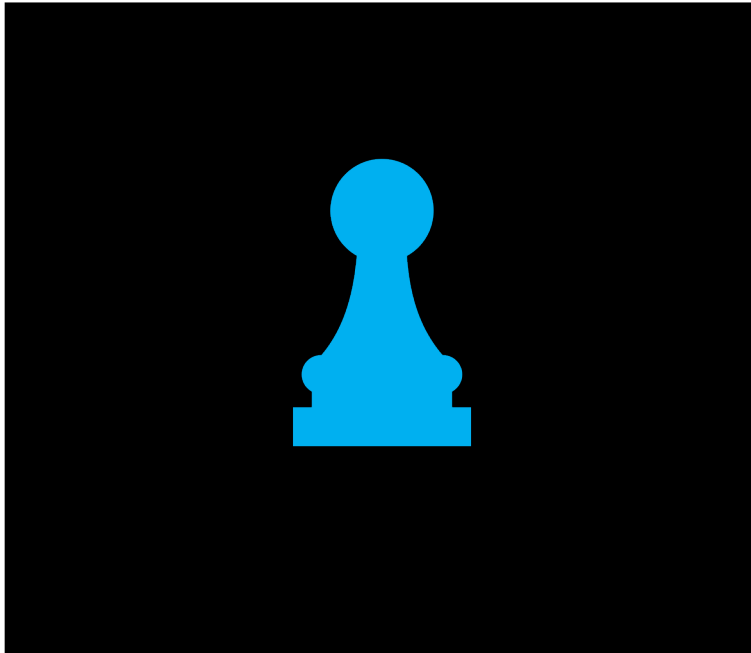


# demonstration 2

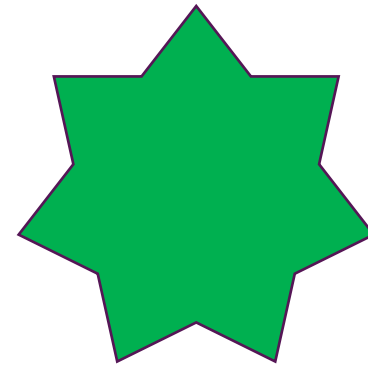
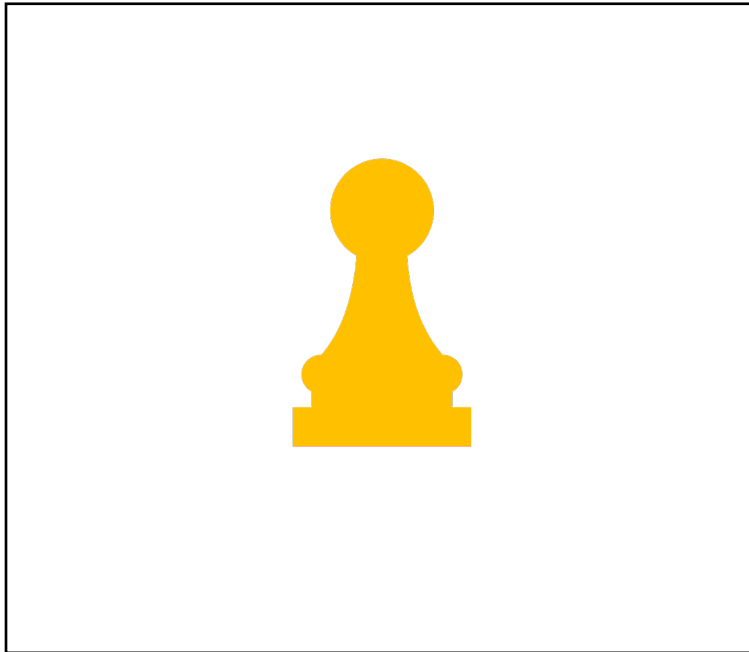




# demonstration 3



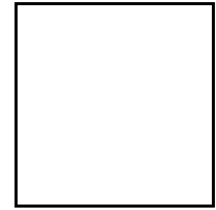
# demonstration 4



# what is the rule?

- how do you turn on a **RED** light?
- how do you turn on a **GREEN** light?

