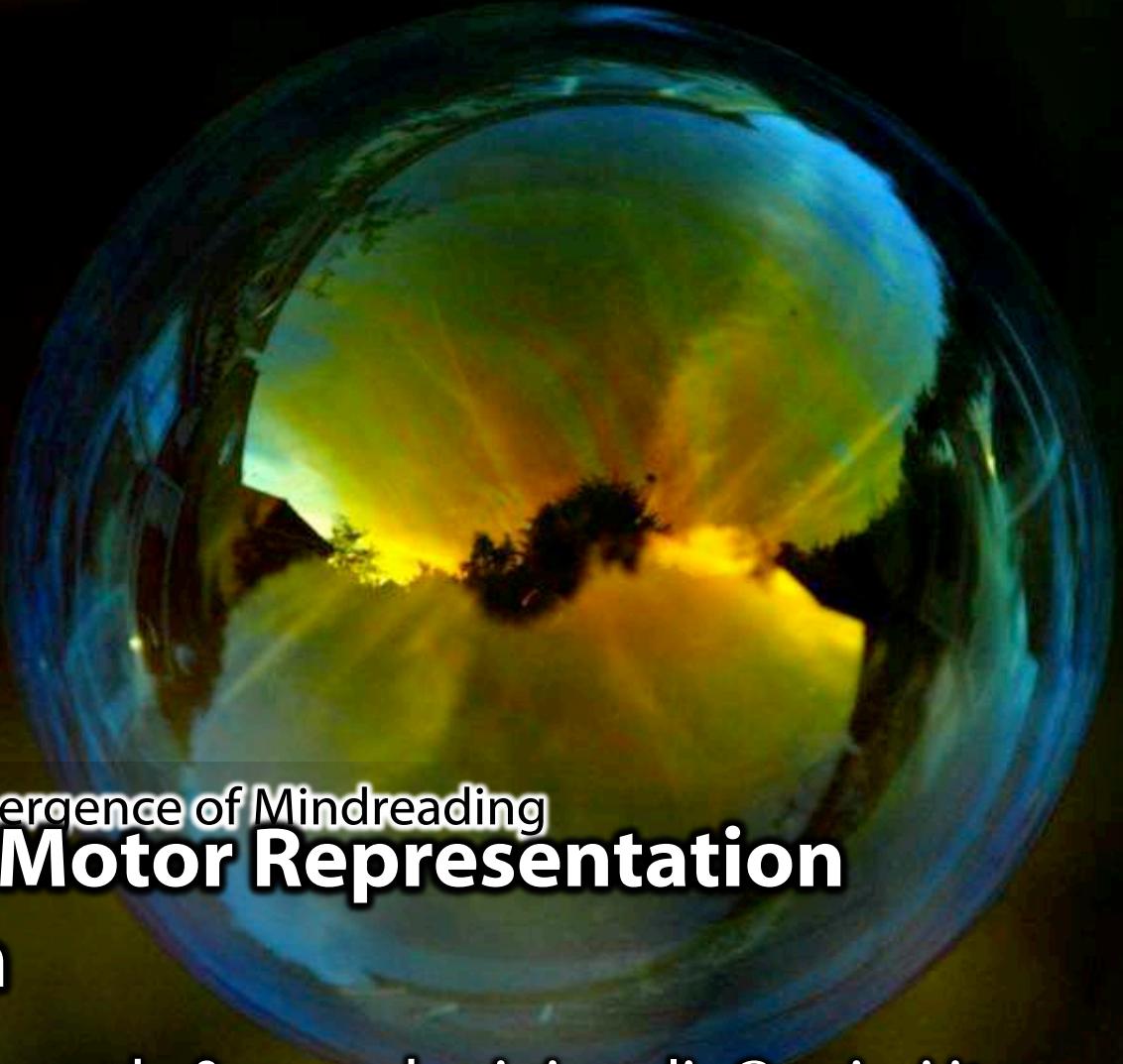


Joint Action and the Emergence of Mindreading
**Intention and Motor Representation
in Joint Action**

s.butterfill@warwick.ac.uk & corrado.sinigaglia@unimi.it

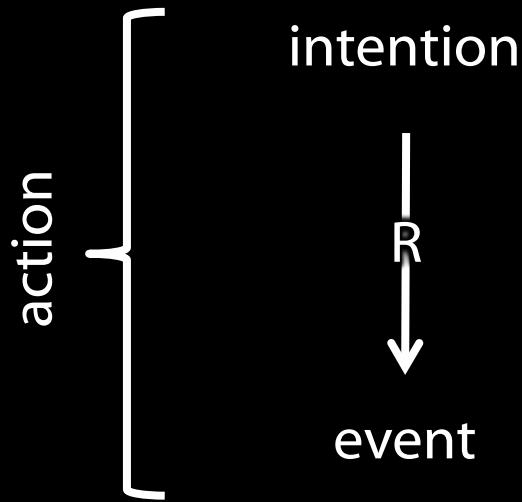


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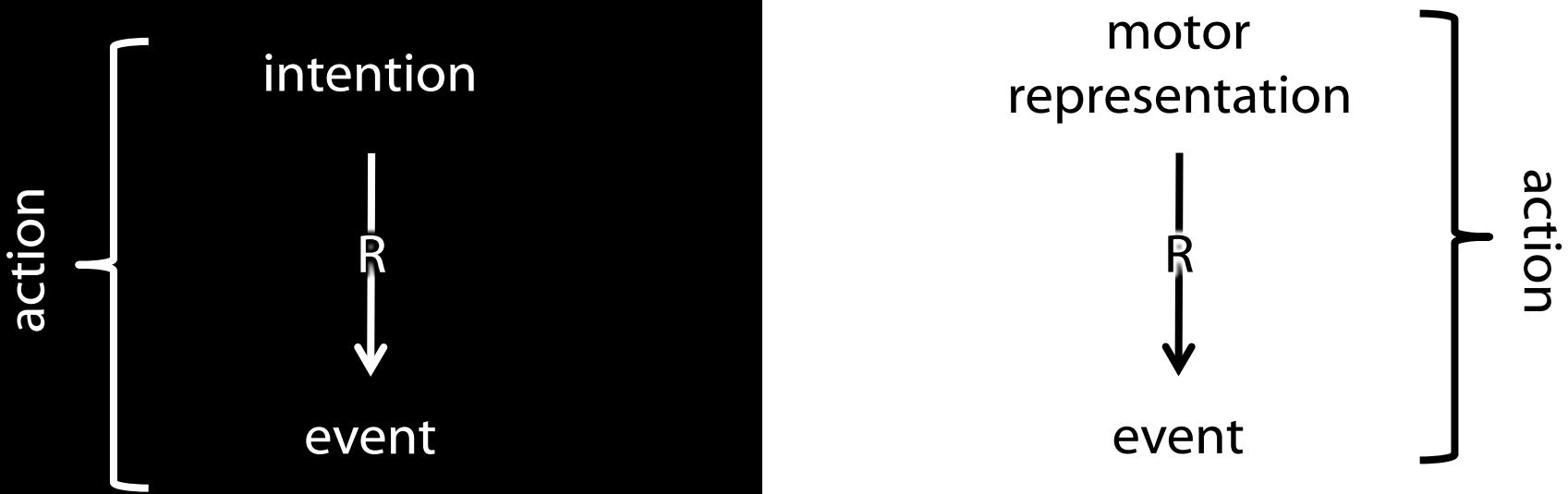
s.butterfill@warwick.ac.uk & corrado.sinigaglia@unimi.it

Which events are actions?

