Joint Action and the Emergence of Mindreading

minimal theory of mind

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A puzzle

Infants' false-belief tracking abilities

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Violation of expectations

- with change of location (Onishi & Baillargeon 2005)

Anticipating action

- pointing (Knudsen & Liszkowski 2011)

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- with deceptive contents (He et al 2011)
- observing verbal comm^{n} (Song et al 2008; Scott et al 2012)

Anticipating action
- looking (Southgate et al 2007)
- pointing (Clements et al 1994)
(Knudsen & Liszkowski 2011)

Helping (Buttlemann et al 2009)

Communicating (Southgate et al 2010)

Altercentric interference (Kovacs et al 2010)

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A-tasks

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1. There are subjects who can pass A-tasks

2. These subjects' success on A-tasks is explained by the fact that they **can** represent (false) beliefs

3-year-olds fail false belief tasks

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prediction
- action (Wimmer & Perner 1983)
- desire (Astington & Gopnik 1991)

retrodiction or explanation (Wimmer & Mayringer 1998)

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1. There are subjects who cannot pass B-tasks.

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All B-tasks impose a requirement (or set of requirements) other than the requirement to represent a false belief.

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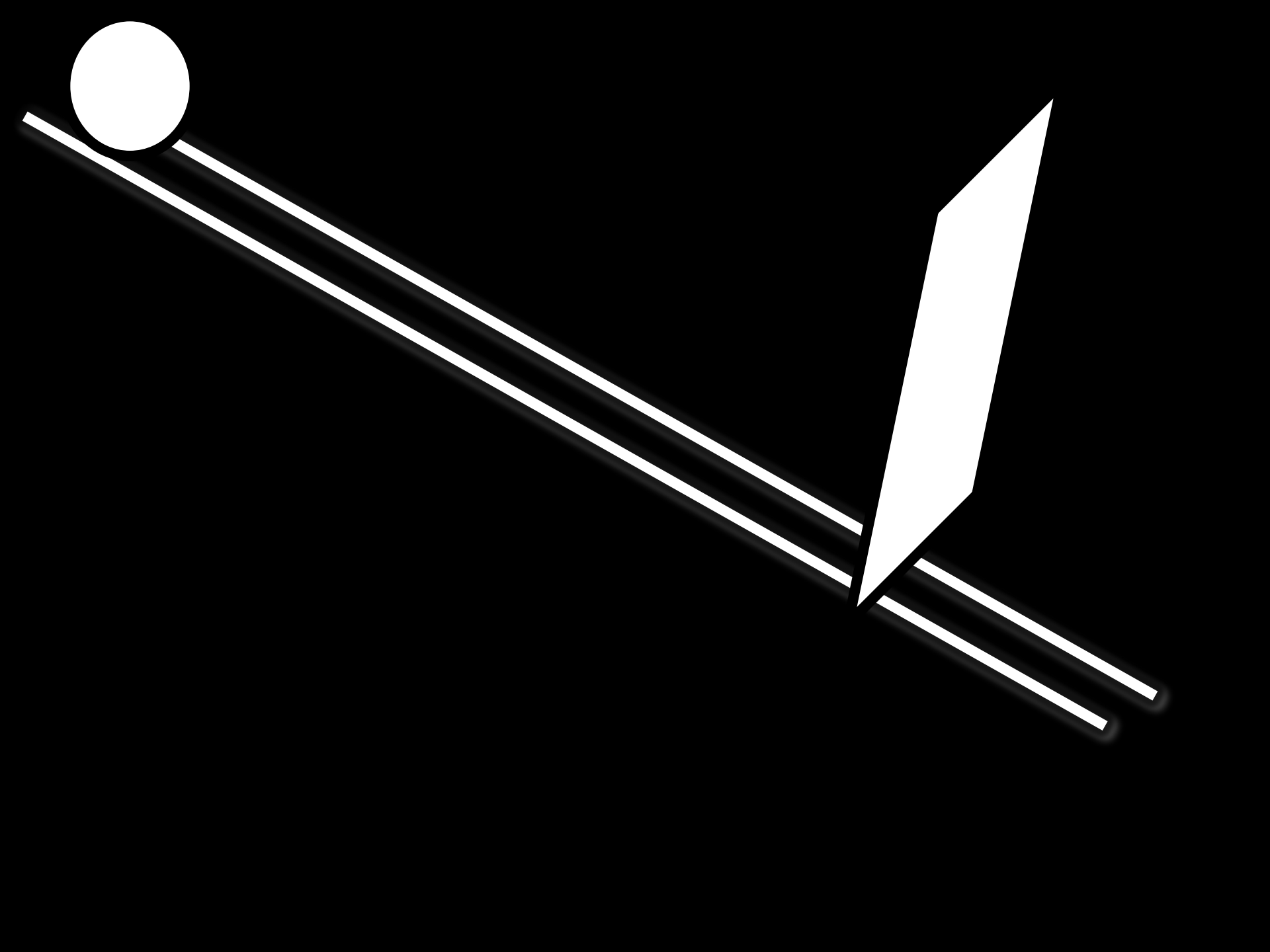
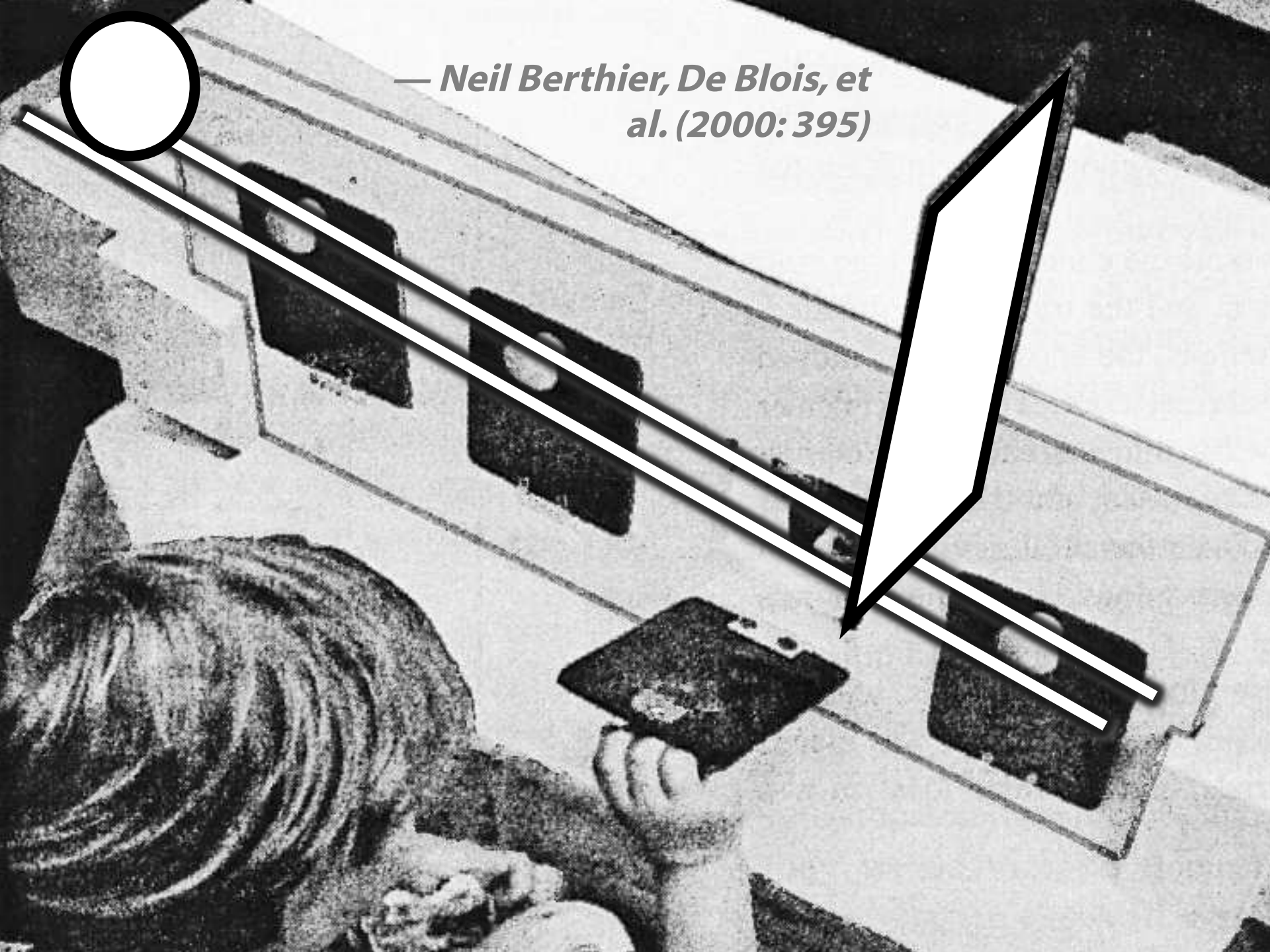
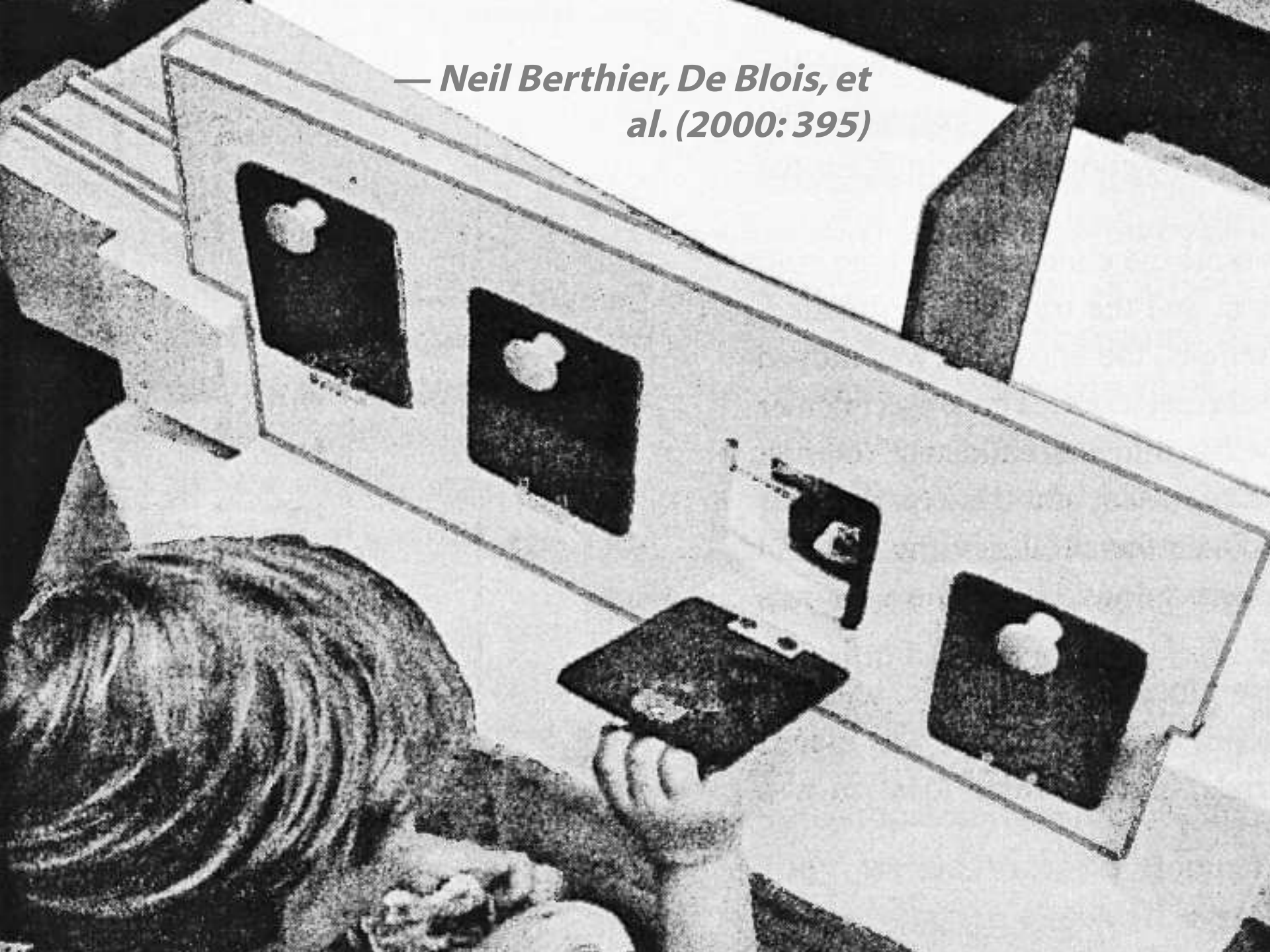



— Neil Berthier, De Blois, et al. (2000: 395)



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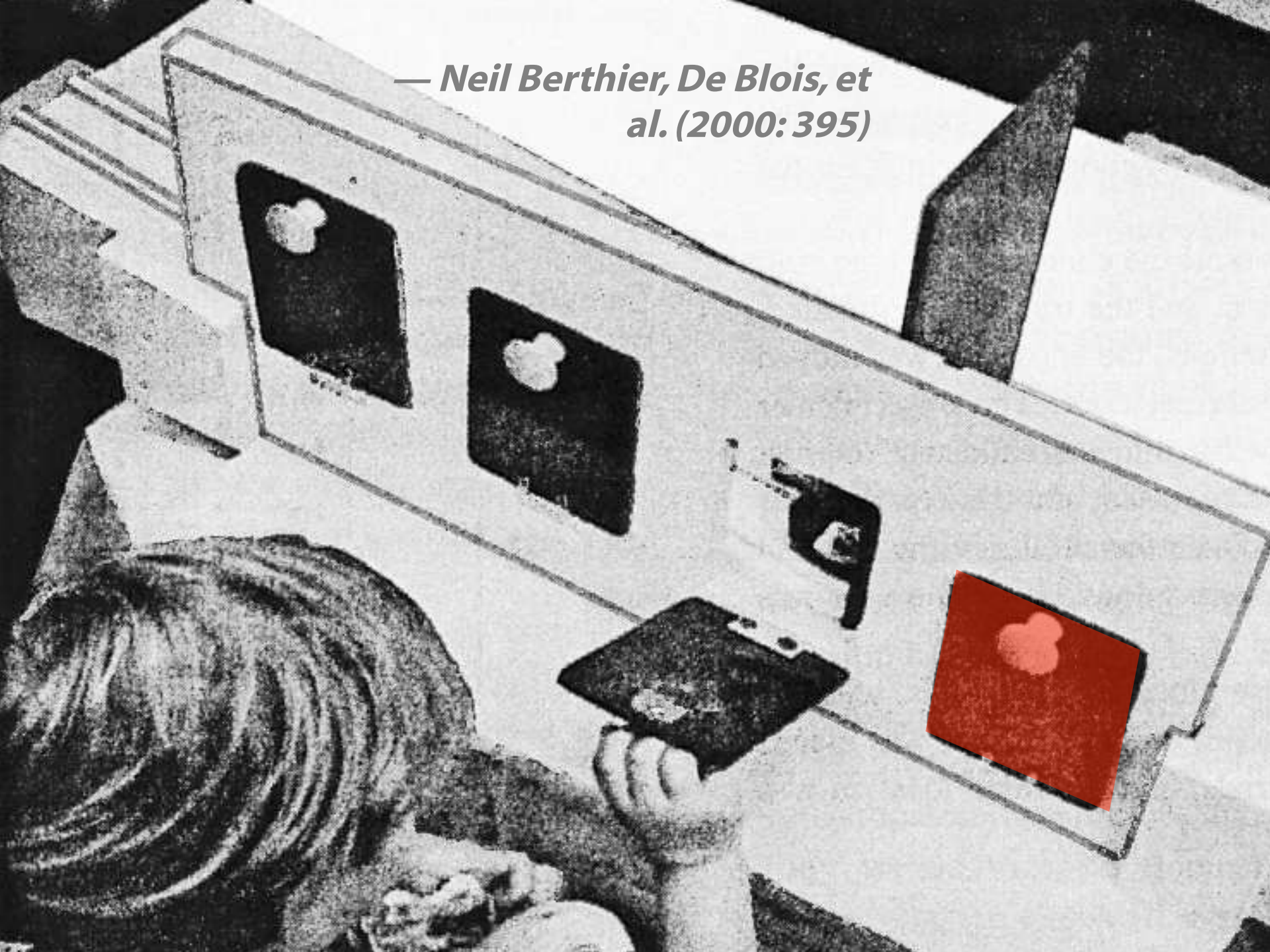