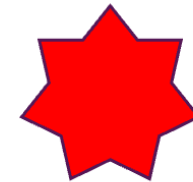
mats



blocks

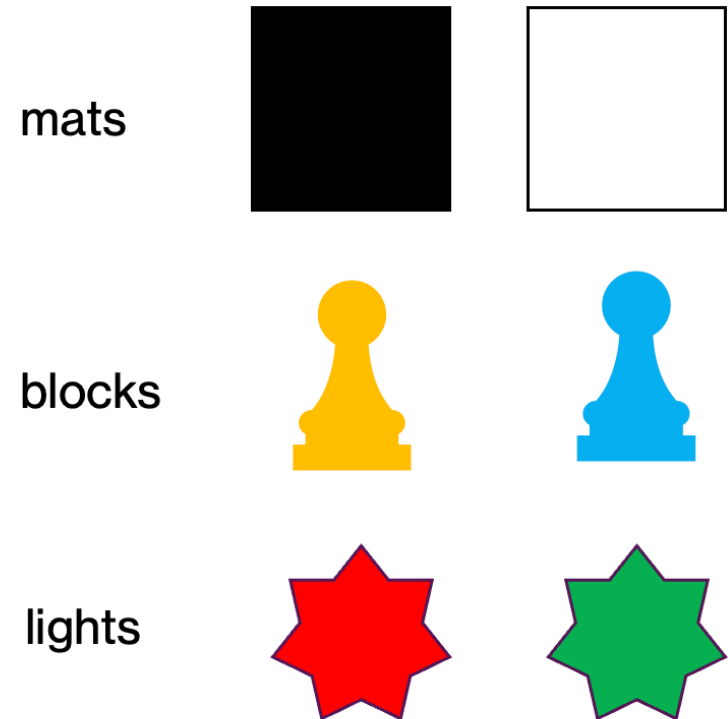


lights



# the rule

- placing the **blue** block on a mat turns on the **RED** light
- placing the **yellow** block on a mat turns on the **GREEN** light
- **mat color is irrelevant**





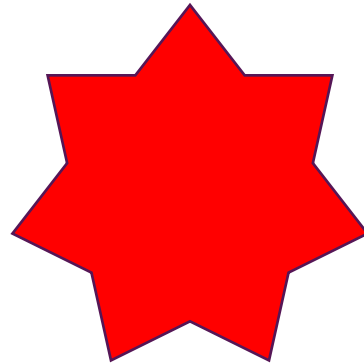
# communicate: part 1

- volunteer
- your goal is to **SHOW** a **RED** light to the naïve agent



**naive agents open your eyes!**

**the red light has turned on!**





# naive agents

- record what you have understood



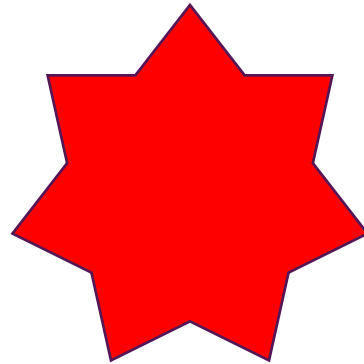
# communicate: part 2

- volunteer
- your goal is to **make the the naïve agent UNDERSTAND** how to turn on a **RED** light