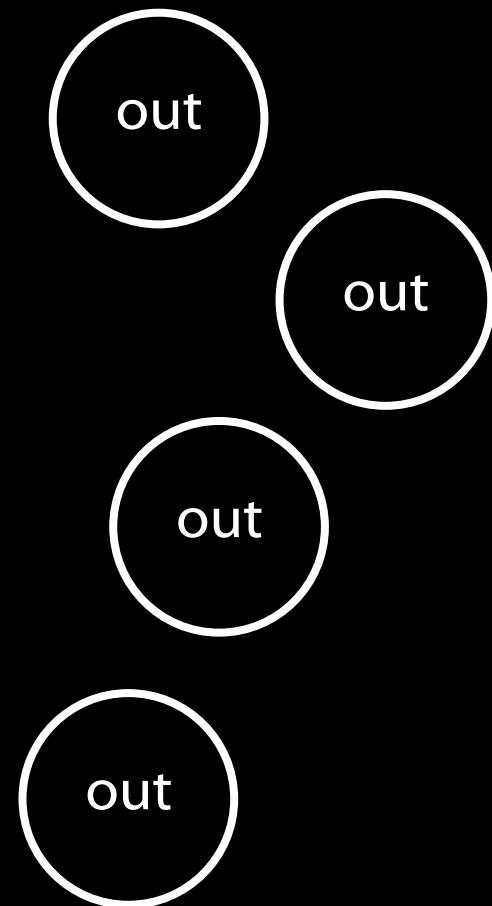
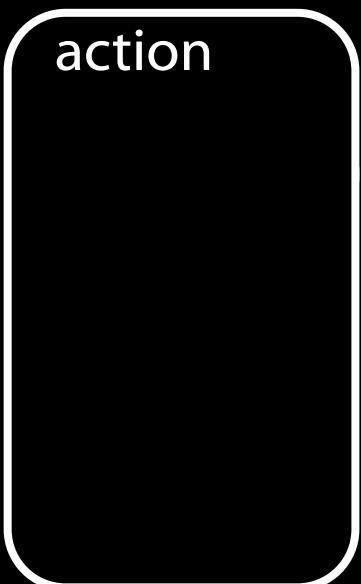
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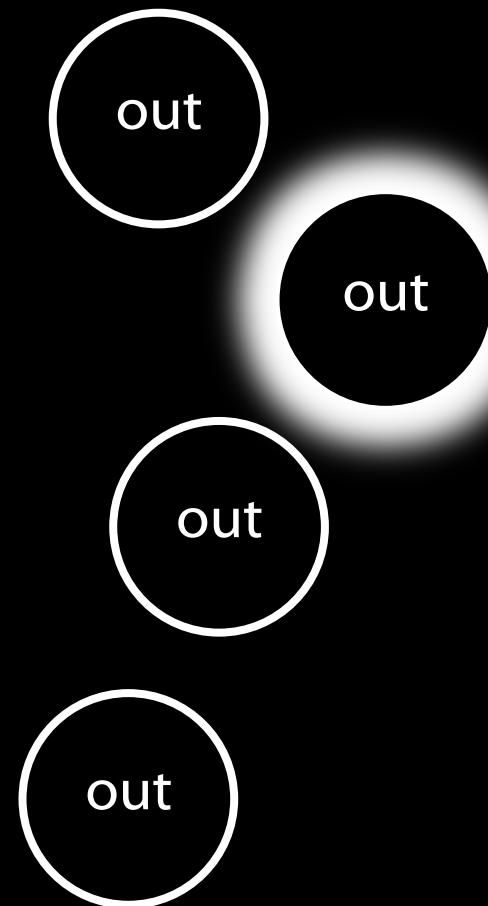
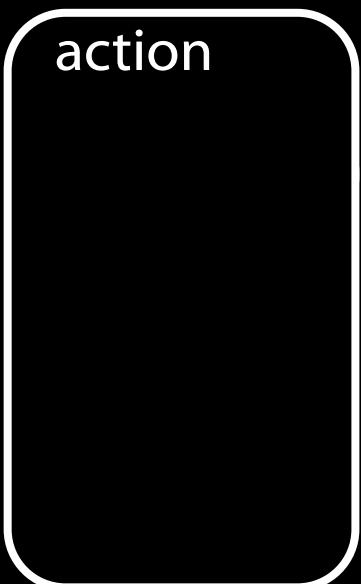
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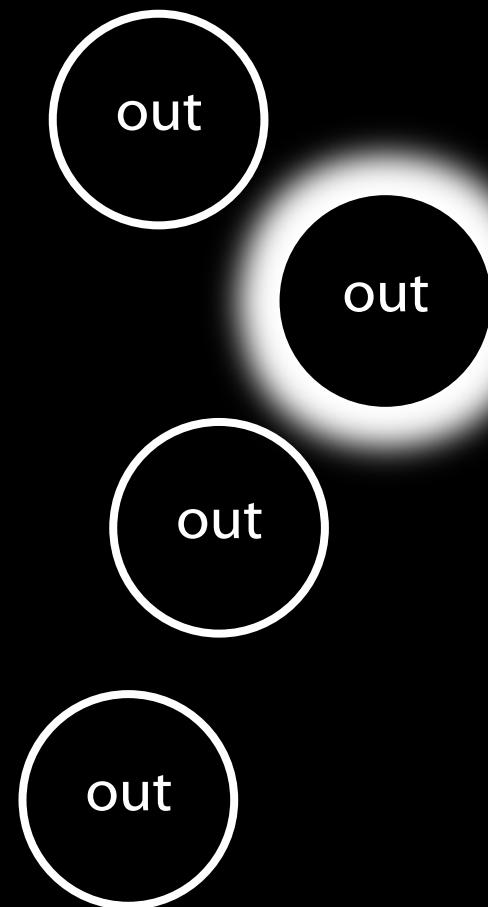
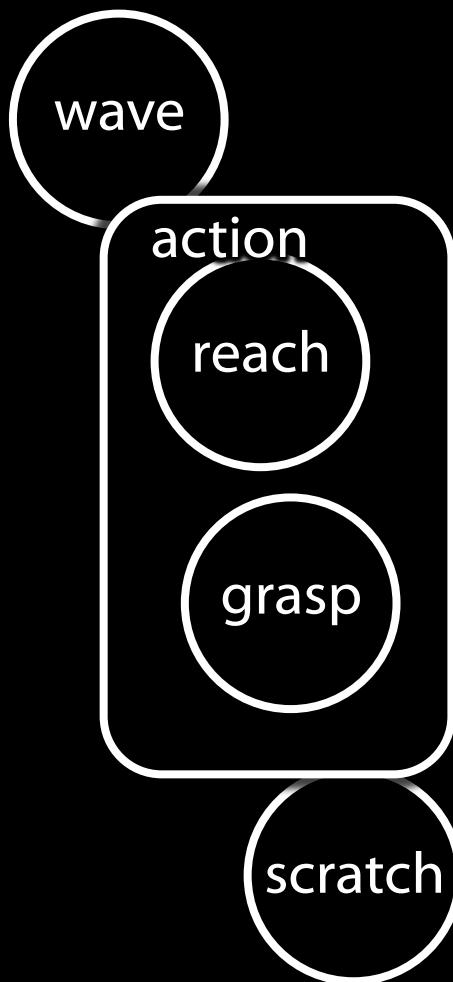
What is the relation between a purposive action and the outcome or outcomes to which it is directed?