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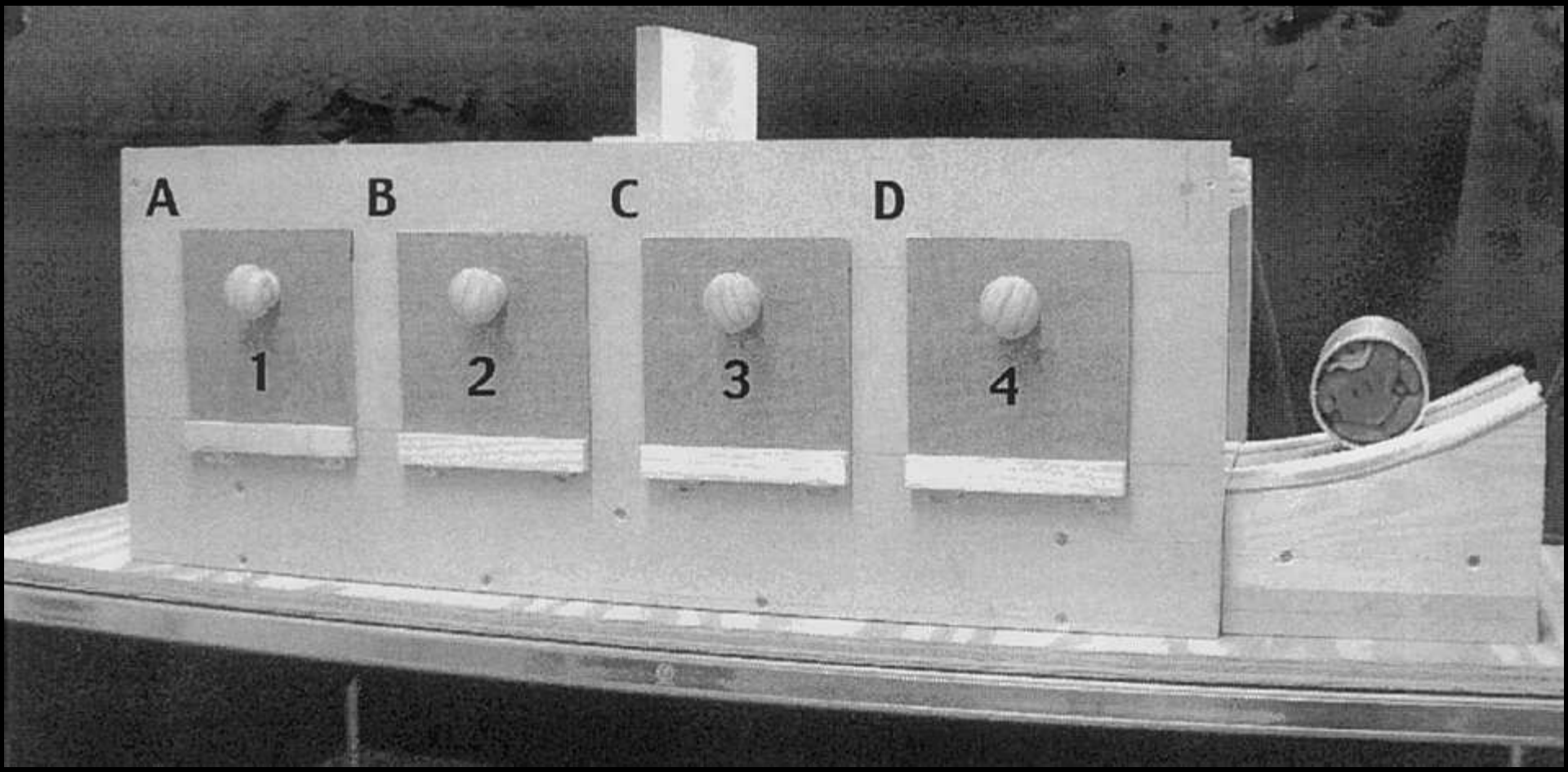

(Hood et al, 2003)

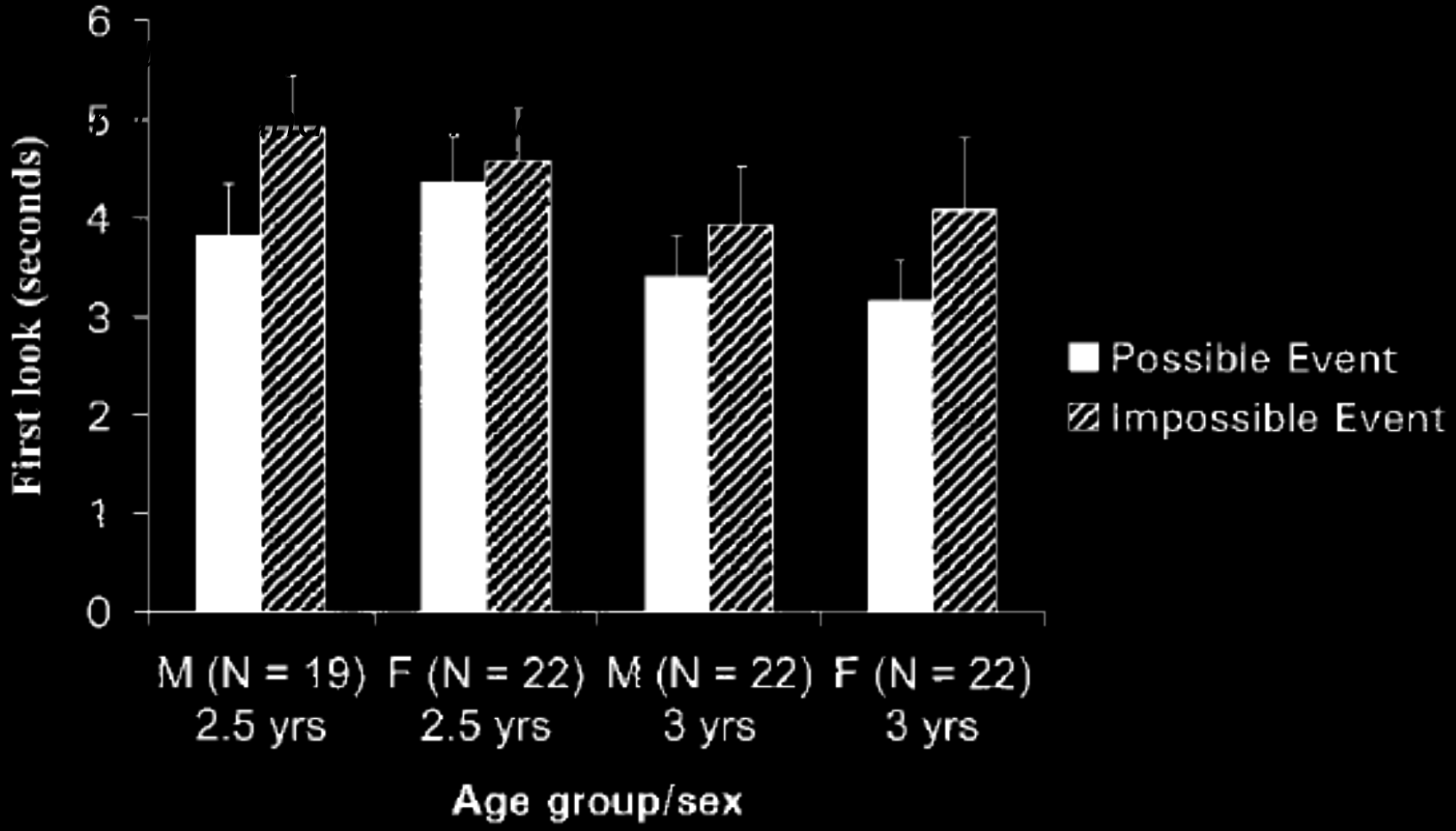

Figure 2. Mean durations of first looks to possible and impossible outcomes, by age and sex. M = male; F = female.

(Hood et al, 2003)

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2. These subjects' success on A-tasks is explained by the fact that they **can** represent (false) beliefs

in a modular process

3. These subjects' failure on B-tasks is explained by the fact that they **cannot** represent (false) beliefs

in a non-modular process

What is a representation of belief?

What is a representation of belief?
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1. There are subjects who can pass A-tasks but cannot pass B-tasks.

2. These subjects' success on A-tasks is explained by the fact that they **can** represent (false) beliefs *using a simple measure in a modular process*

3. These subjects' failure on B-tasks is explained by the fact that they **cannot** represent (false) beliefs *using a sophisticated measure in a non-modular process*

What could infants, chimps and scrub-jays represent that would enable them, within limits, to track others' perceptions, knowledge, beliefs and other propositional attitudes?

question

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question

Propositional attitude

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Relational attitude

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e.g. believes that ...
e.g. intends that ...
e.g. knows that ...

Relational attitude

e.g. excited by ...
e.g. encountered ...
e.g. wants apple juice

Propositional attitude	Relational attitude
e.g. believes that ... e.g. intends that ... e.g. knows that ...	e.g. excited by ... e.g. encountered ... e.g. wants apple juice
arbitrarily nestable contents	no contents
uncodifiably complex effects on action	parameter-setting effects on action
permit mistakes about appearance, identity and existence	enable tracking a limited range of false beliefs only

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level-1 perspective taking	Y	Y
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level-2 perspective taking	Y	N
false beliefs about non-existence	Y	N
false beliefs about location	Y	Y
false beliefs about identity	Y	N

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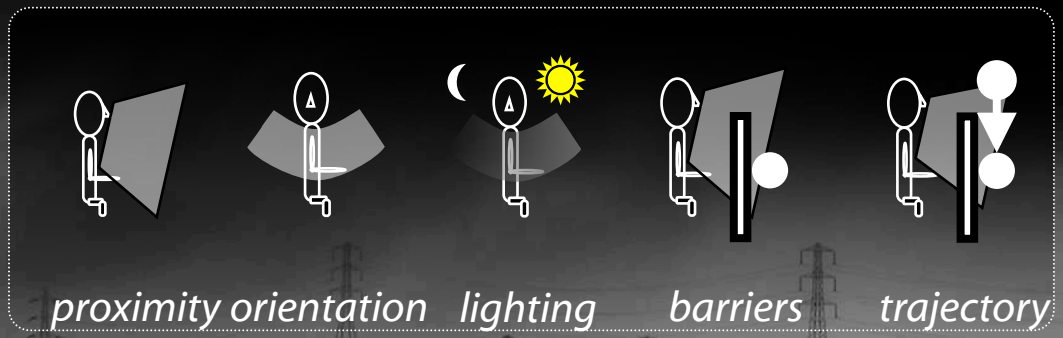

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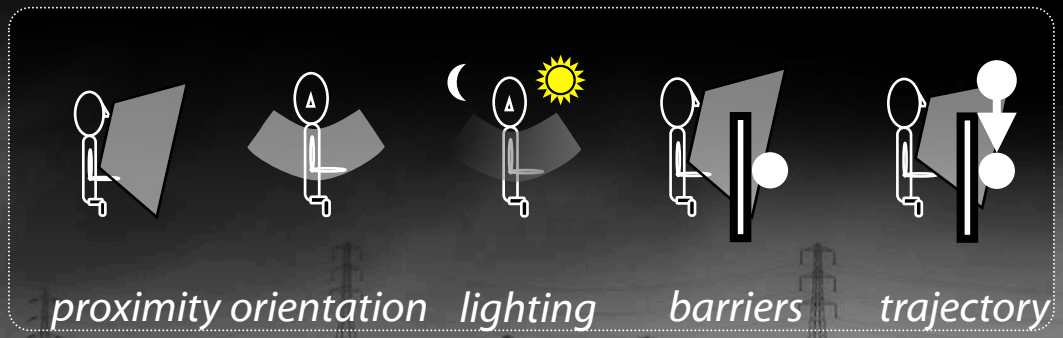

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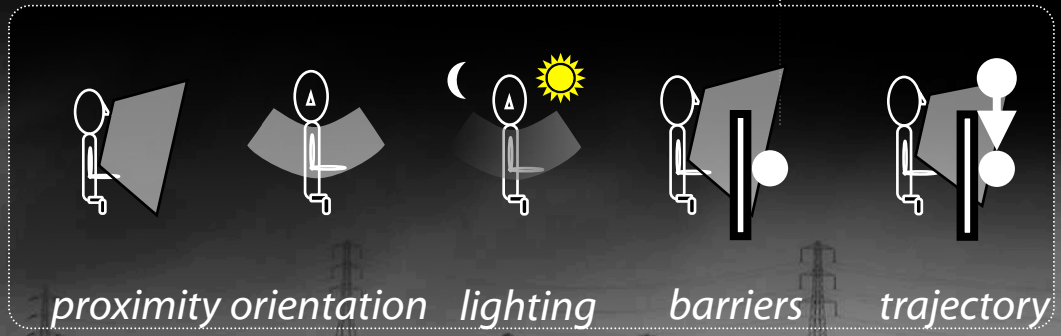

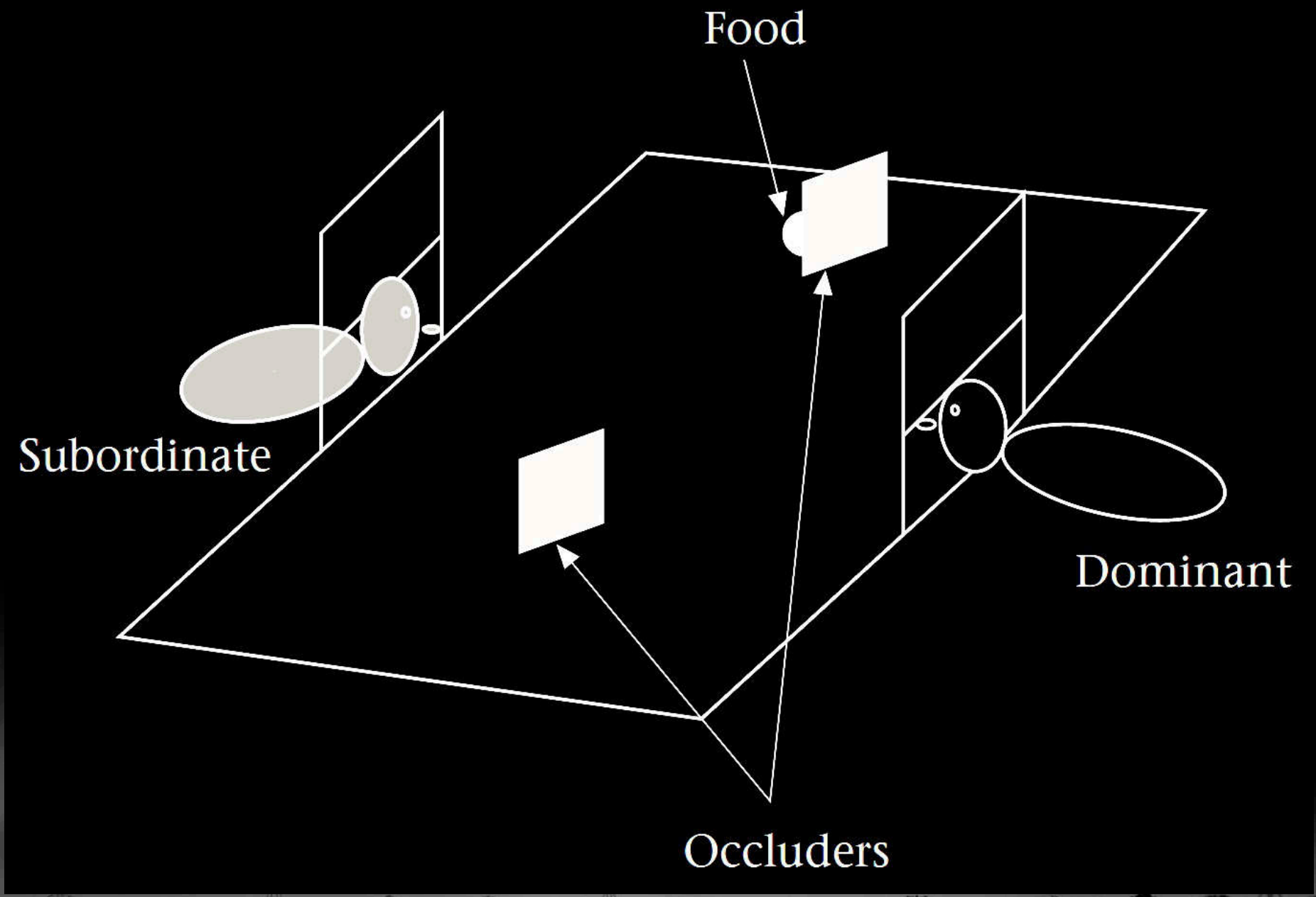
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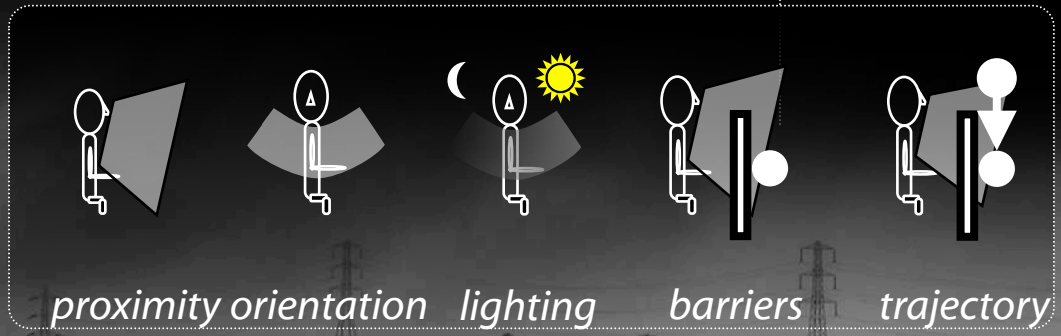