**naive agents open your eyes!**

**the red light has turned on!**



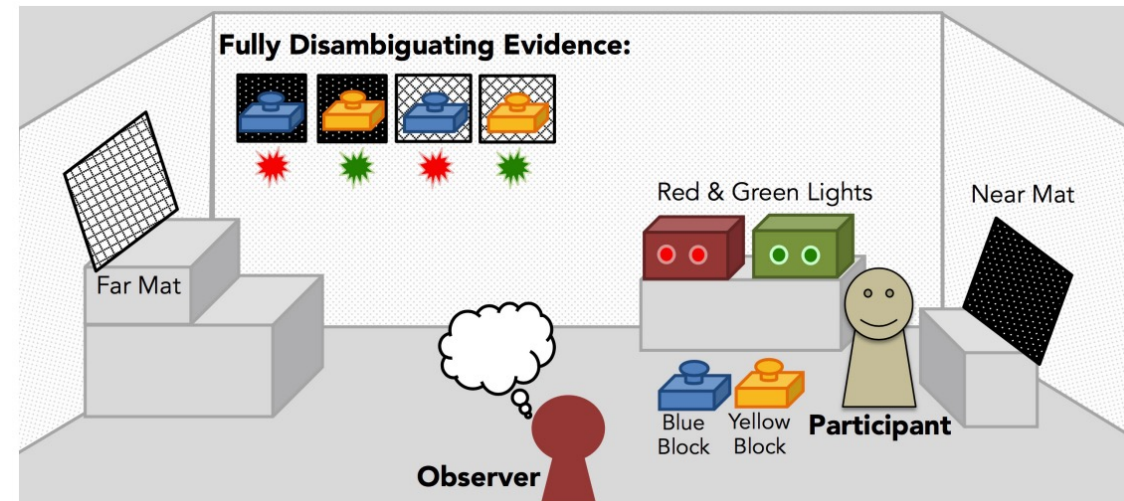


# naive agents

- record what you have understood

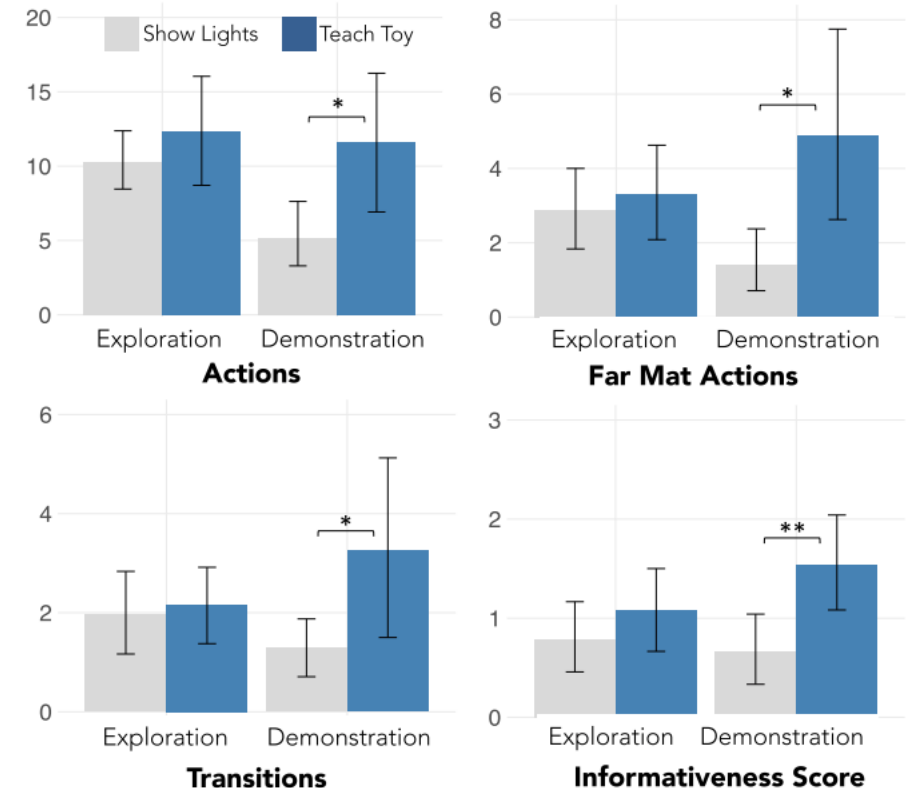
# child as **teacher**: inferring mental states

- Gweon and Schulz (2018) presented 4-to-7-year-olds with a **causally ambiguous toy** and then demonstrated the toy to a **naïve agent**
  - naive agent wants to see the effect generated (**Show Lights**) or understand how the toy works (**Teach Toy**)
- actions, far mat actions, transitions, and informativeness (first four actions) were measured