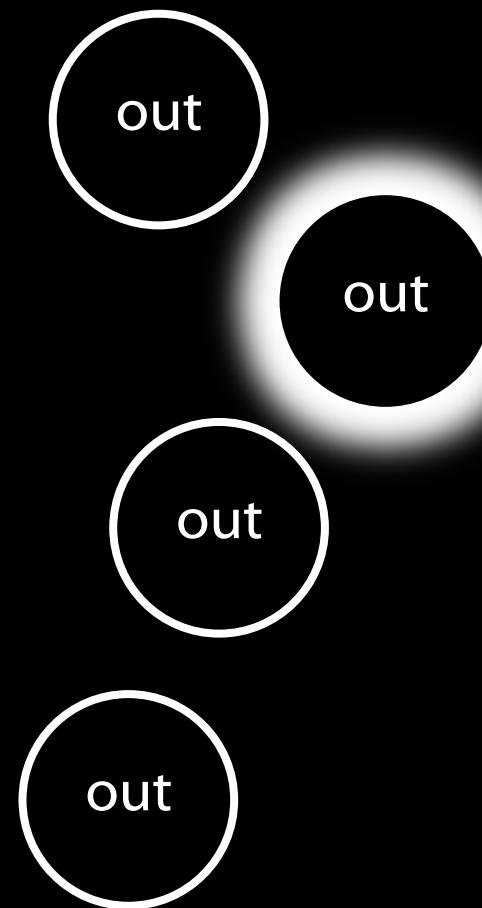
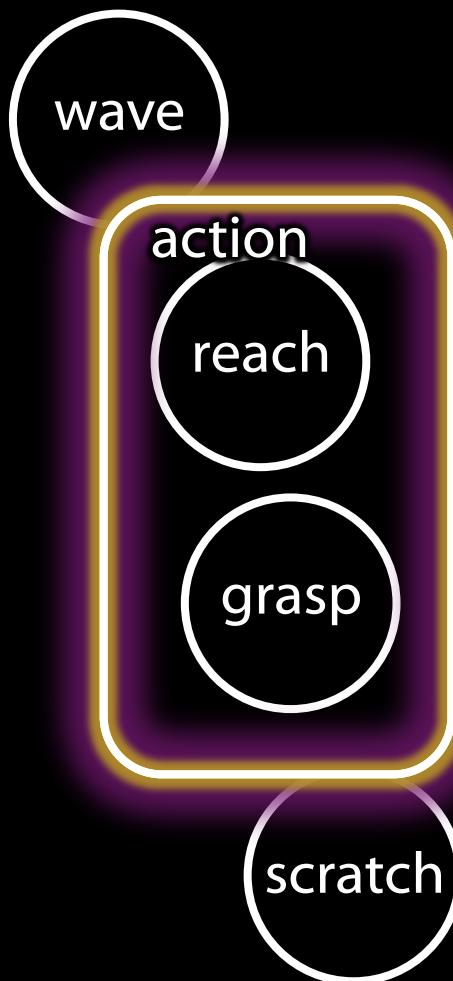
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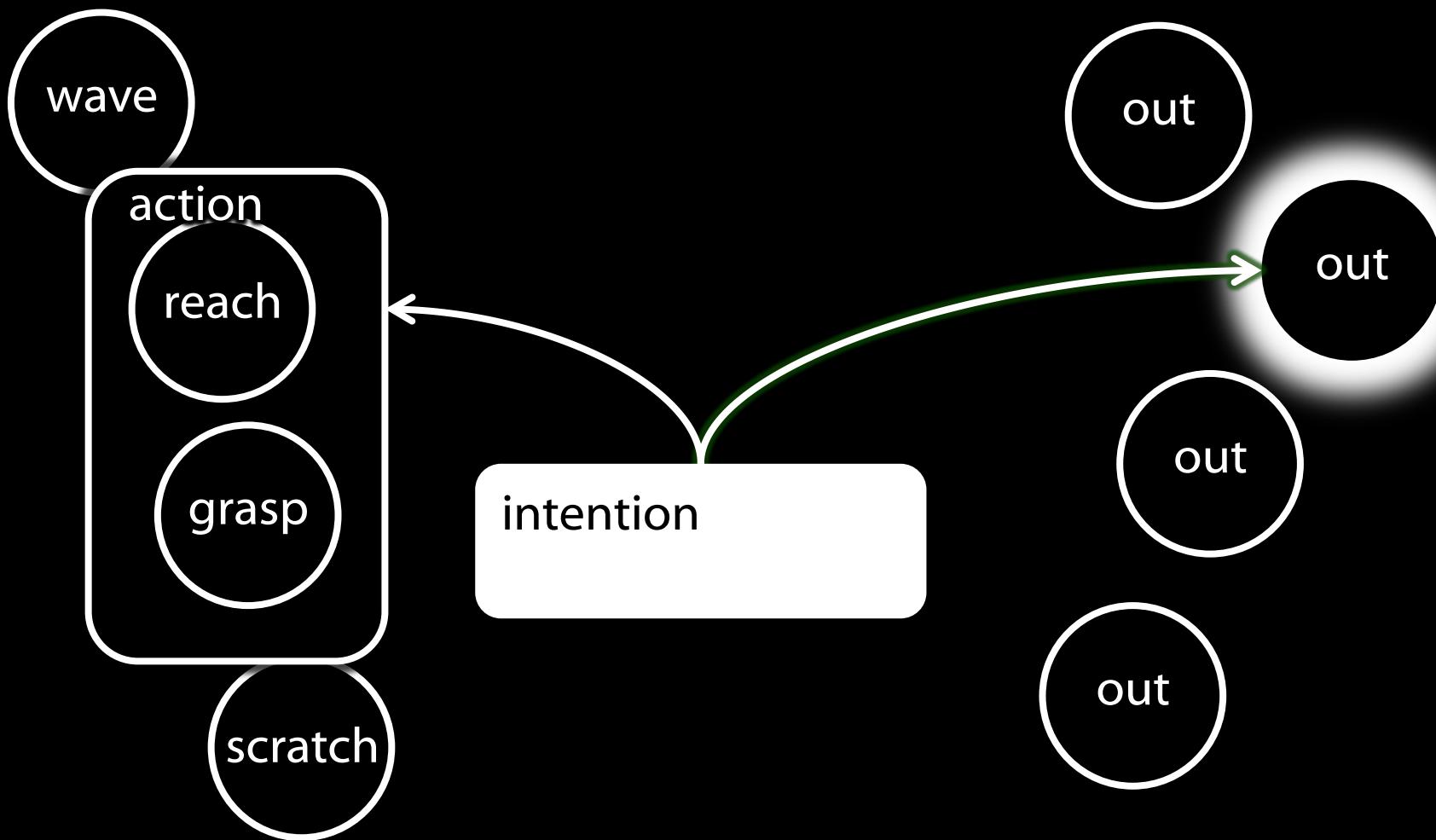
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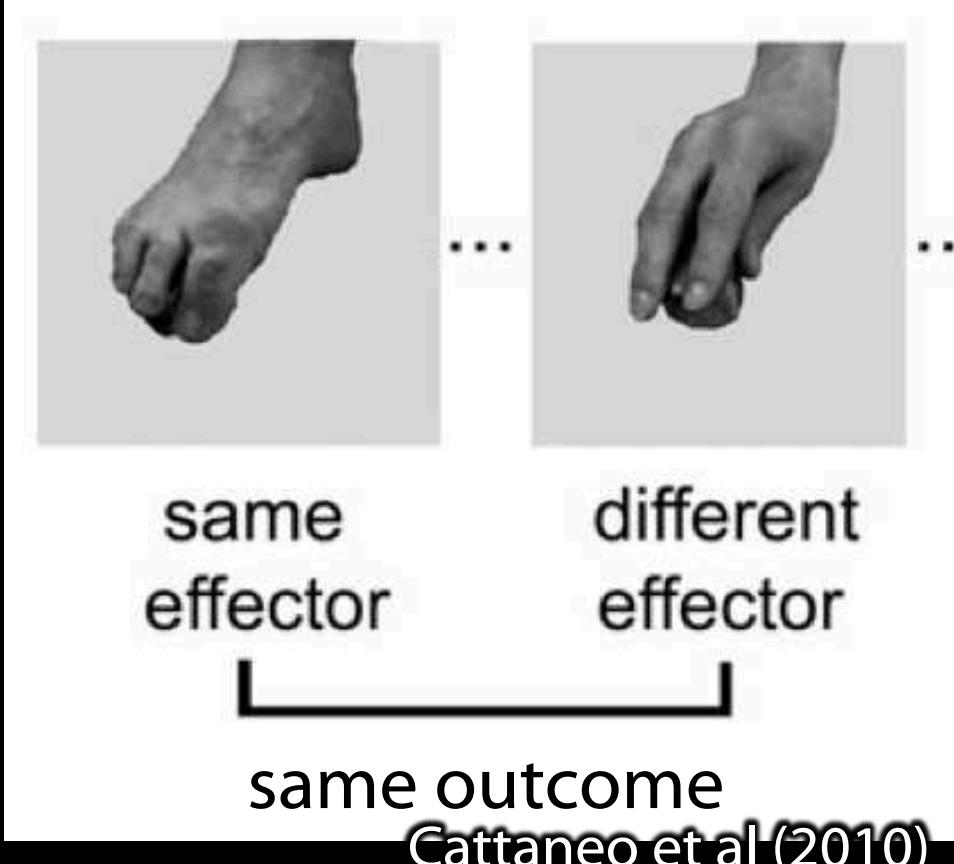


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Some motor representations carry information about outcomes.

Some motor representations carry information about outcomes.



Some motor representations carry information about outcomes.



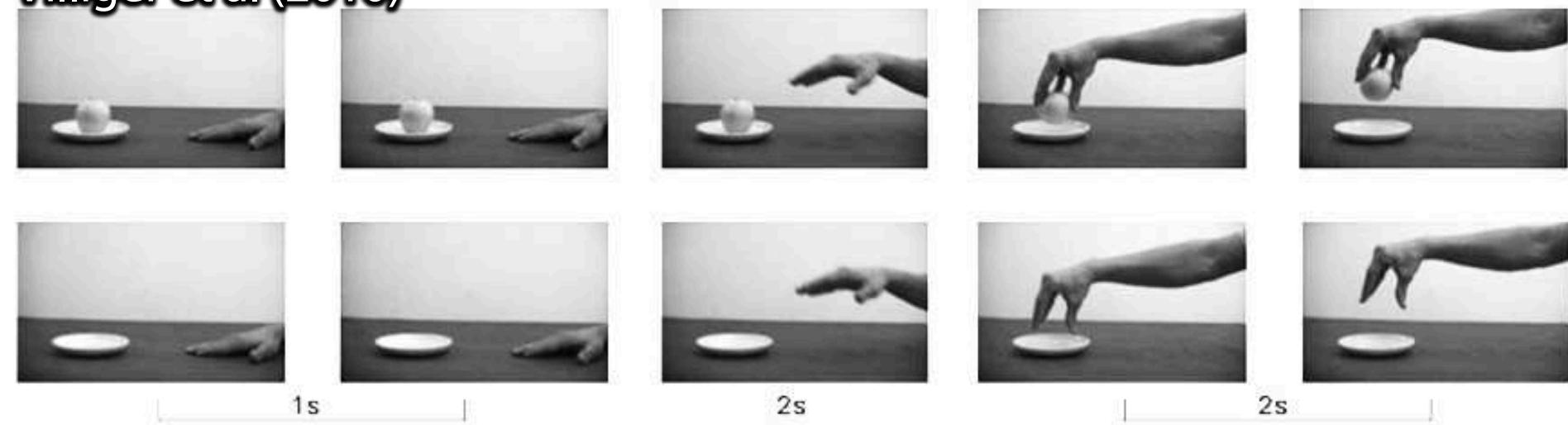
same
effector

different
effector

same outcome

Cattaneo et al (2010)

Villiger et.al.(2010)



Some motor representations carry information about outcomes.