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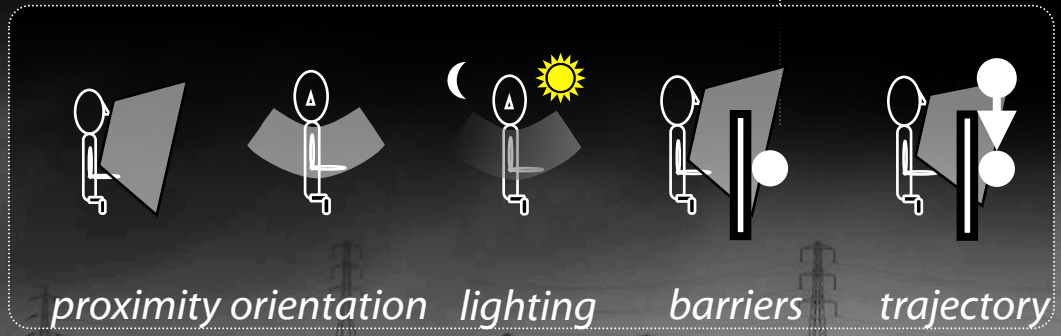

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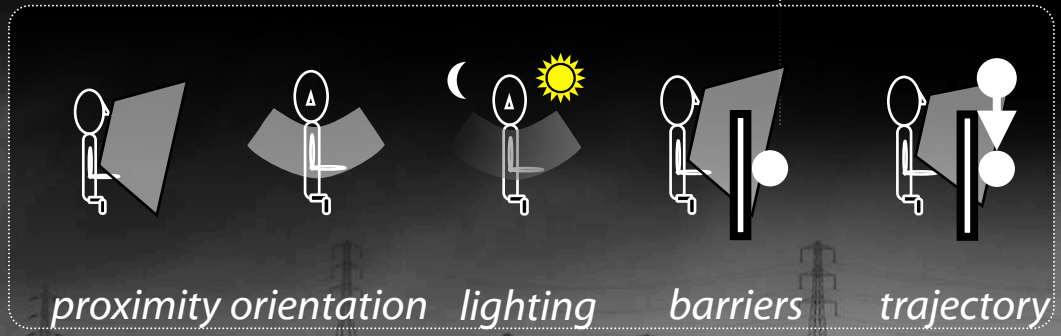

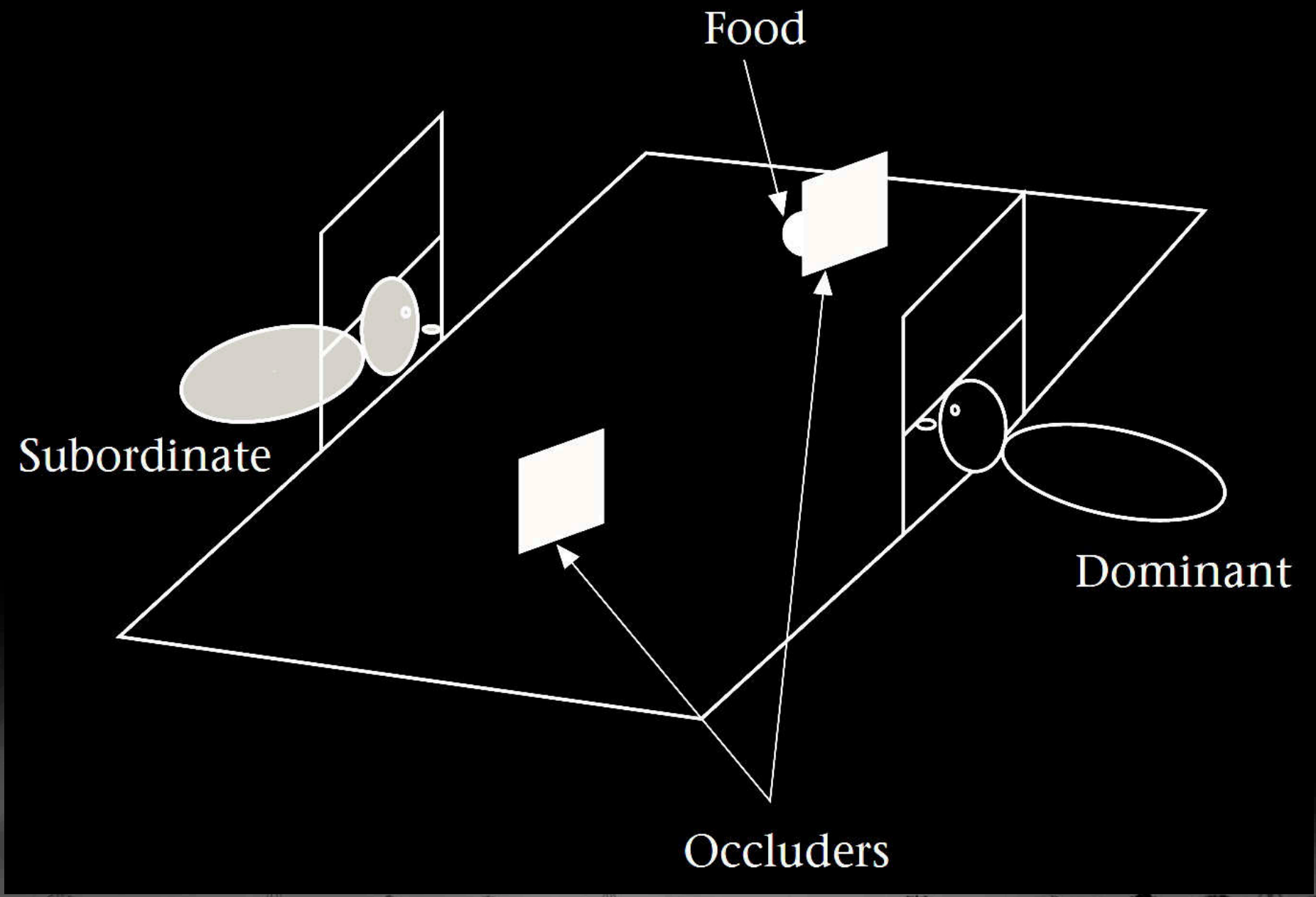
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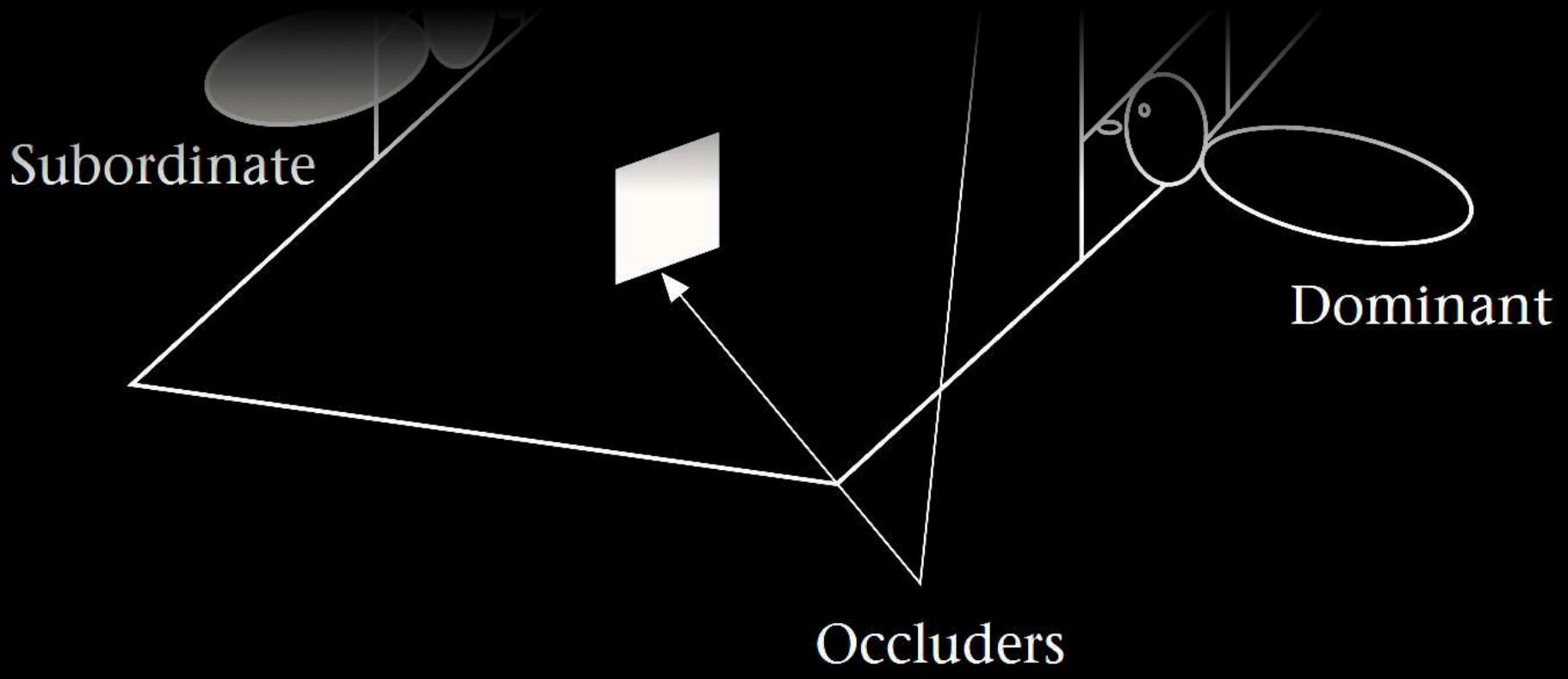
"chimpanzees understand … intentions … perception and knowledge … Moreover, they understand how these psychological states work together to produce intentional action"

(Call & Tomasello 2008:191)



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"our [typical adult humans'] fundamental conception of what it is to know that P is itself an explanatory conception […] we think of S's knowledge that P as something that can properly be explained by reference to what S has perceived or remembered or proved or ..."
(Cassam 2007: 356)

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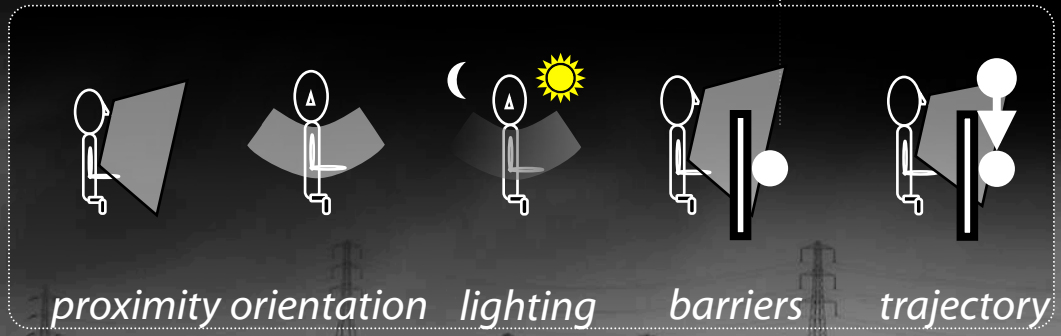

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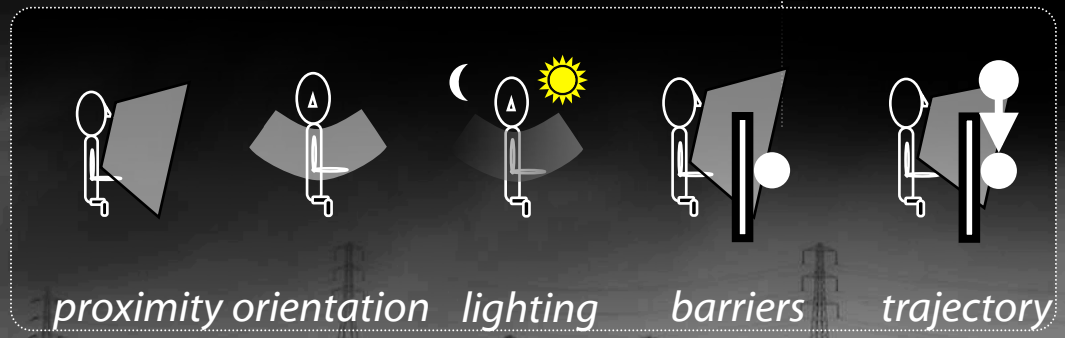

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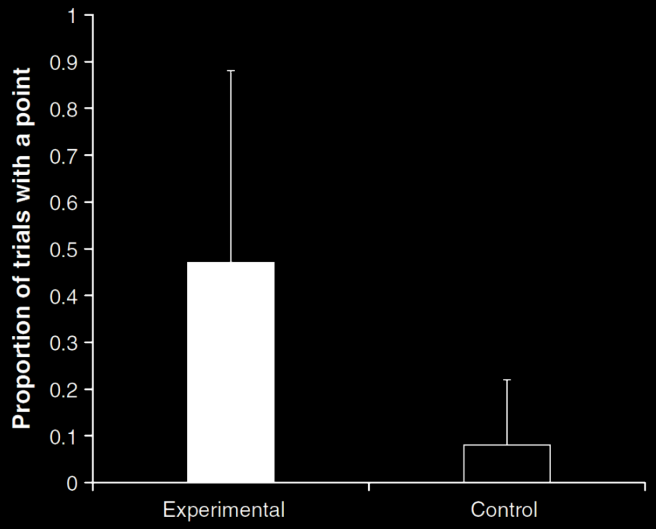

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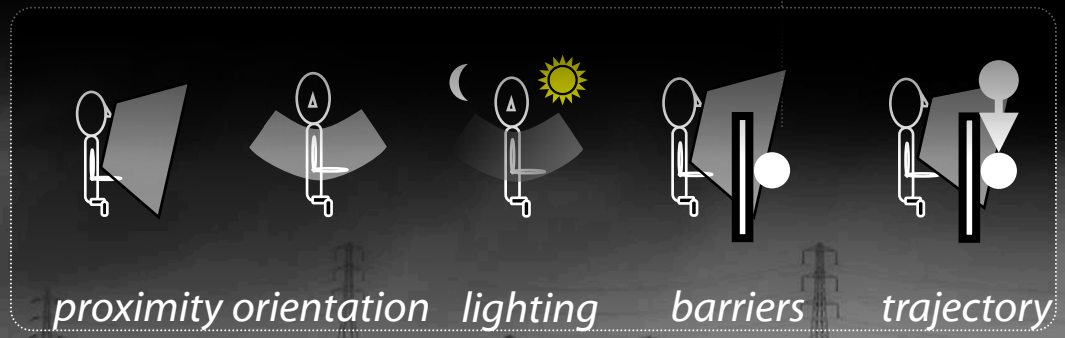
"Helping by informing inextricably involves … an understanding of others' goals and … of others' ignorance."
(Liszkowski, Carpenter & Tomasello 2008: 738-9)