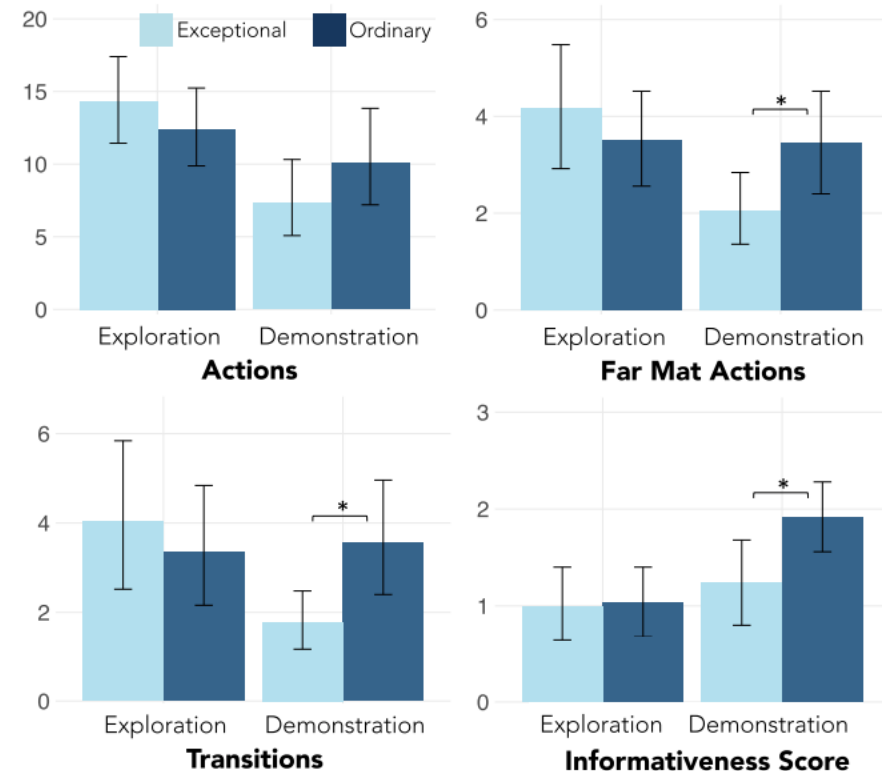
# child as **teacher**: inferring mental states

- no differences during exploration phase
- children in the Teach Toy condition **produced more actions**, more far mat actions, **more transitions** compared to the Show Lights condition



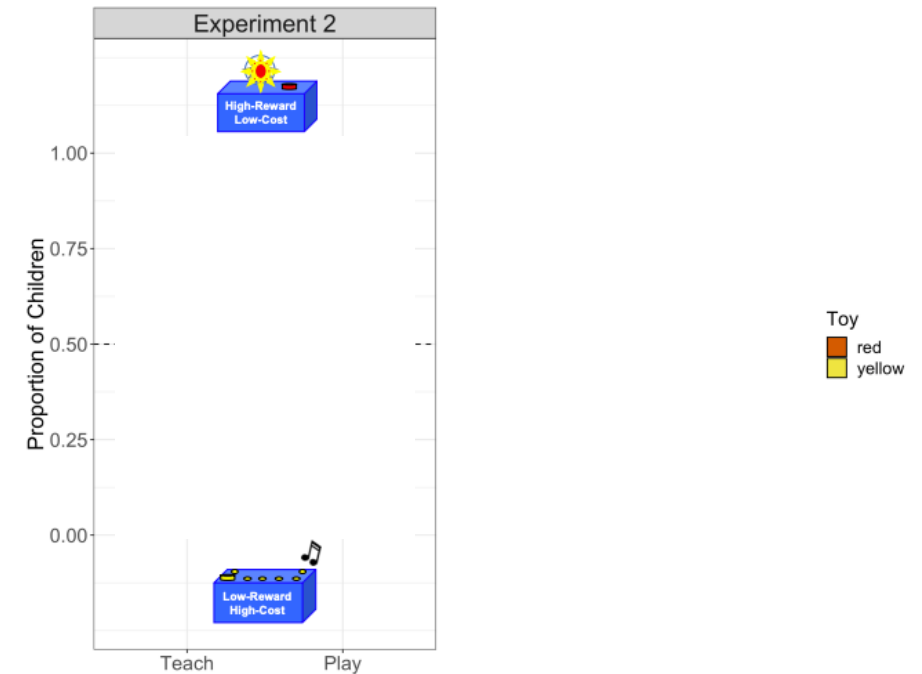
# child as **teacher**: inferring mental states