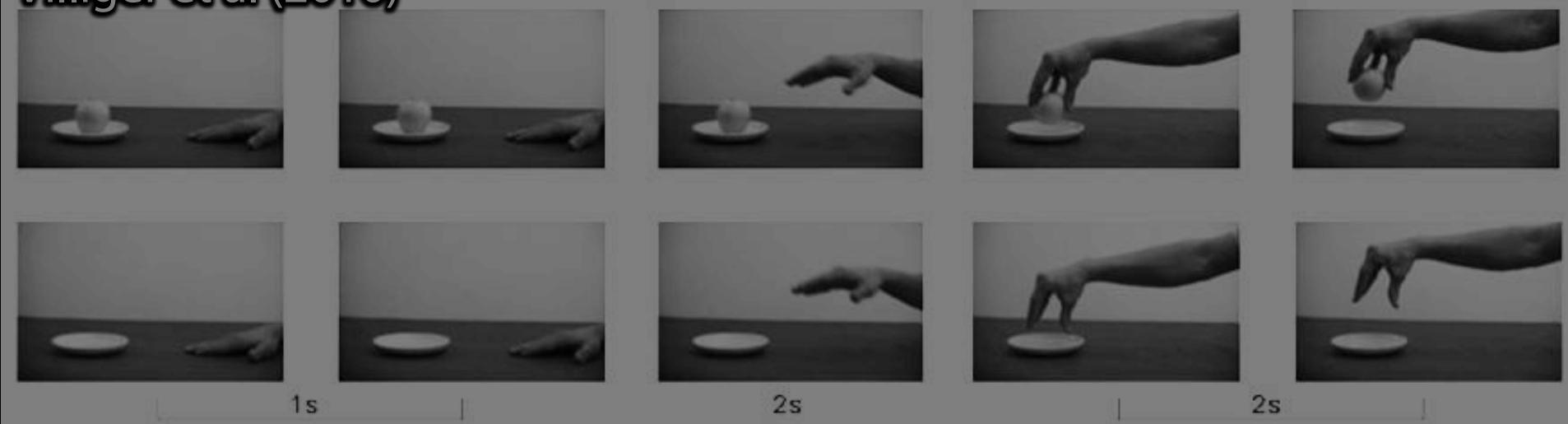
same
effector

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Cattaneo et al (2010)

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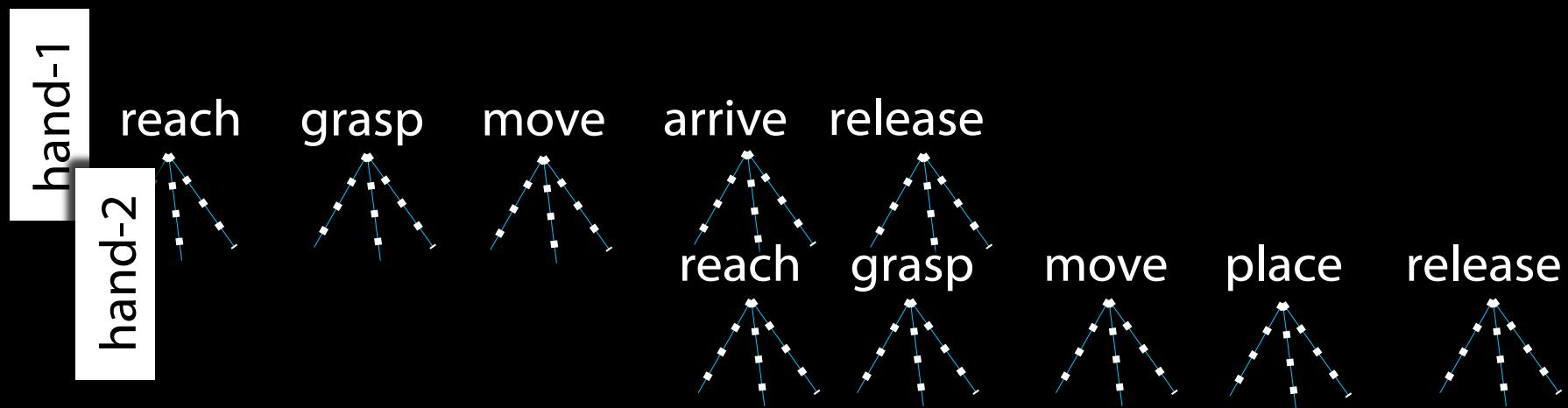


Some motor representations carry information about outcomes.

Information about outcomes guides planning.