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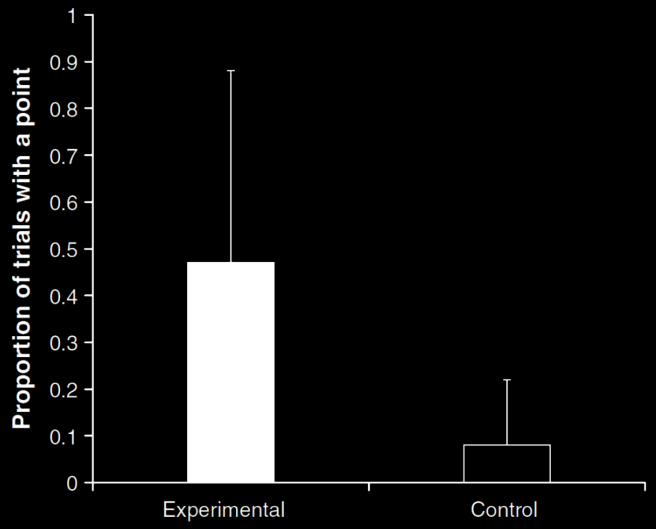

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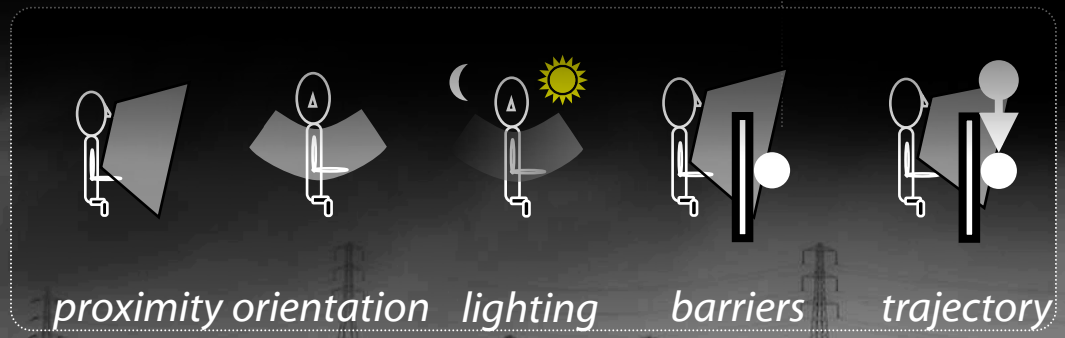

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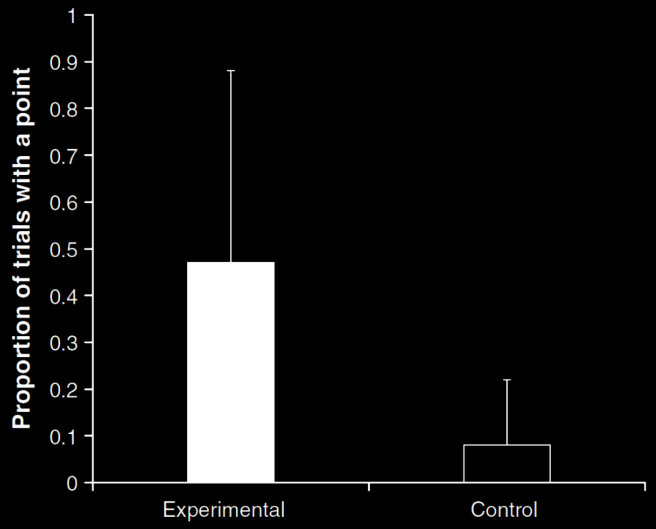

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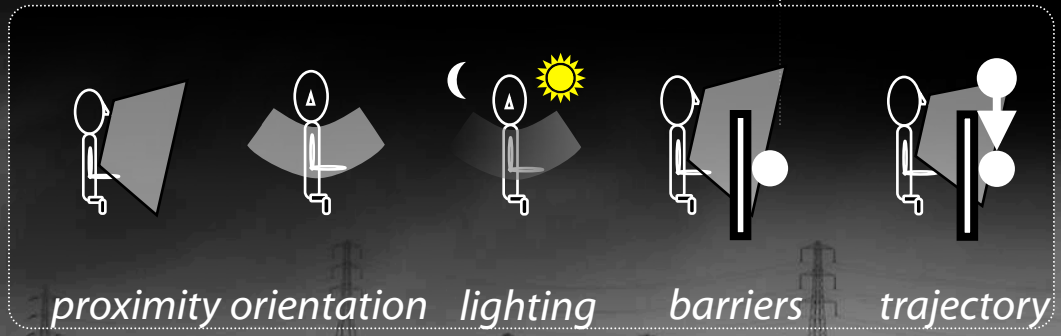

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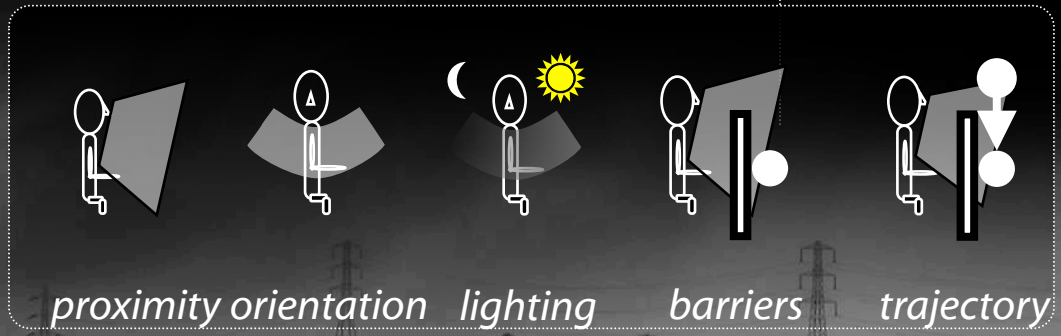
Principle 3



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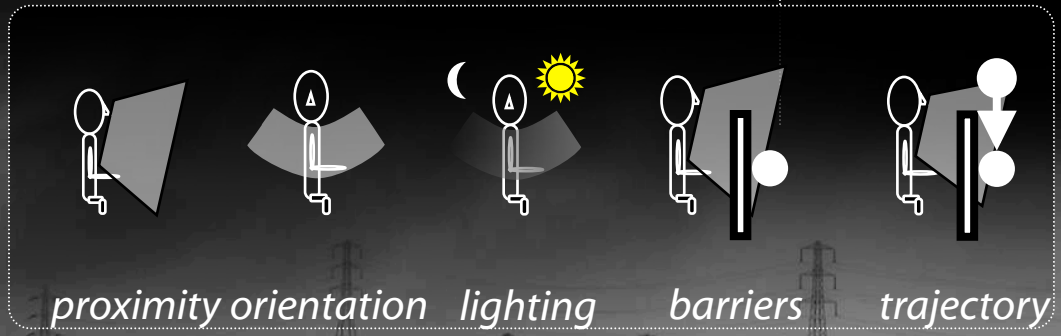
Principle 2: correct registration is a condition of *successful* action.

Principle 3: when an agent performs a goal-directed action and the goal specifies an object, the agent will act as if the object were actually in the location she registers it at.



signature limits

1. There are subjects who can pass A-tasks but cannot pass B-tasks.

2. These subjects' success on A-tasks is explained by the fact that they **can** represent (false) beliefs *using a simple measure in a modular process*

3. These subjects' failure on B-tasks is explained by the fact that they **cannot** represent (false) beliefs *using a sophisticated measure in a non-modular process*

signature limits

1. Charly is Samantha

2. Mitch believes that Charly is in Baltimore

3. Mitch believes that Samantha is in Baltimore

(1) & (2) $\not\Rightarrow$ (3)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(1) & (2) ⇏ (3)

1. Charly is Samantha

2. Mitch believes that Charly is in Baltimore

3. Mitch believes that Samantha is in Baltimore

(1) & (2) $\not\Rightarrow$ (3)

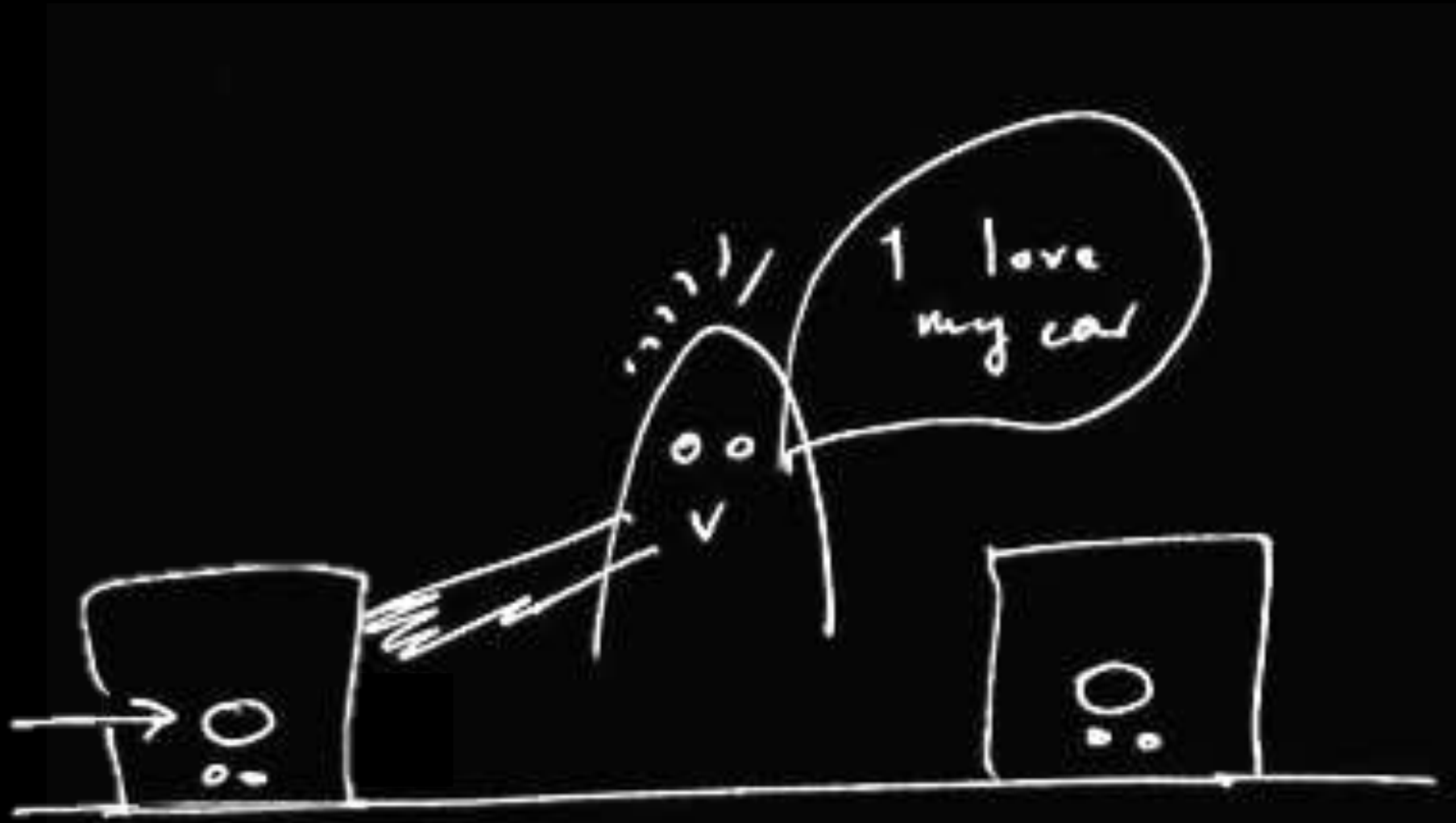
4. Mitch registers <Charly, Baltimore>

5. Mitch registers <Samantha, Baltimore>

(1) & (4) $\Rightarrow$ (5)

	False belief about location	False belief about identity
Subjects represent registration	*pass*	*fail*
Subjects represent beliefs	*pass*	*pass*