- experiment 2: children were asked to teach the observer (**exceptional** or **ordinary**)
- children did **more actions and transitions** for ordinary agents and were more informative early on for the ordinary agents
- inference: children can **flexibly adjust** evidence based on the observer's **goals and competence**



# child as **teacher**: inferring utilities

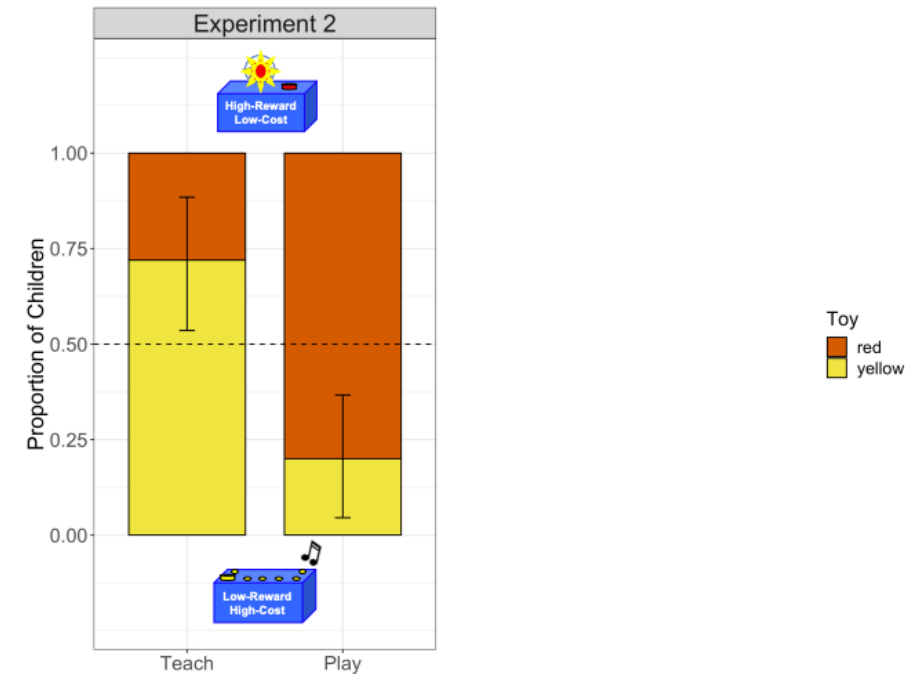
- Bridgers, Jara-Ettinger, and Gweon (2020) tested 5–7-year-olds with toys
  - low/high **cost**
  - low/high **reward**
- experiment 2: choose a toy to **teach** or **play**





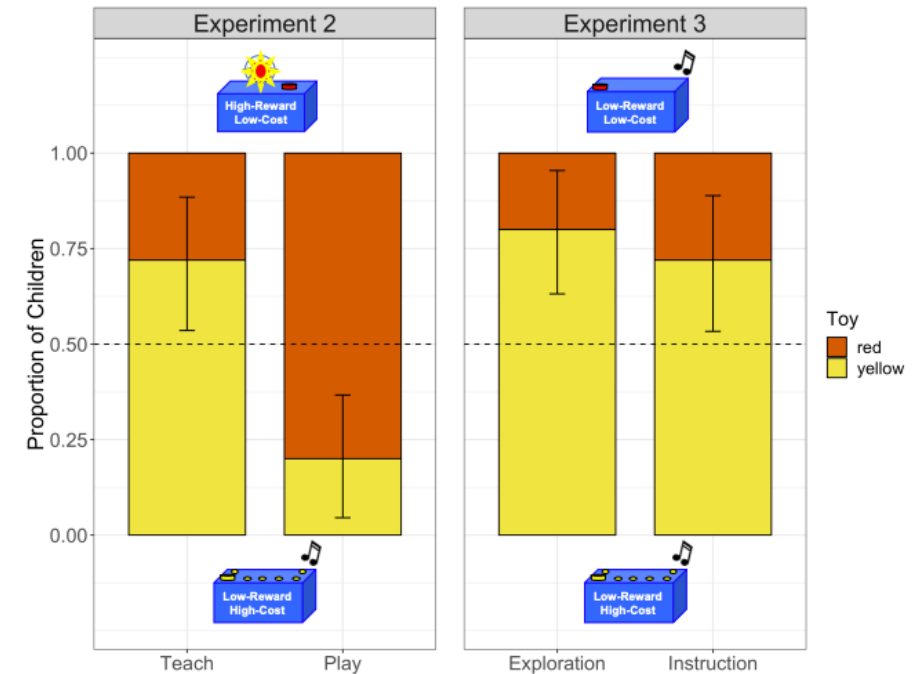
# child as **teacher**: inferring utilities