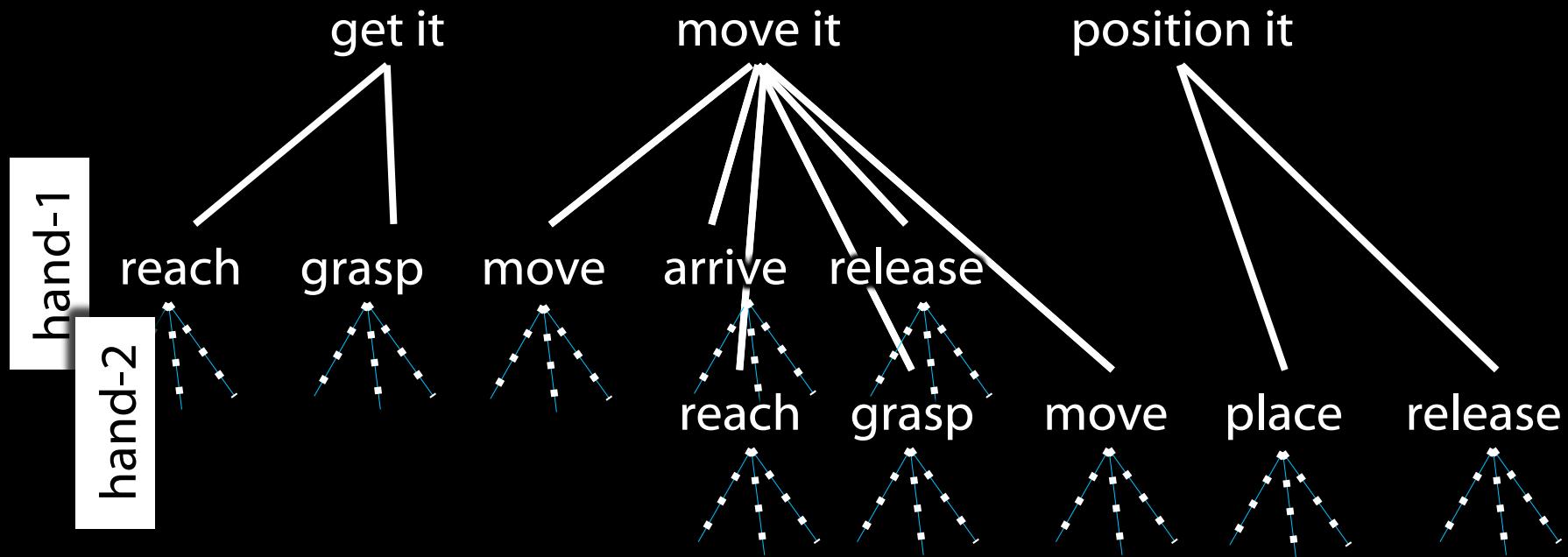
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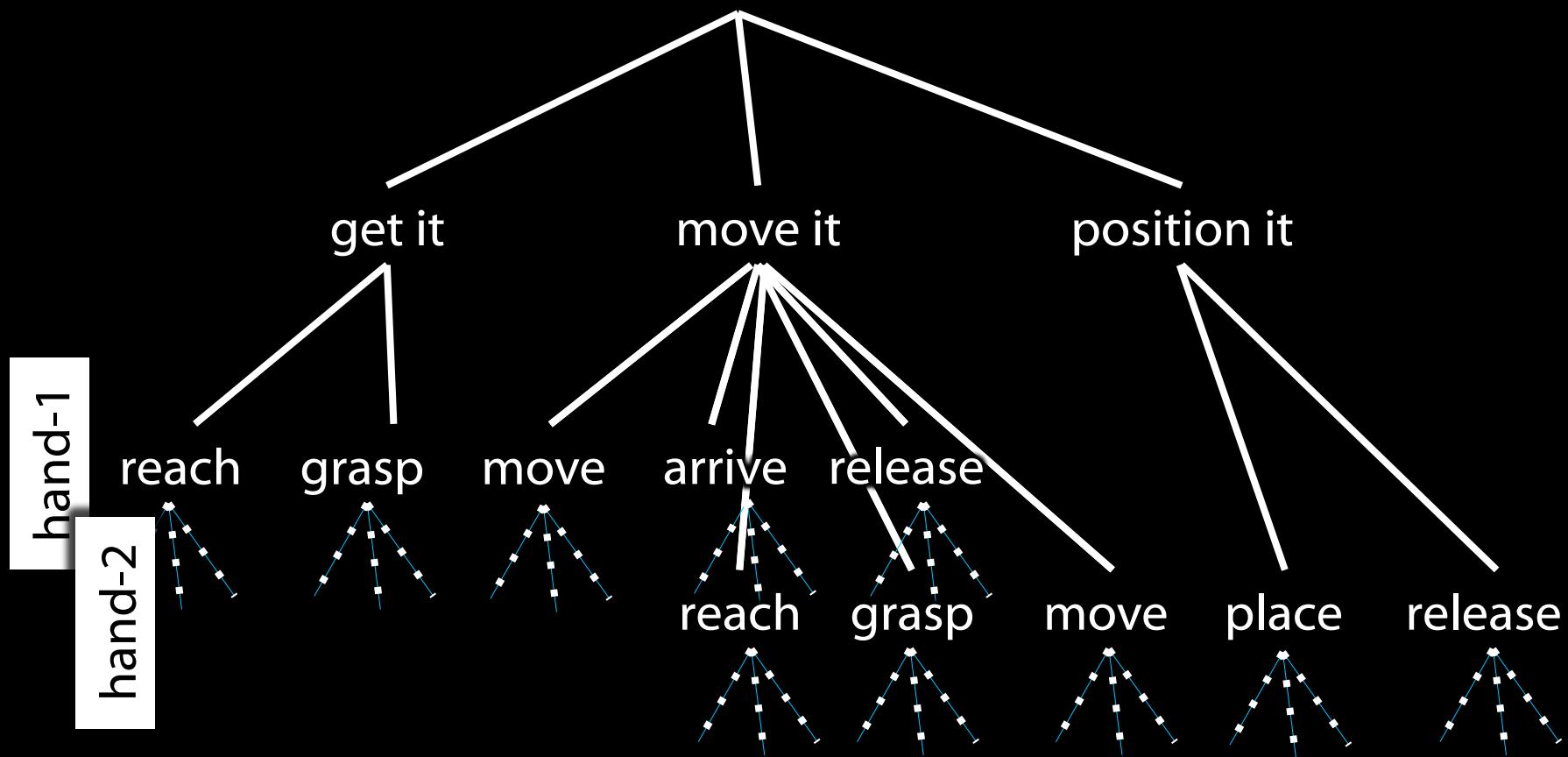
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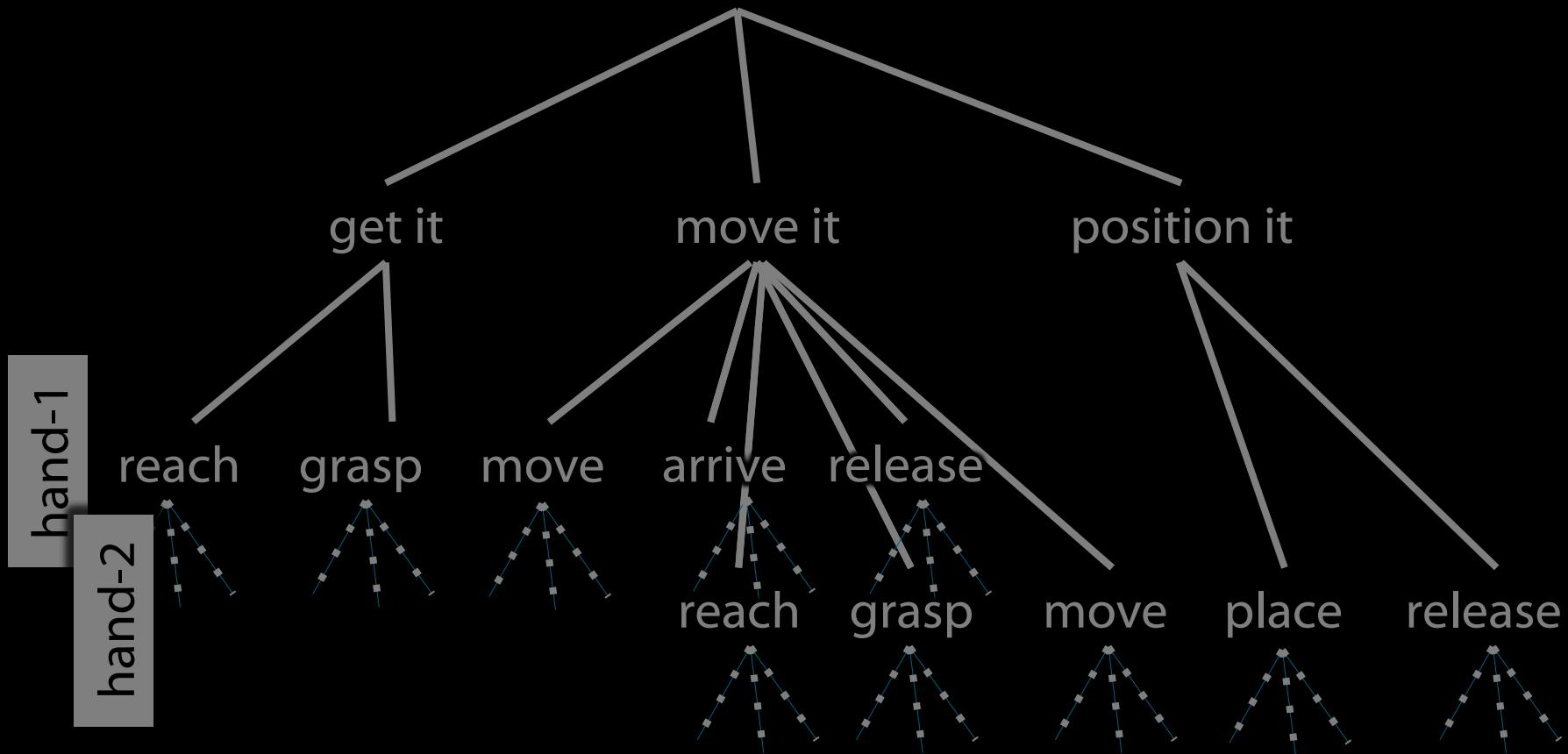
Move it from there to here