Rubio, Richardson & Butterfill

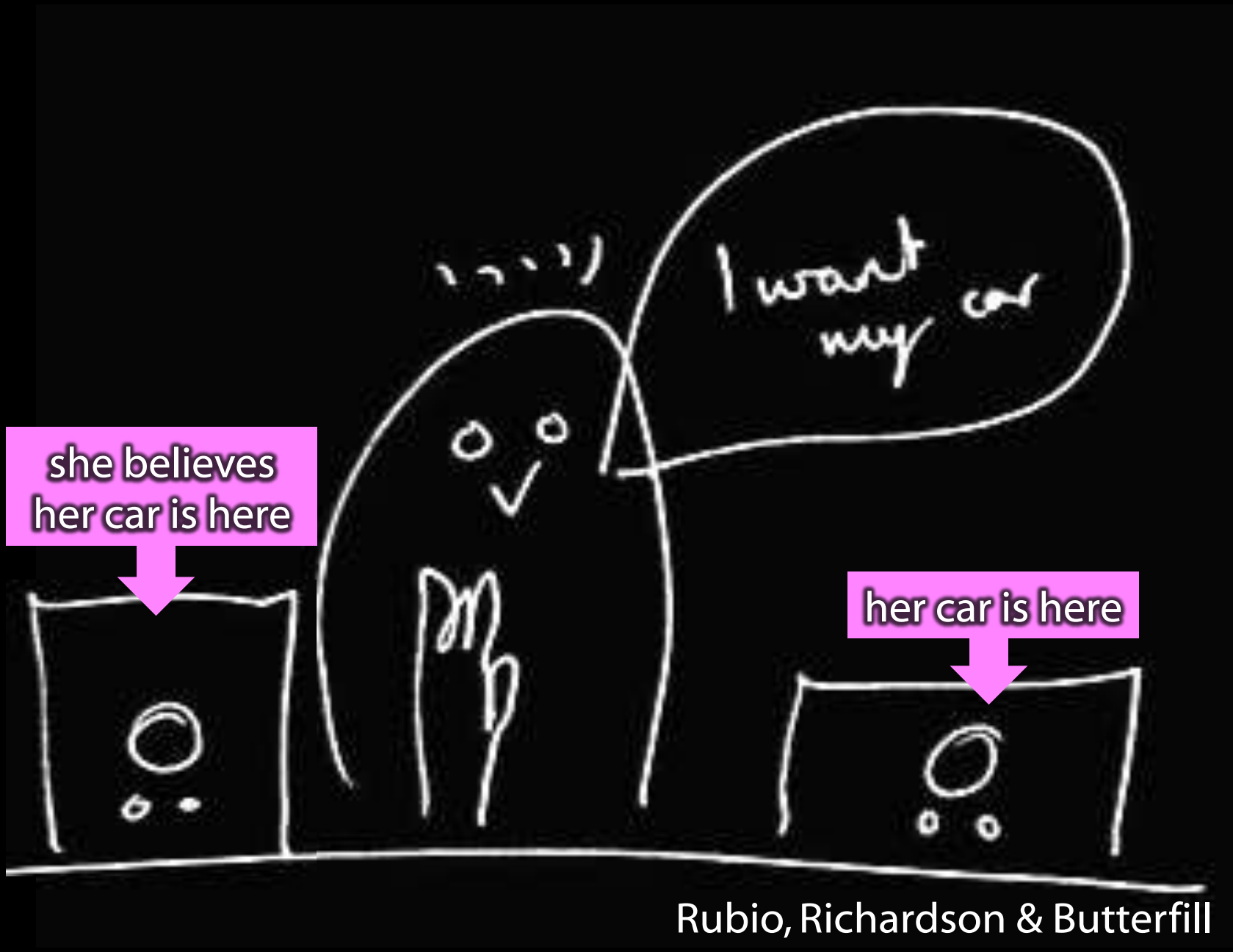


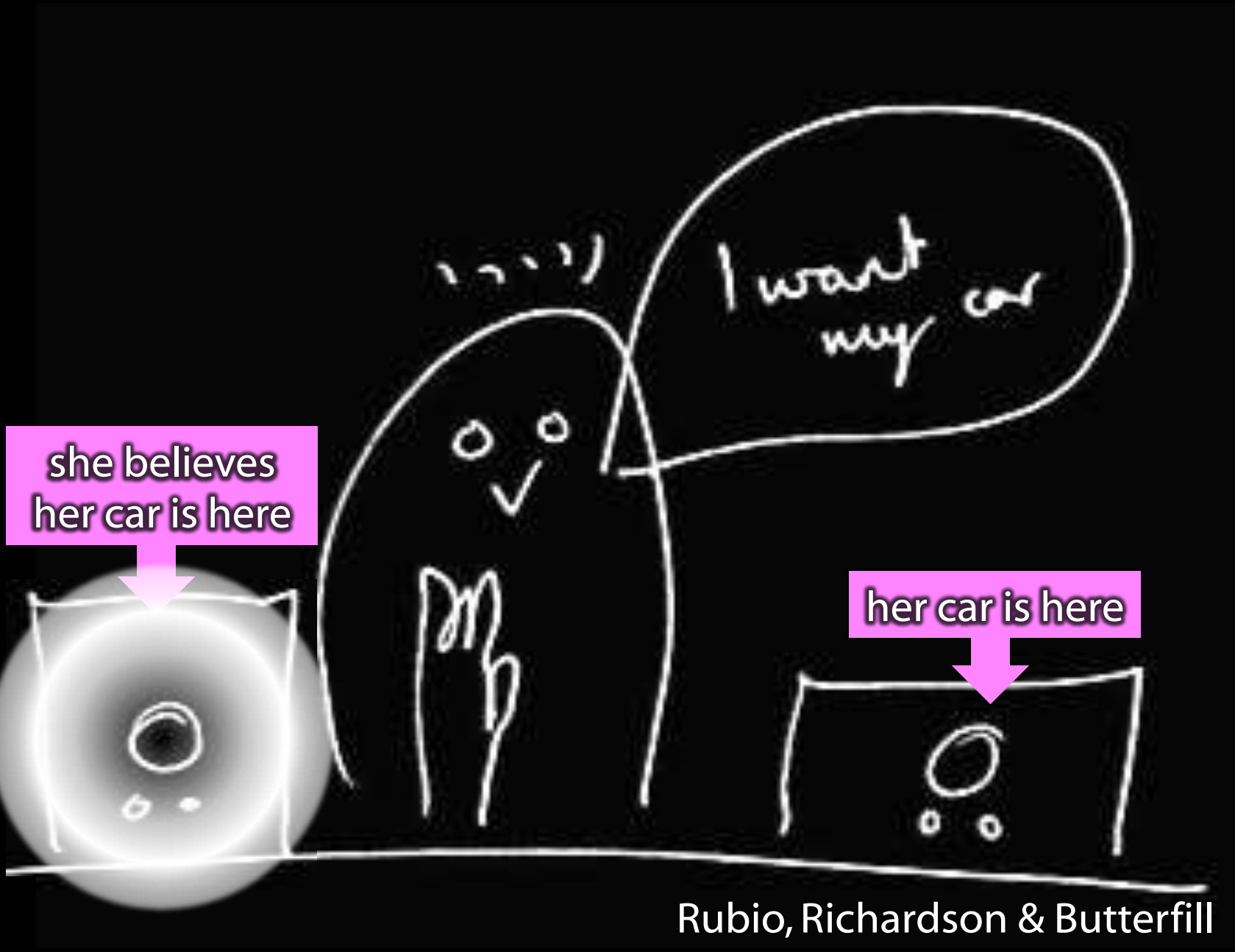
Rubio, Richardson & Butterfill

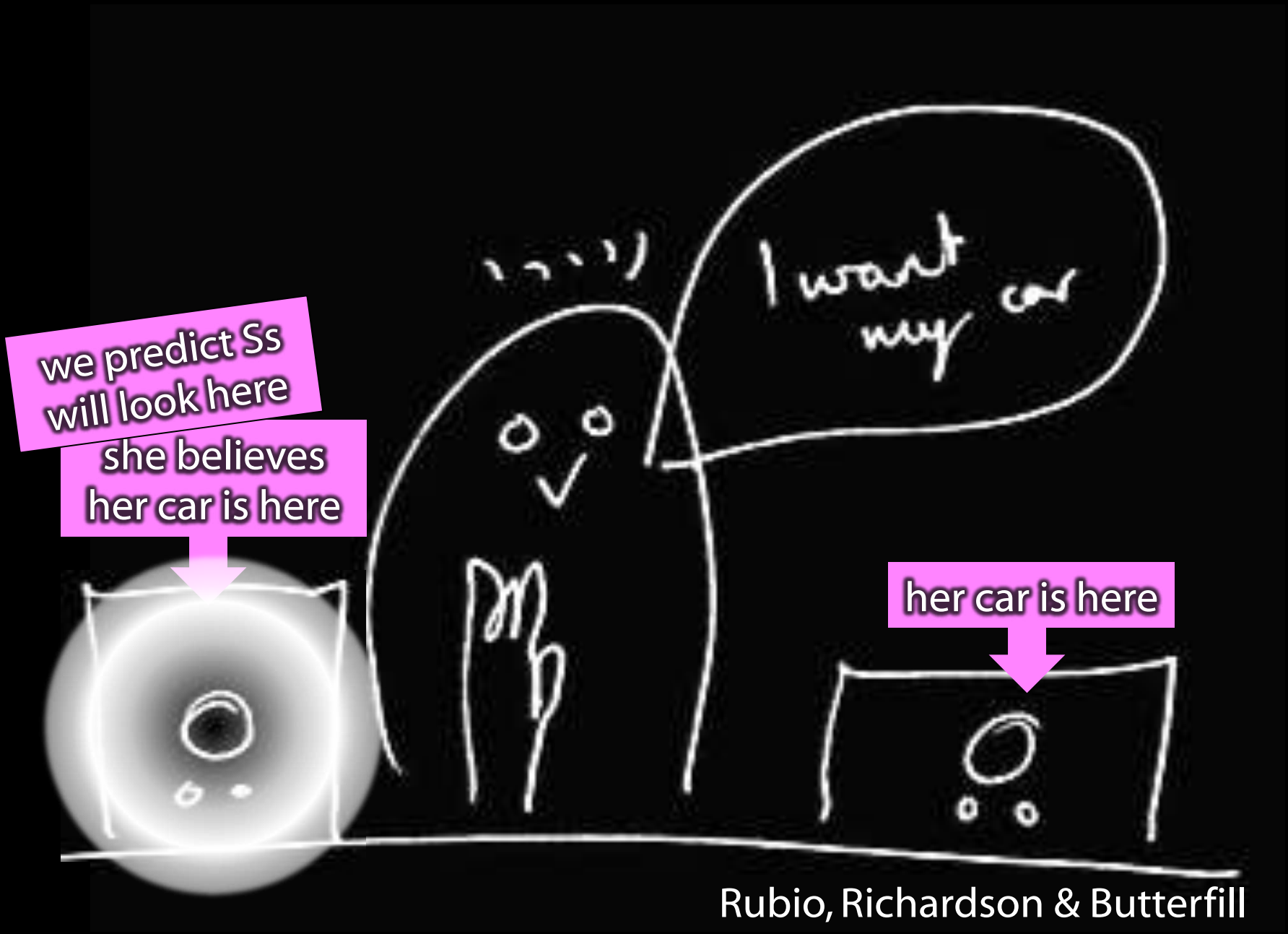
Rubio, Richardson & Butterfill

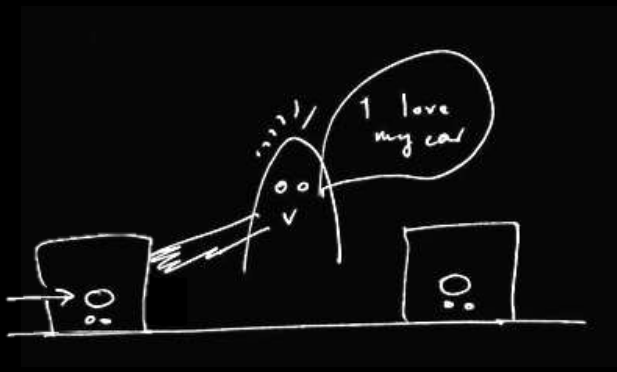
Rubio, Richardson & Butterfill

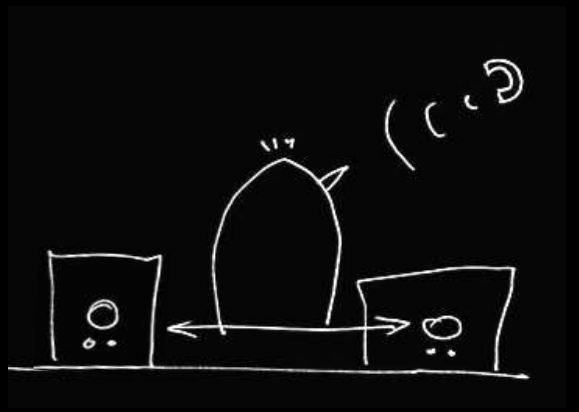
Rubio, Richardson & Butterfill


she believes
her car is here
I want my car
her car is here
Rubio, Richardson & Butterfill

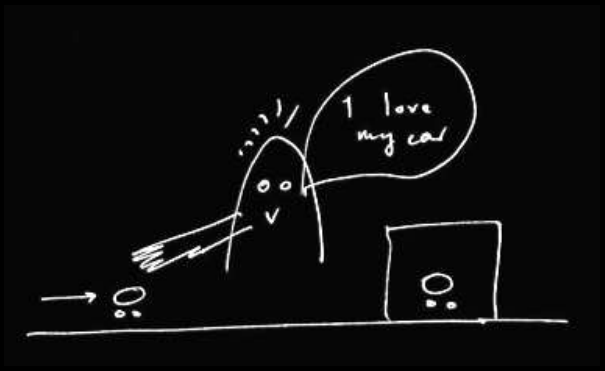

I want my car
she believes her car is here
her car is here
Rubio, Richardson & Butterfill

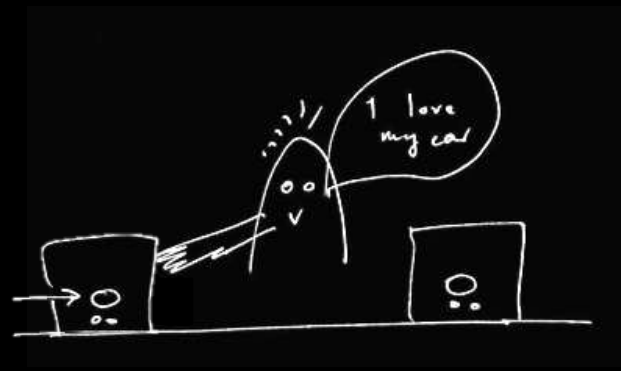

we predict Ss will look here
she believes her car is here
I want my car
her car is here
Rubio, Richardson & Butterfill

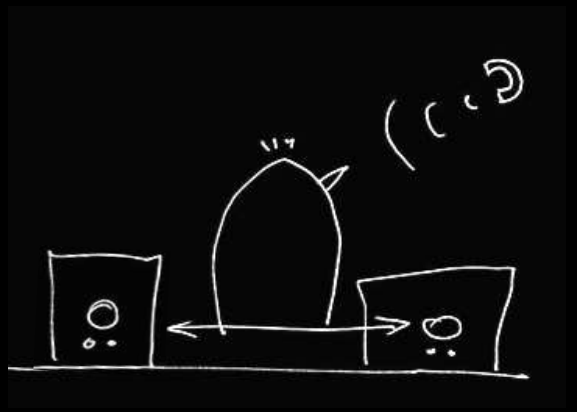




Rubio, Richardson & Butterfill

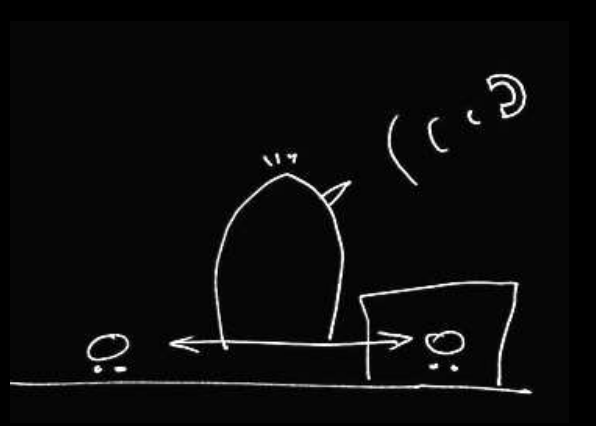






Rubio, Richardson & Butterfill

2



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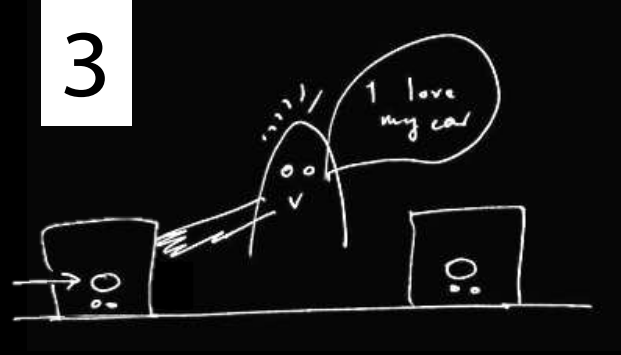

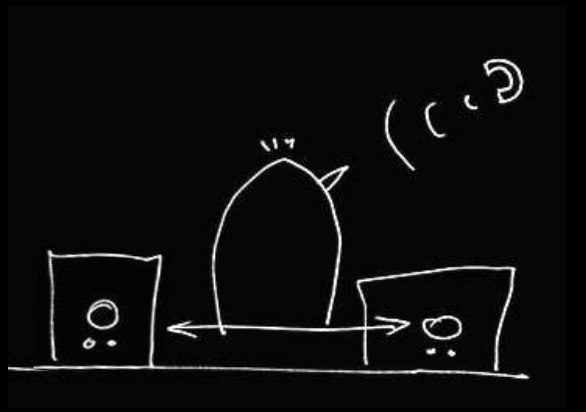

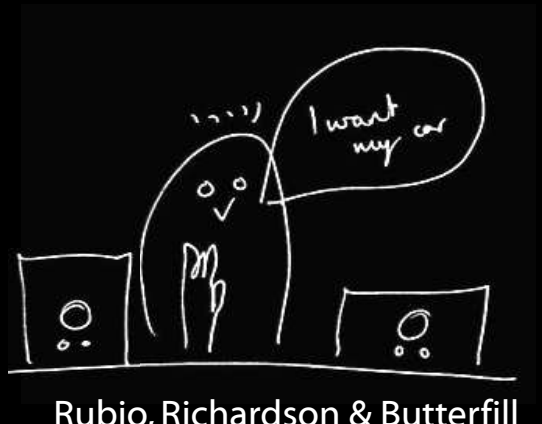

Rubio, Richardson & Butterfill

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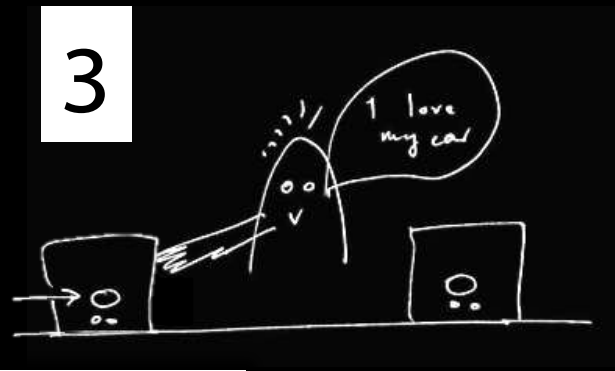
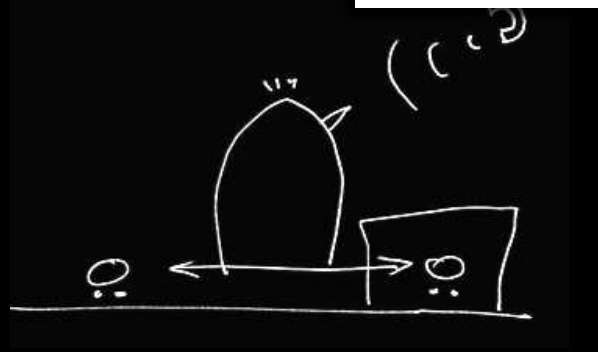
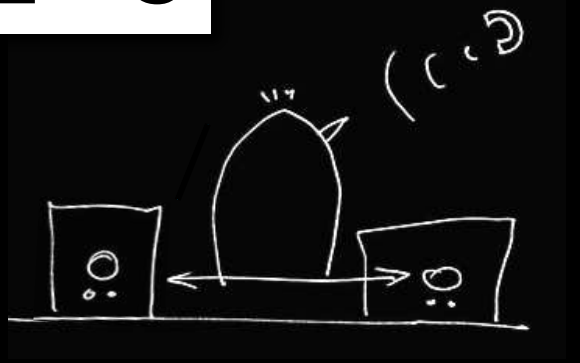
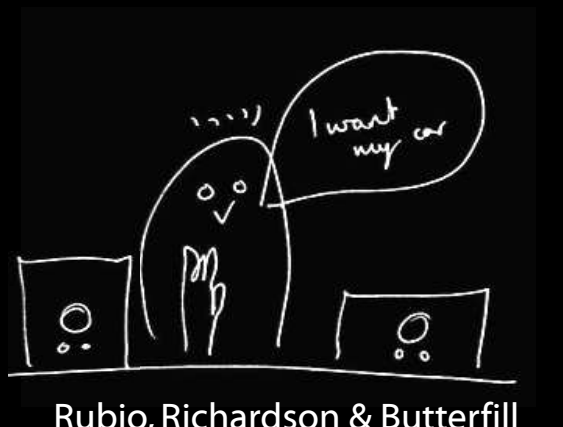