- Bridgers, Jara-Ettinger, and Gweon (2020) tested 5–7-year-olds with toys
  - low/high **cost**
  - low/high **reward**
- experiment 2: choose a toy to **teach** or **play**
- children chose **low-reward/high-cost** toys to **teach** and **high-reward/low-cost** toys to **play** with
- children prioritized the learner's utilities over their own when deciding what to teach



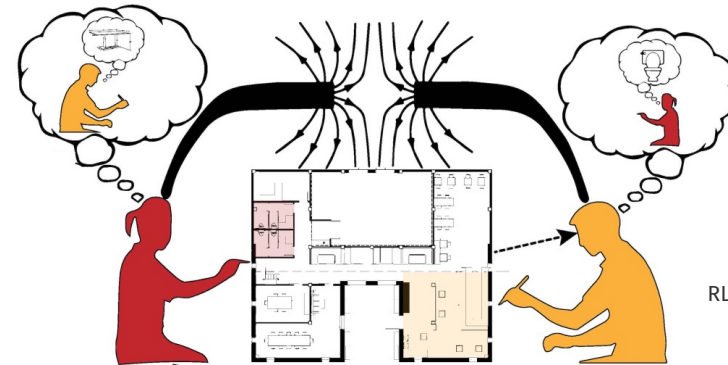
# child as **teacher**: inferring utilities

- experiment 3: choose a toy to teach after **exploration** or **instruction**
- children chose low-reward/high-cost toys regardless of whether or not they explored the toys themselves or not
- children can infer the costs for others' learnings even in the absence of direct experience

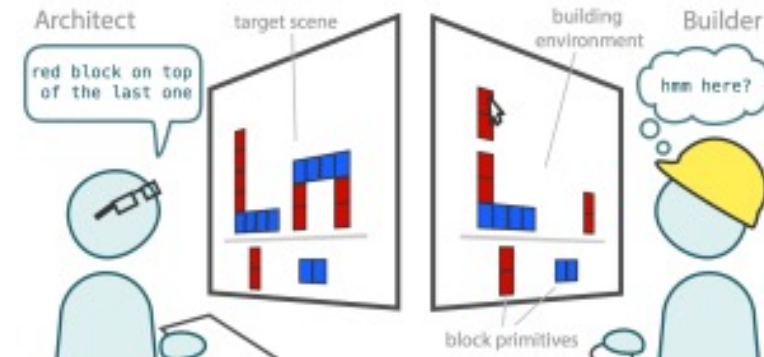


# social cognition

- researchers combine **developmental + adult human studies** with explicit **mathematical models** to account for a wide variety of cognitive phenomena
  - communication
  - helping
  - collaboration
  - cooperation
  - competition
  - teaching
  - ...



RL Goldstone, E Andrade-Lotero, RD Hawkins, ME Roberts (2023). The emergence of specialized roles within groups. *Topics in Cognitive Science*.



W McCarthy\*, RD Hawkins\*, C Holdaway, H Wang, J Fan (2021). Learning to communicate about shared procedural abstractions. *Proceedings of the 43rd Annual Conference of the Cognitive Science Society*.

# next class



- **before** class:
  - *finish*: L11 quiz/assignments
  - *review*: practice materials on Canvas
- **during** class:
  - L0-L12 review!
  - [poll for submitting questions](#)