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Move it from there to here

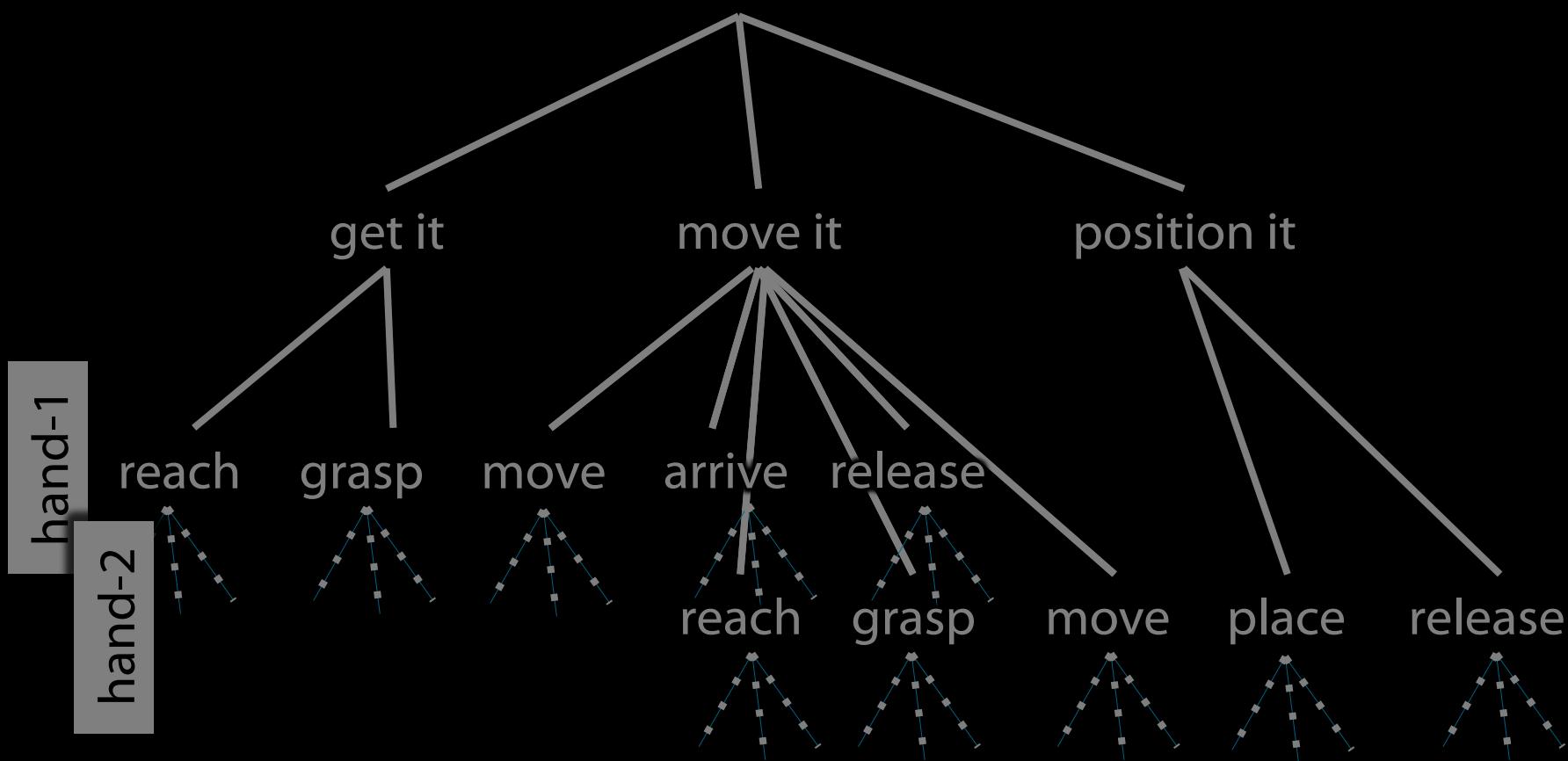


Some motor representations carry information about outcomes.

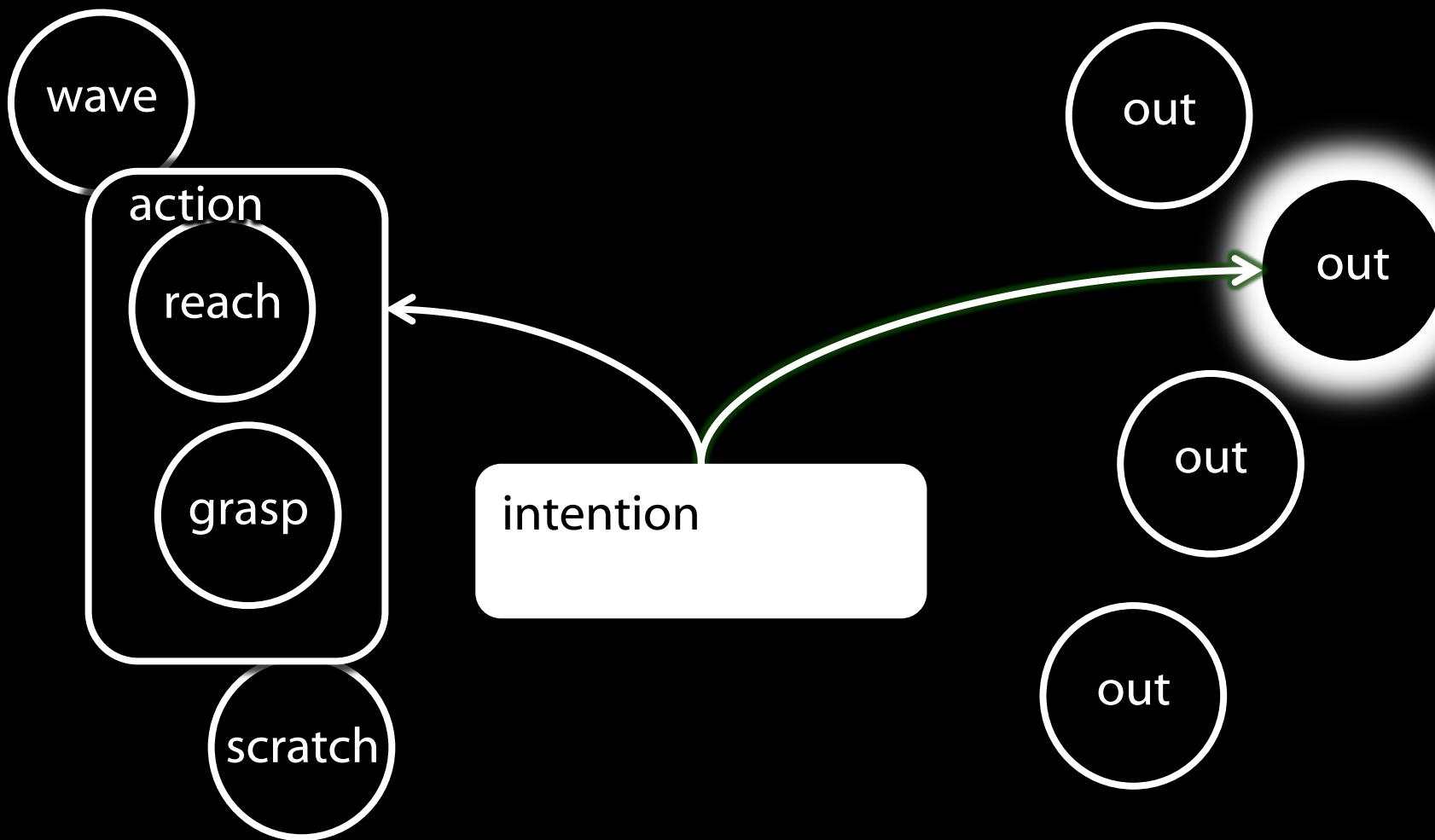
Information about outcomes guides planning.