belief: $2 \approx 3$







Rubio, Richardson & Butterfill

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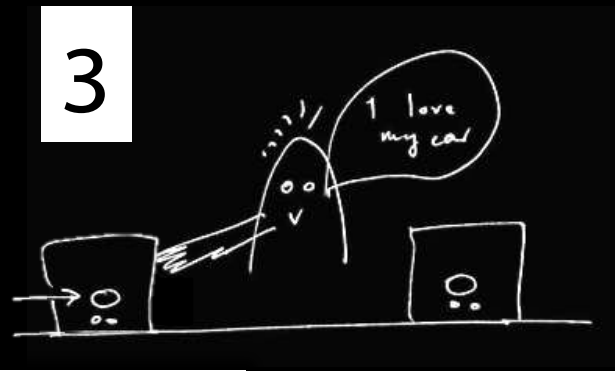
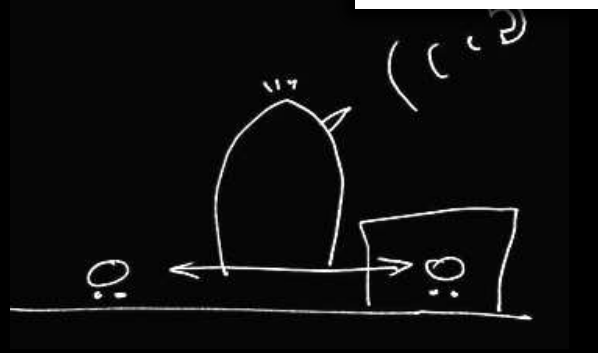
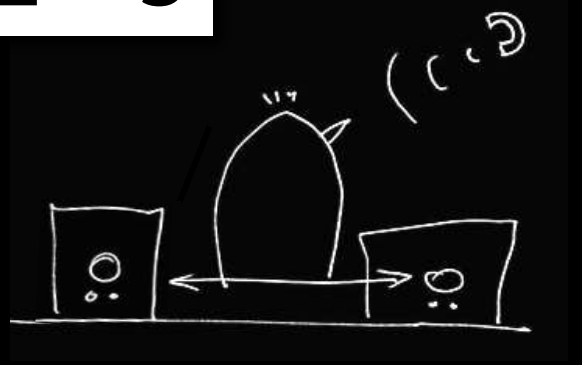
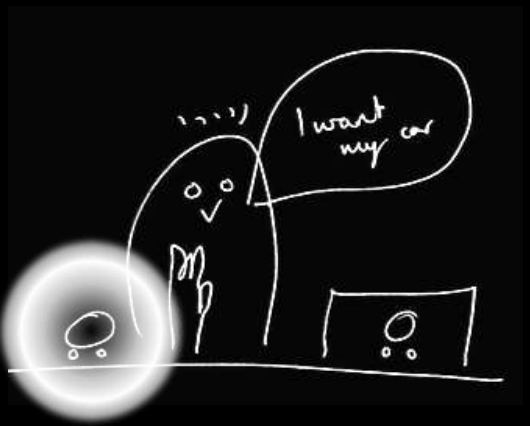


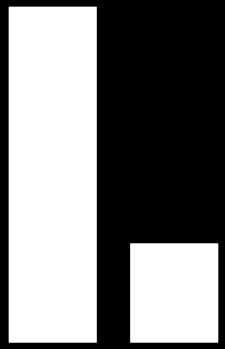
belief: 2 ≈ 3







Rubio, Richardson & Butterfill



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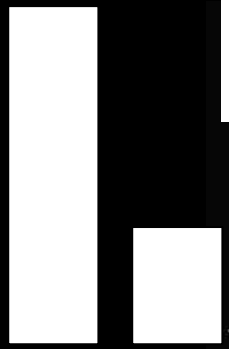
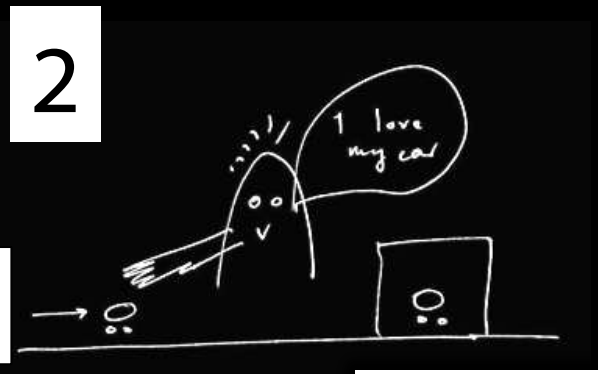
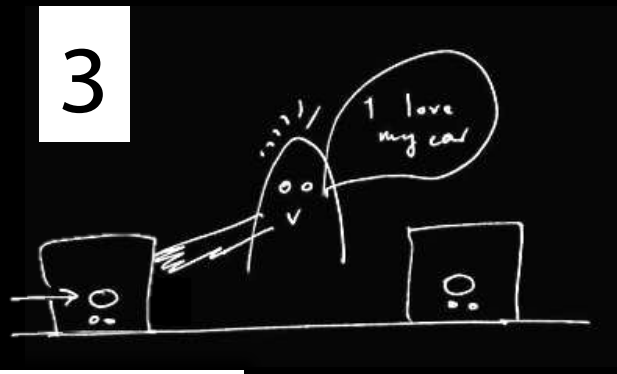


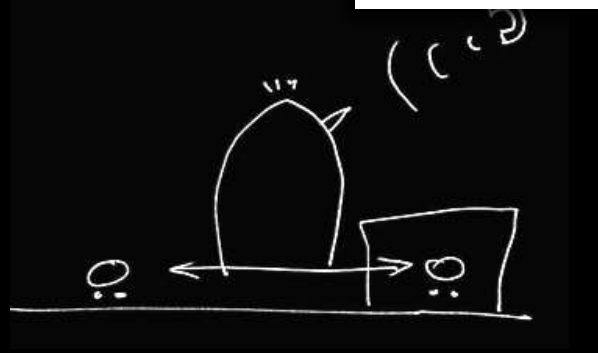
left right

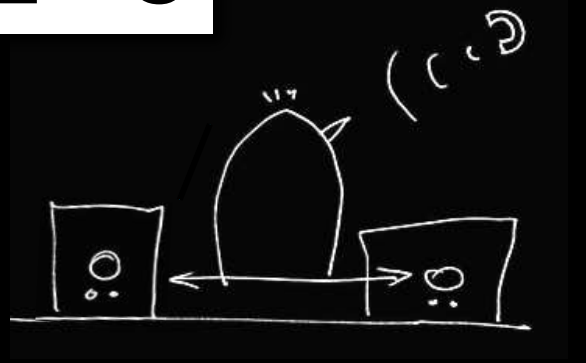
3

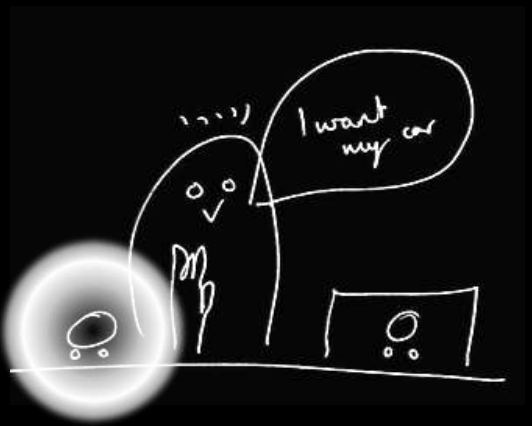




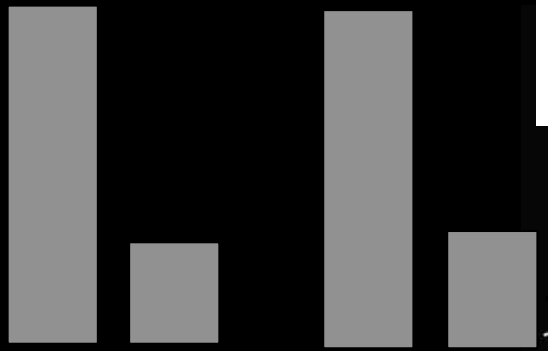
belief: $2 \approx 3$







Rubio, Richardson & Butterfill



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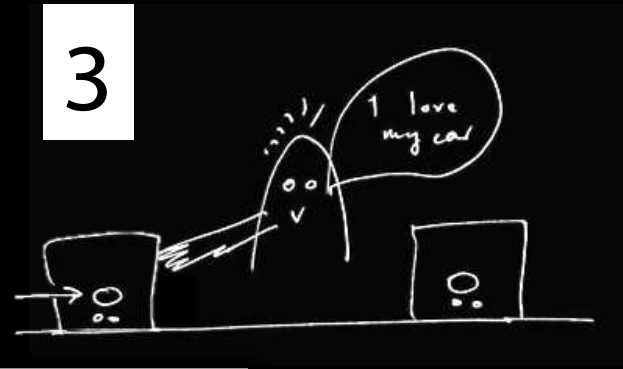
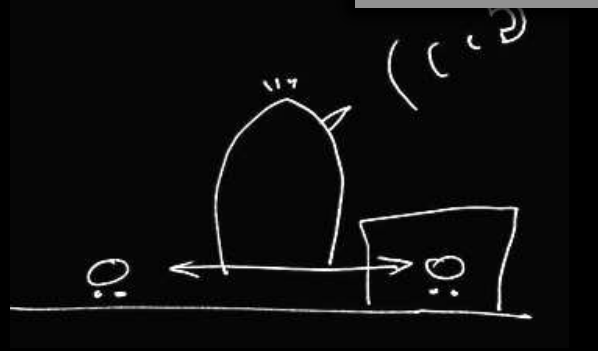
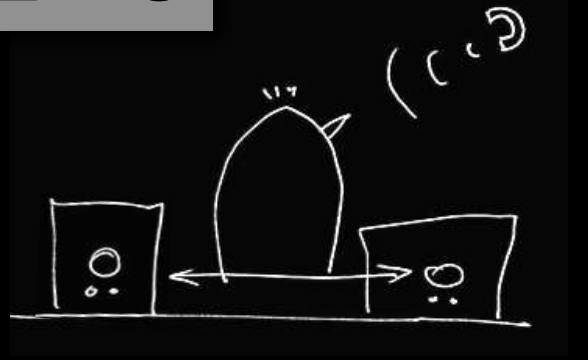
3



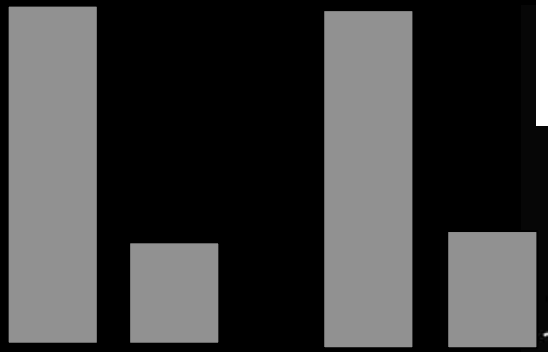
belief: $2 \approx 3$





registration: $2 \not\approx 3$

Rubio, Richardson & Butterfill



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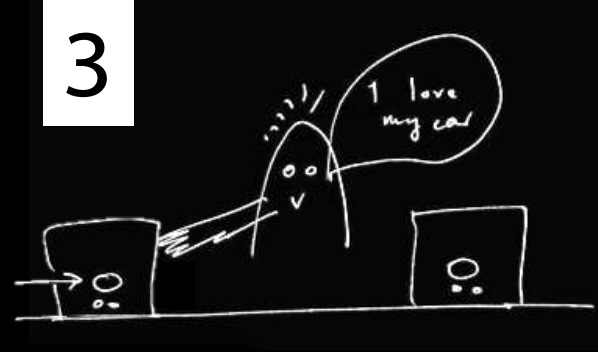
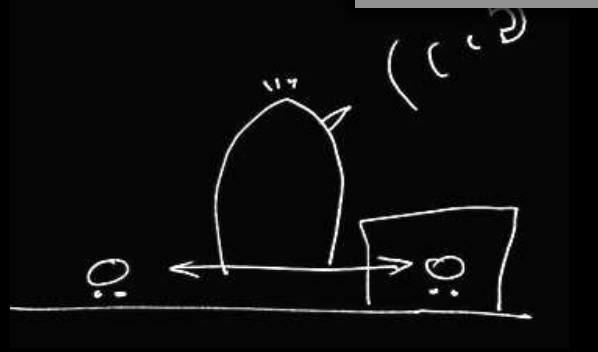
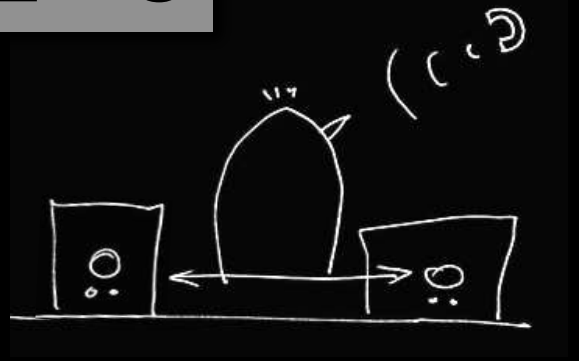


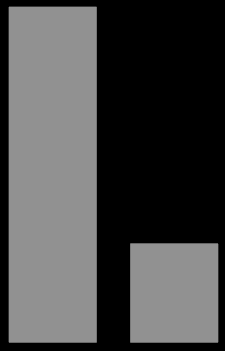
belief: $2 \approx 3$





registration: $2 \not\approx 3$

Rubio, Richardson & Butterfill



left right

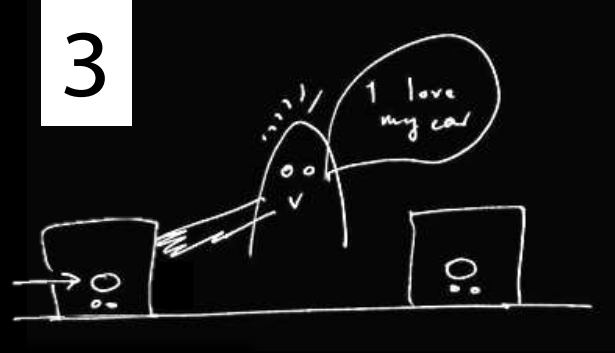
2

left right

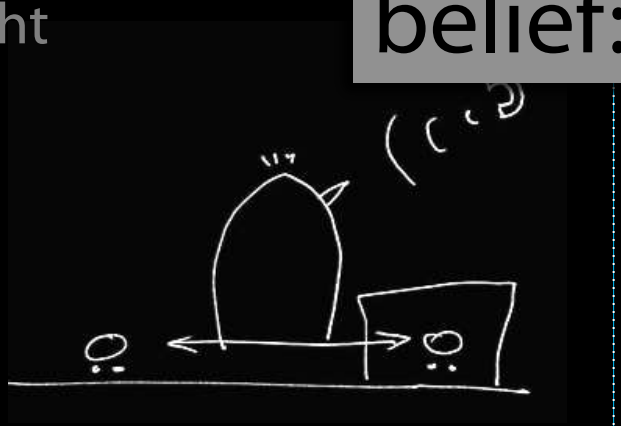
3

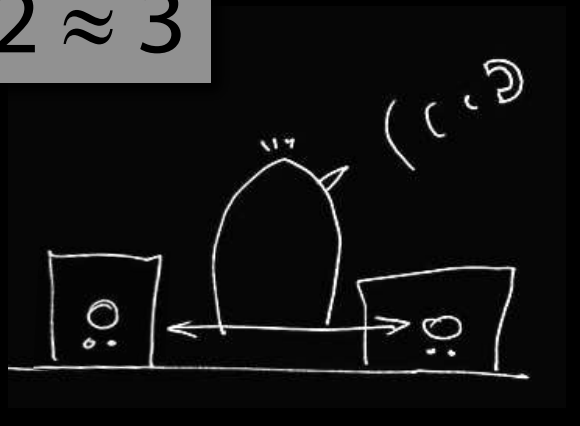
2

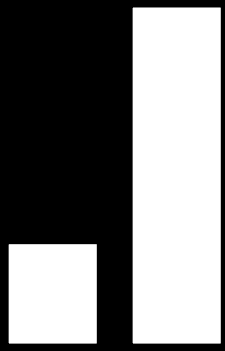
3



belief: $2 \approx 3$

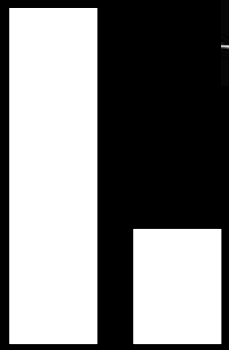






left right

2

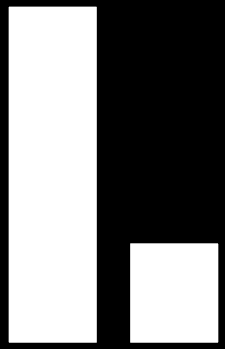


left right

3

registration: $2 \not\approx 3$

Rubio, Richardson & Butterfill



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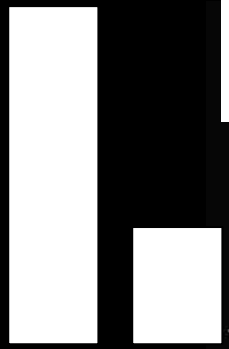

left right

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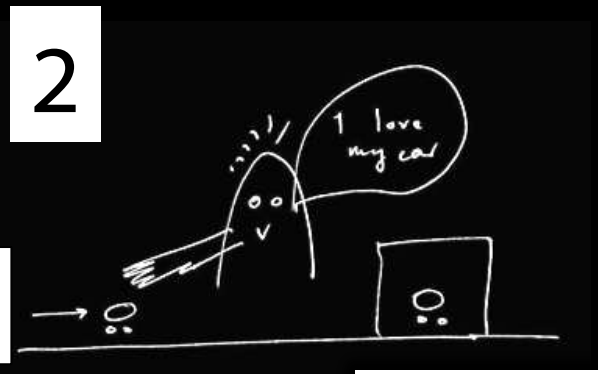
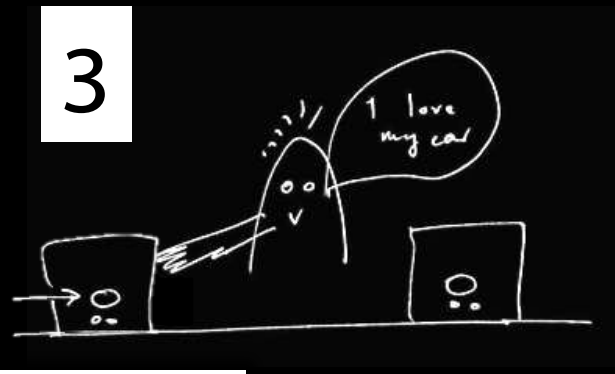
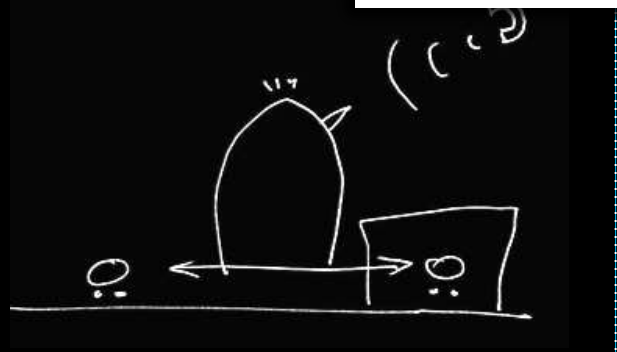
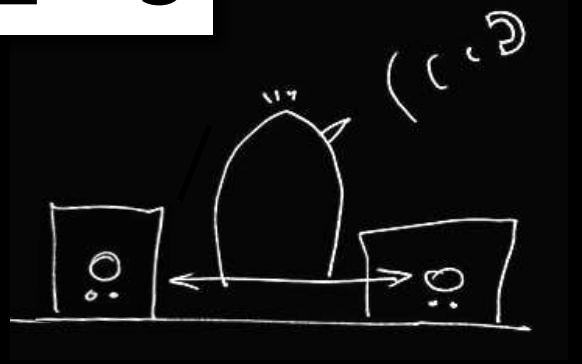
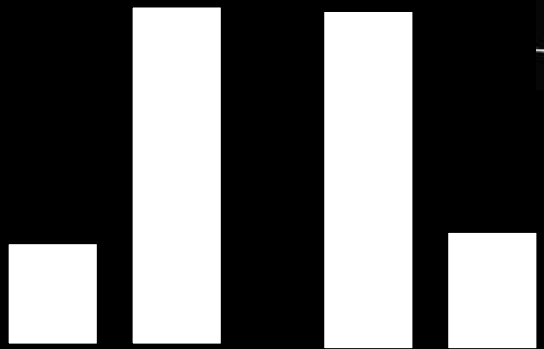