Some motor representations represent outcomes

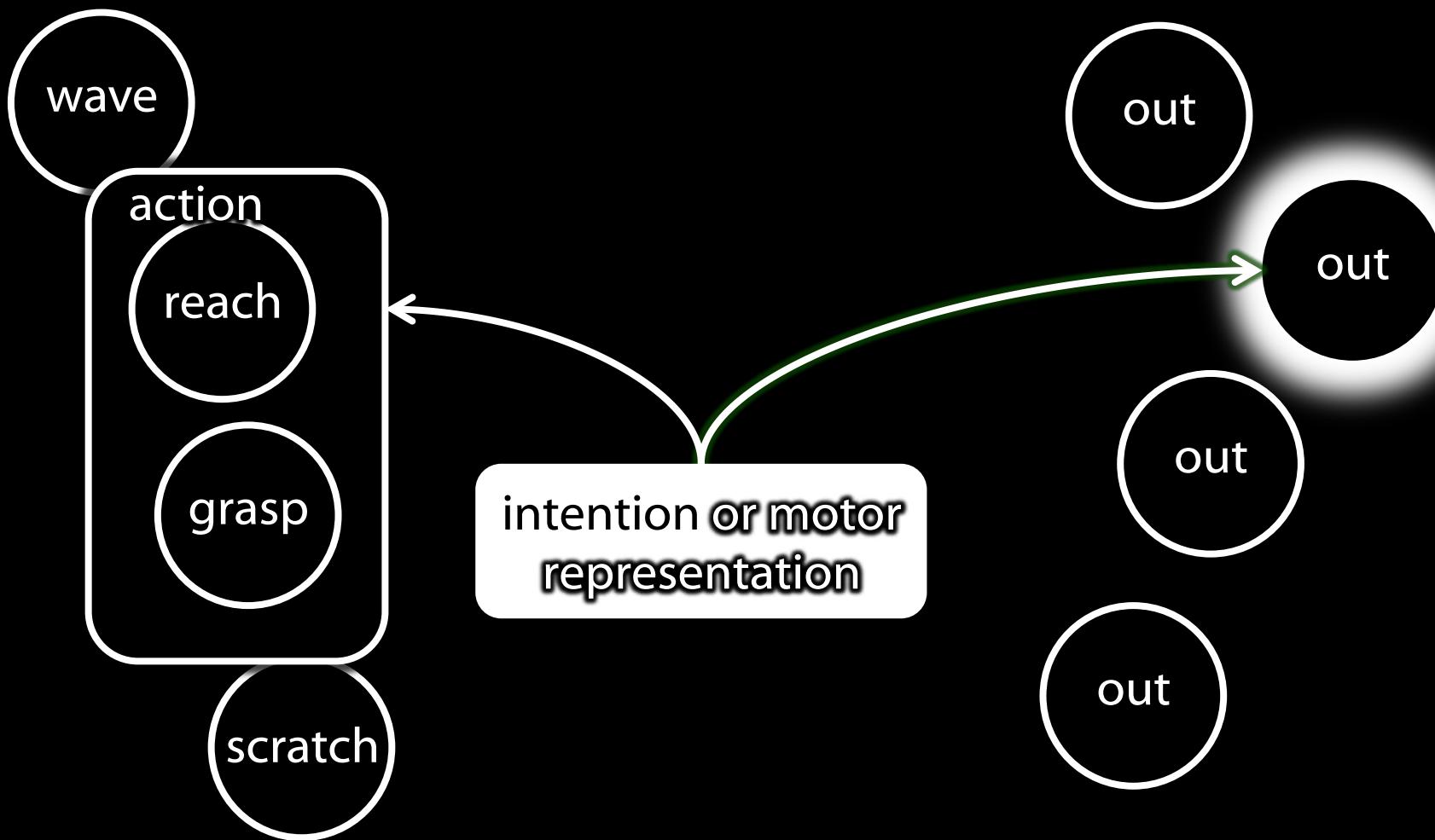
Move it from there to here

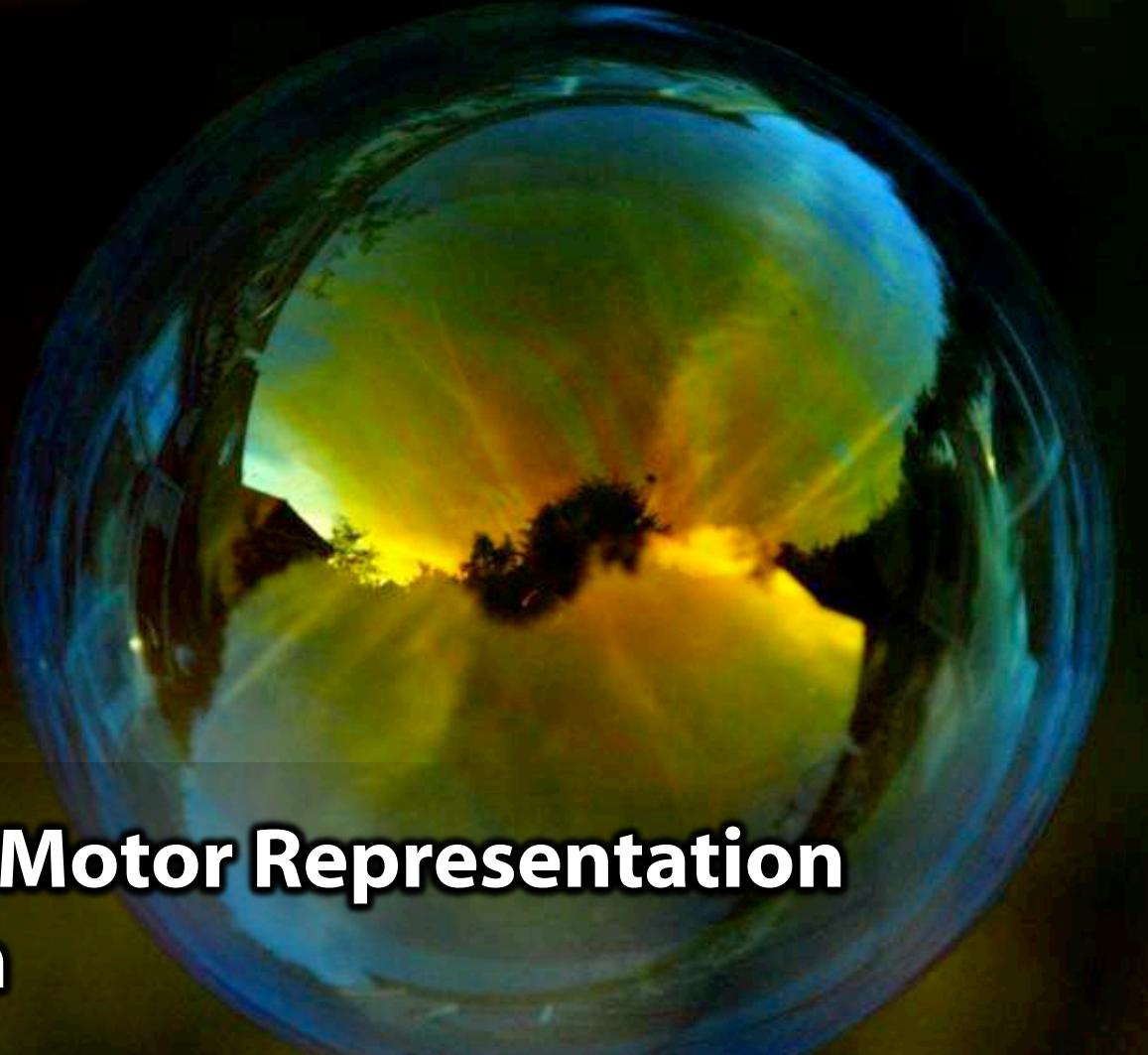


What is the relation between a purposive action and the outcome or outcomes to which it is directed?



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Intention and Motor Representation in Joint Action

s.butterfill@warwick.ac.uk & corrado.sinigaglia@unimi.it

premise:

Reciprocal agent-neutral motor representation
enables some joint actions

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Reciprocal **agent-neutral** motor representation
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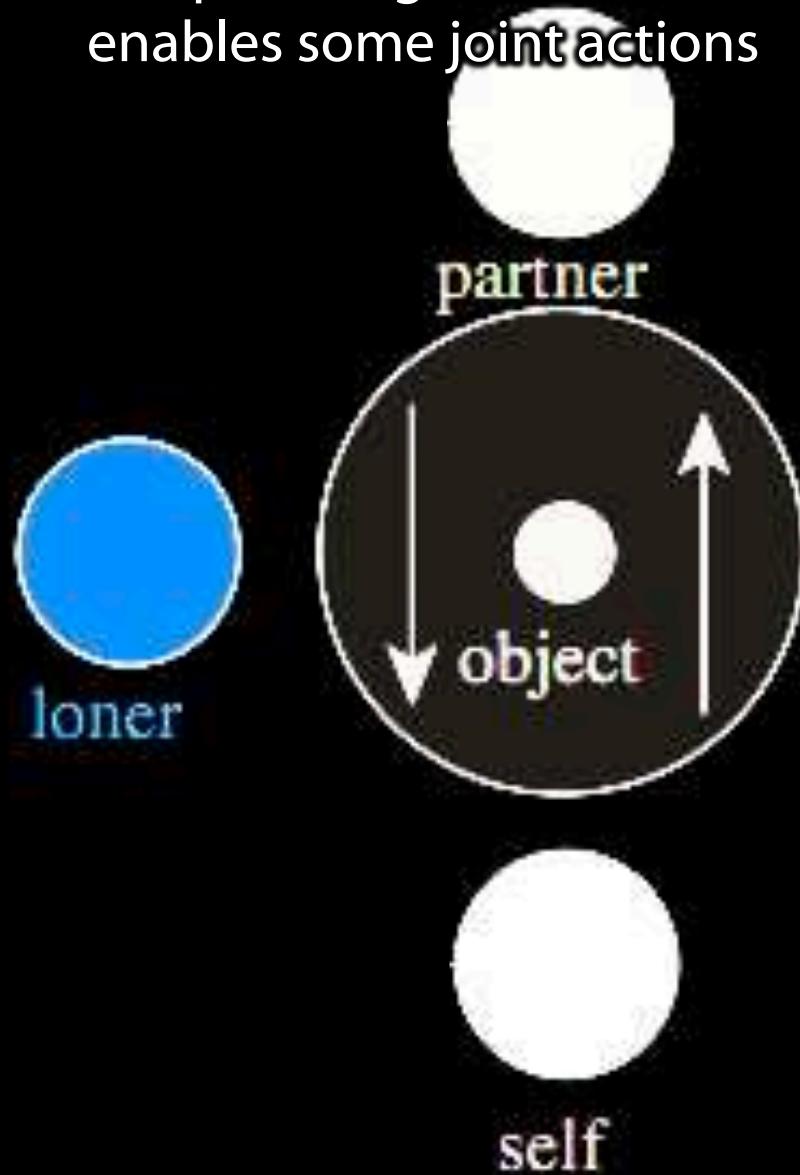
“Simulation of another person’s action, as reflected
in the activation of motor cortices, gets stronger the
more the other is perceived as an interaction
partner.”