belief: $2 \approx 3$







left right

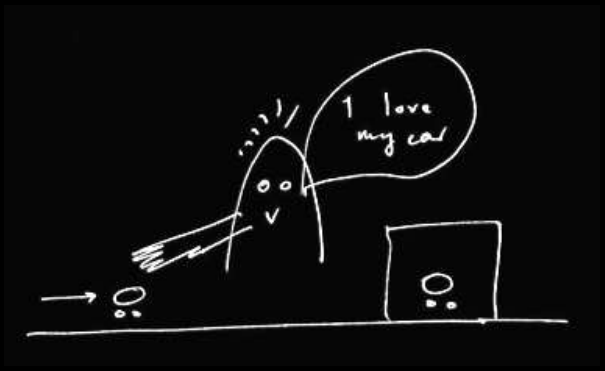
2

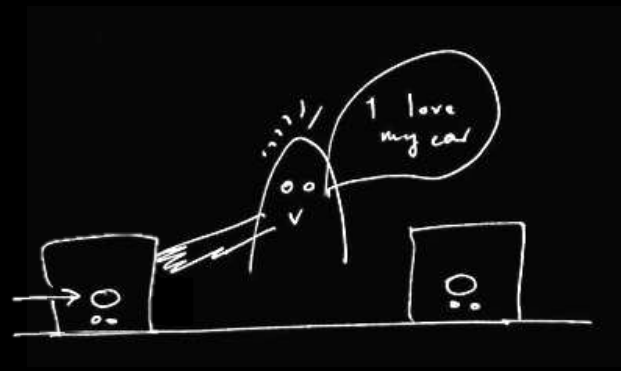
left right

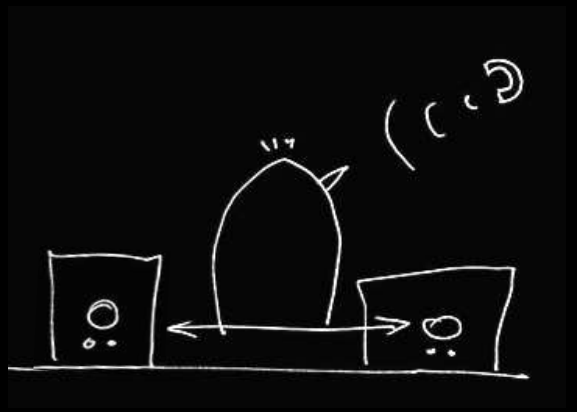
3

registration: $2 \not\approx 3$

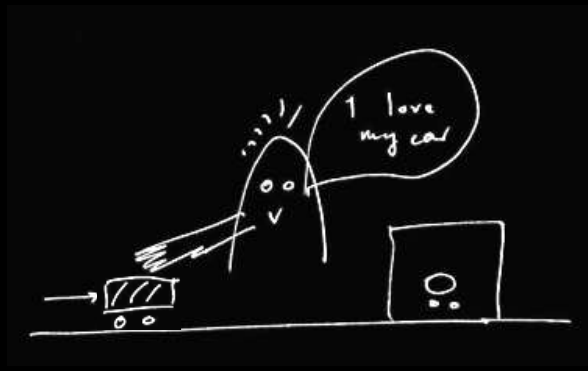
Rubio, Richardson & Butterfill

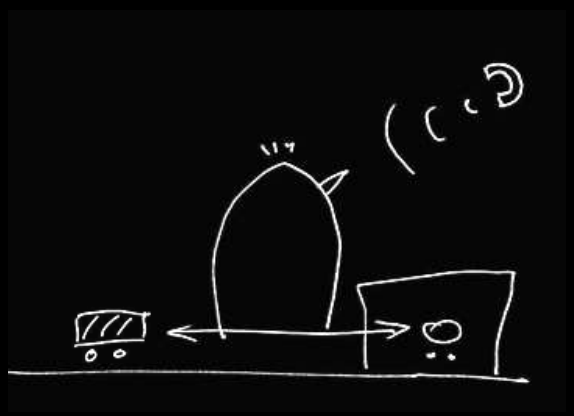


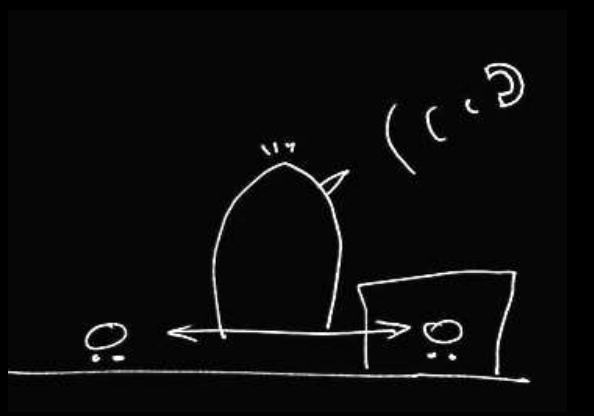


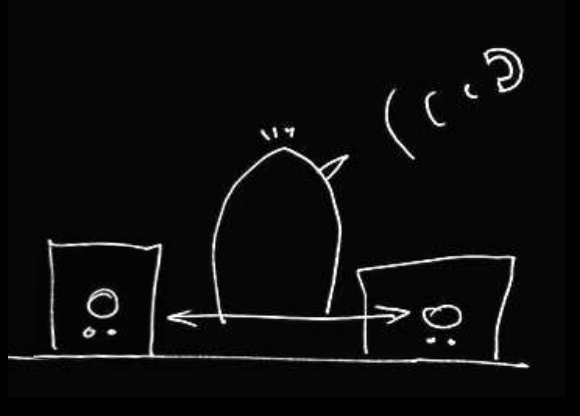


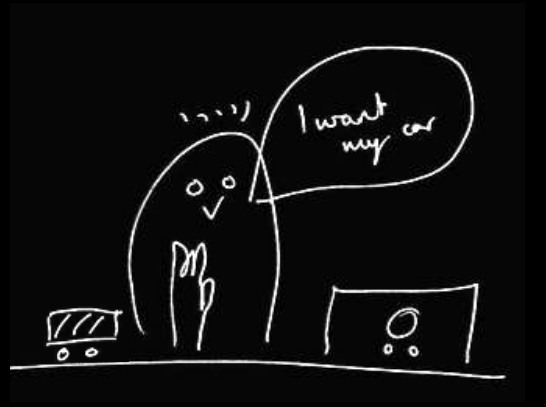
Rubio, Richardson & Butterfill



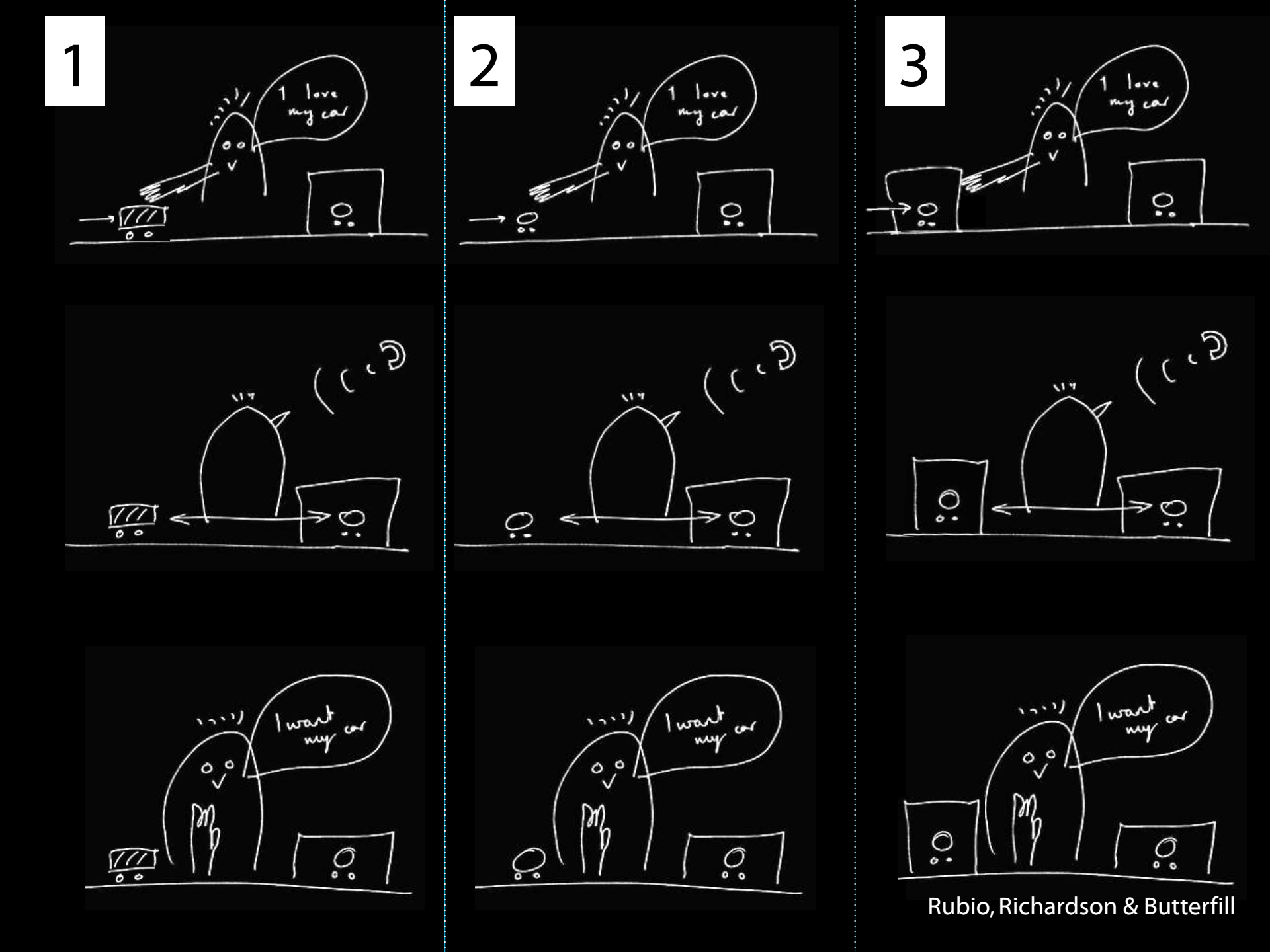




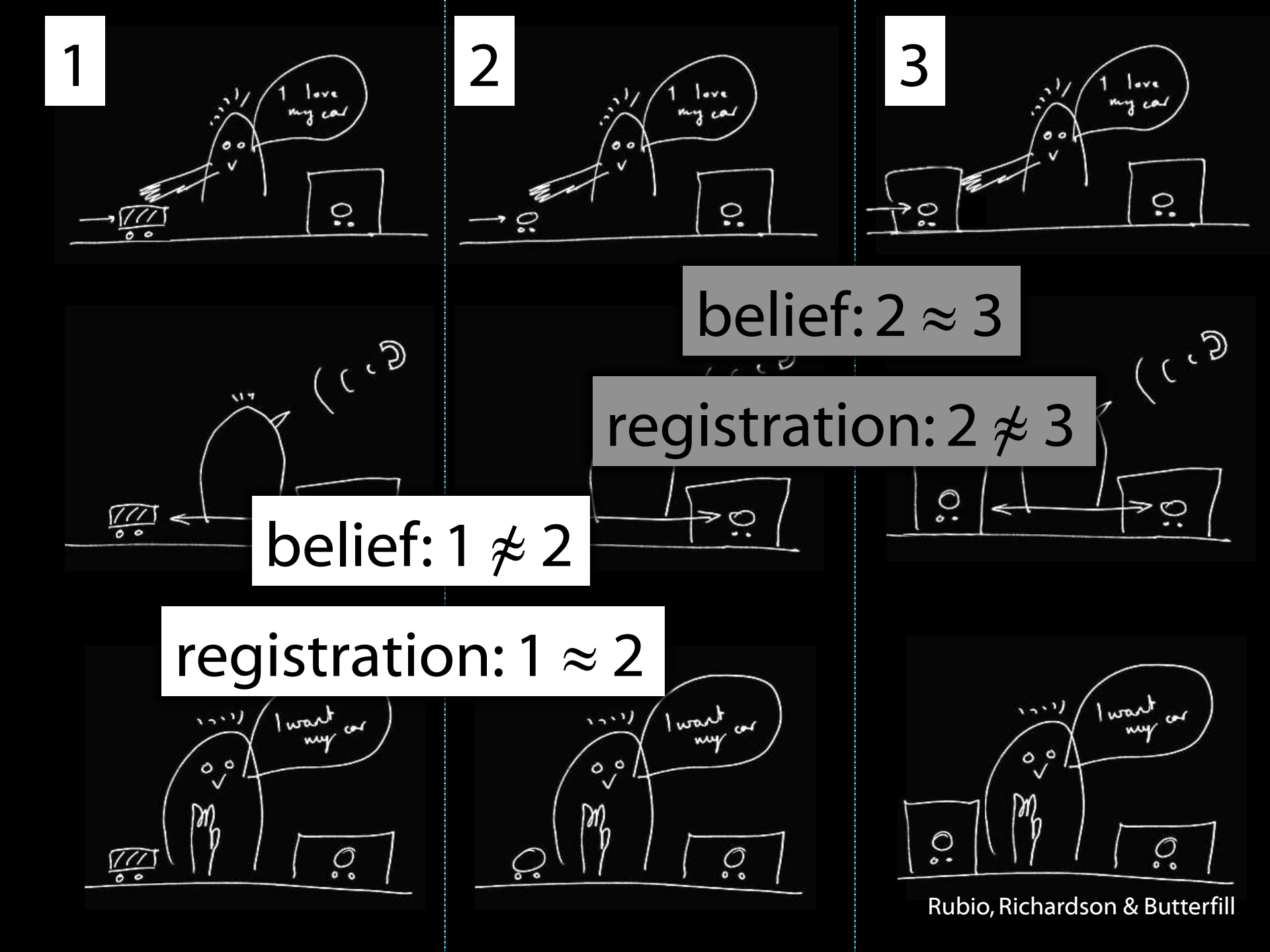




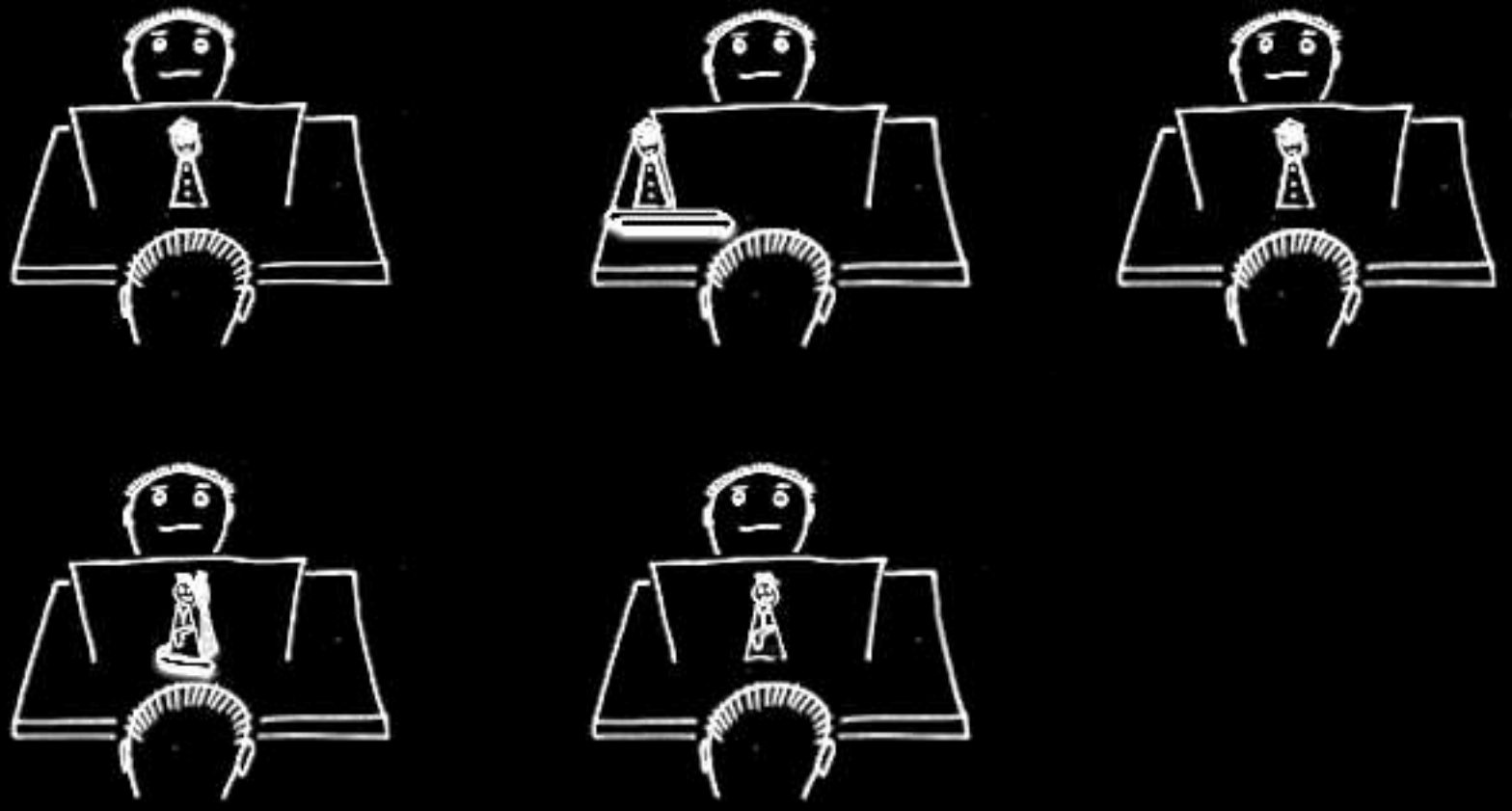
Rubio, Richardson & Butterfill

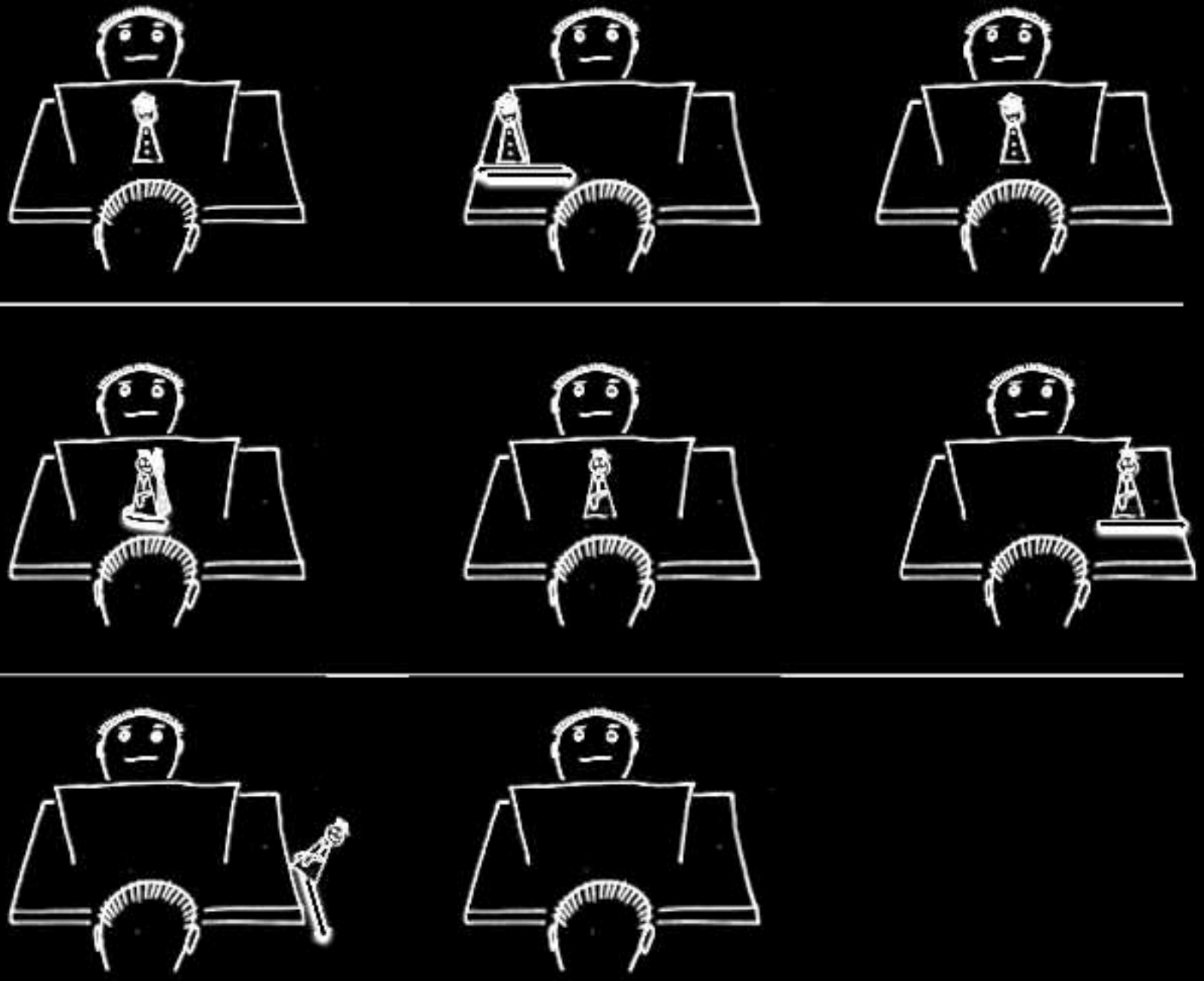


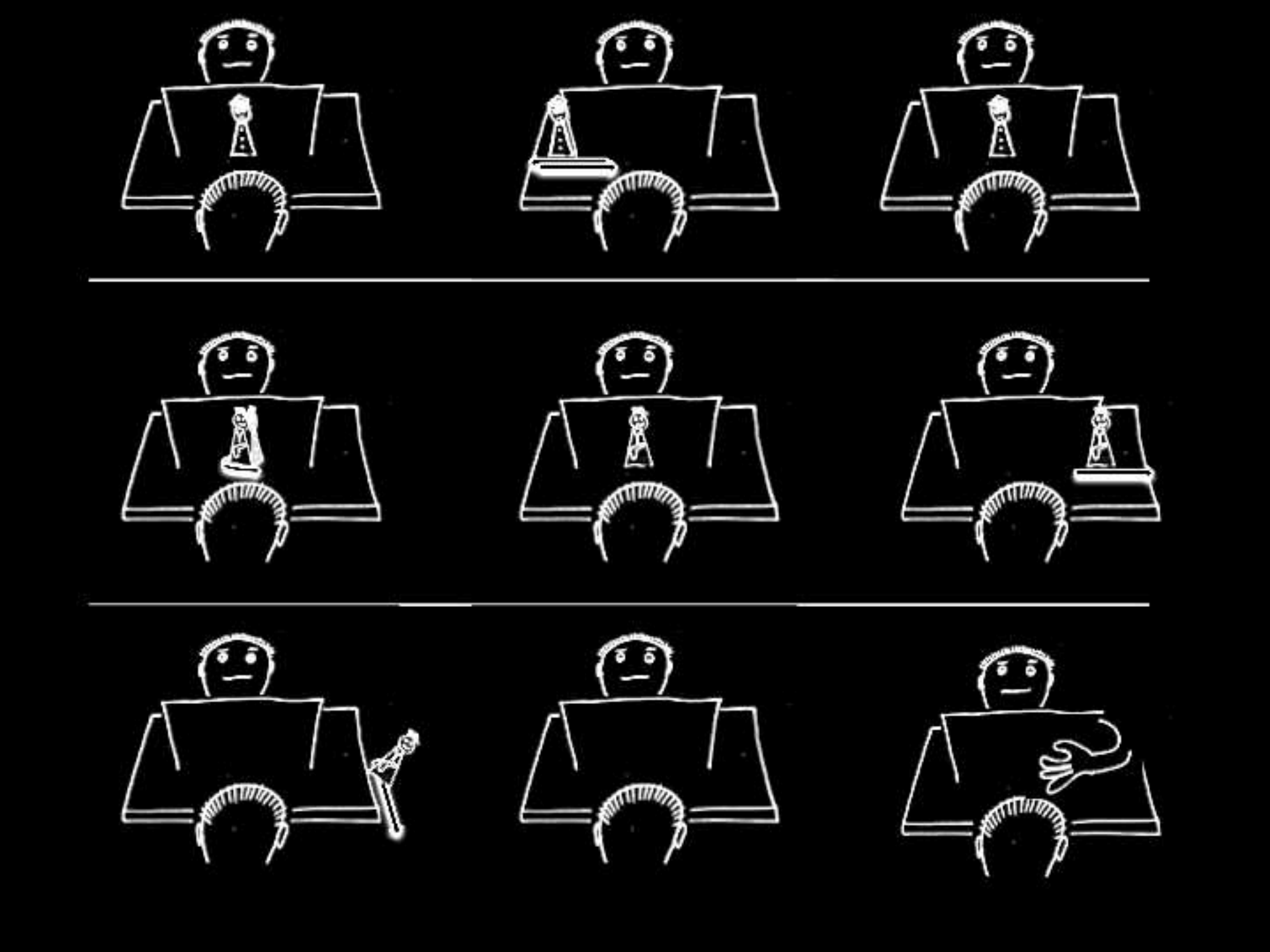
Rubio, Richardson & Butterfill


1
I love my car
2
I love my car
3
I love my car
belief: 2 ≈ 3
registration: 2 ≉ 3
belief: 1 ≉ 2
registration: 1 ≈ 2
I want my car
I want my car
I want my car
Rubio, Richardson & Butterfill

	False belief about location	False belief about identity
Subjects represent registration	*pass*	*fail*
Subjects represent beliefs	*pass*	*pass*







1. There are subjects who can pass A-tasks but cannot pass B-tasks.

2. These subjects' success on A-tasks is explained by the fact that they **can** represent (false) beliefs *using a simple measure in a modular process*

3. These subjects' failure on B-tasks is explained by the fact that they **cannot** represent (false) beliefs *using a sophisticated measure in a non-modular process*

challenge

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conjecture

The existence of abilities to engage in joint action partially explains how sophisticated forms of mindreading emerge in evolution or development (or both)

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