--- Kourtis, Sebanz & Knoblich (2010, p. 4)



premise:

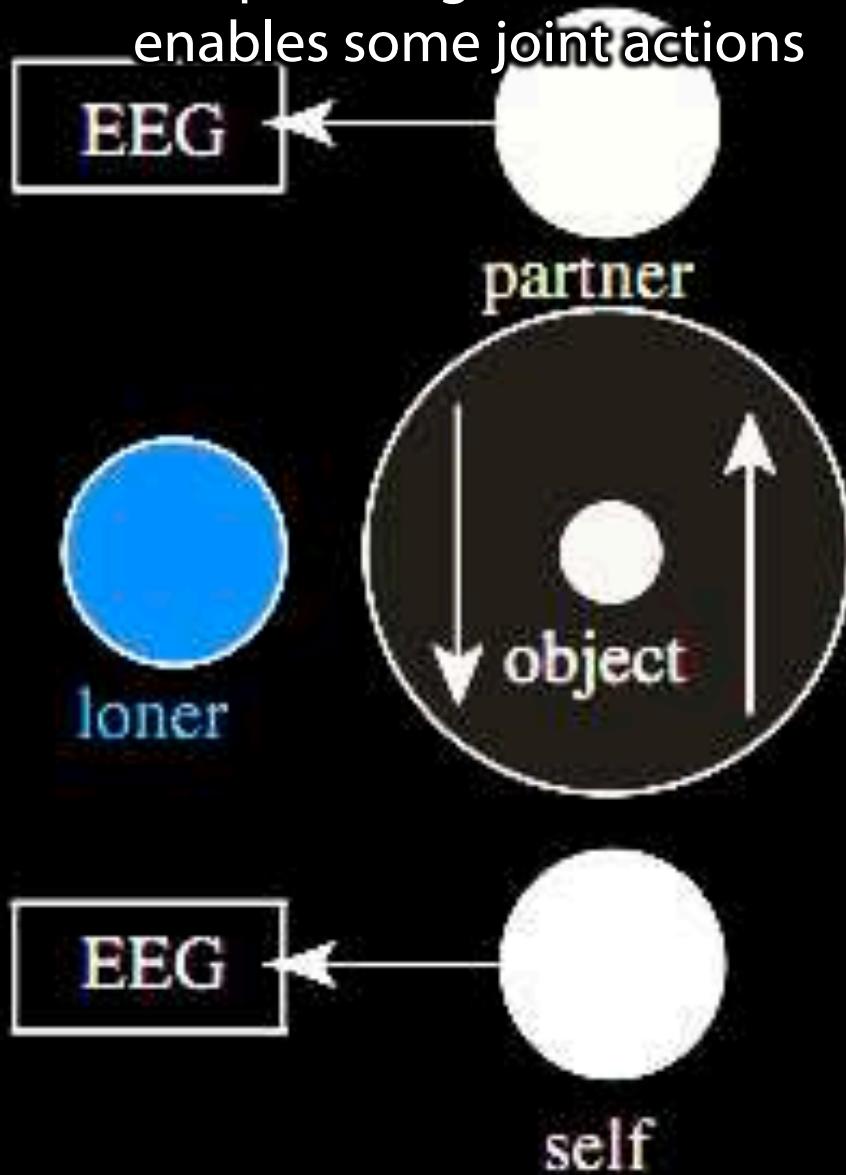
Reciprocal agent-neutral motor representation
enables some joint actions



Kourtis, Sebanz & Knoblich (2010)

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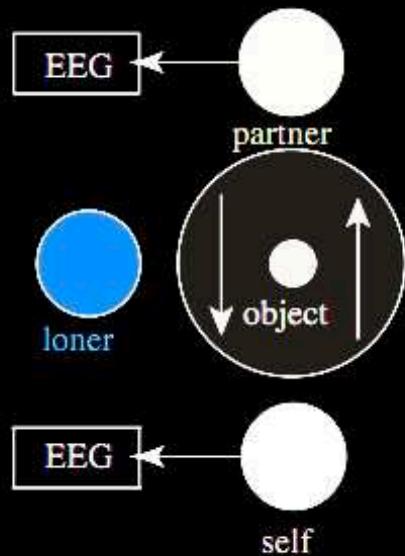


Kourtis, Sebanz & Knoblich (2010)

premise:

Reciprocal agent-neutral motor representation
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(a)



Kourtis, Sebanz & Knoblich (2010)

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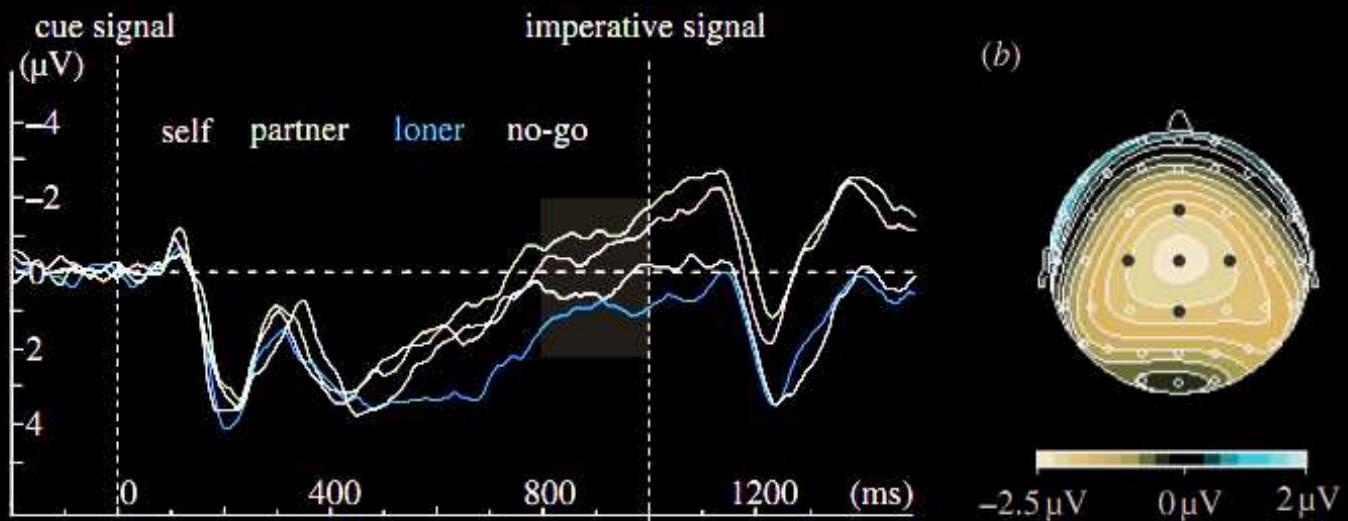
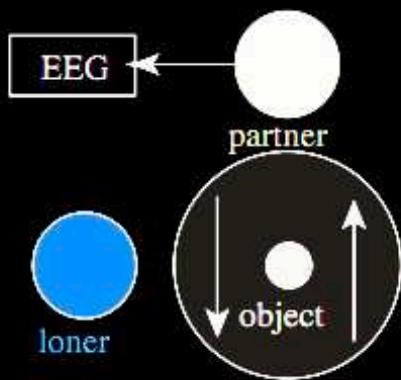
Reciprocal agent-neutral motor representation enables some joint actions



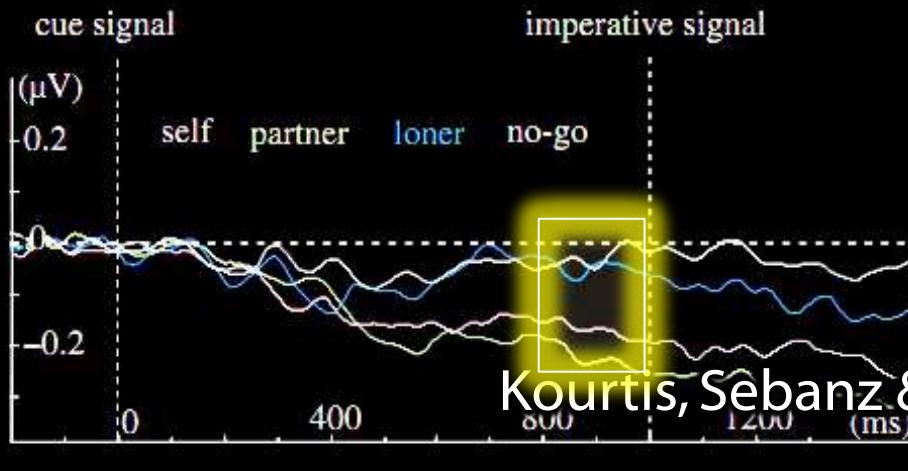
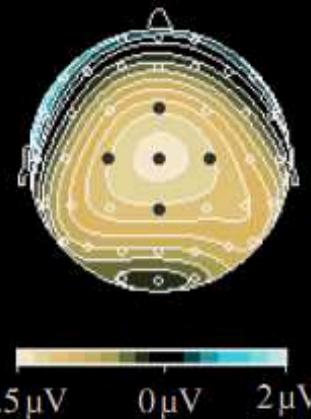
premise:

Reciprocal agent-neutral motor representation
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(a)



(b)



(c)

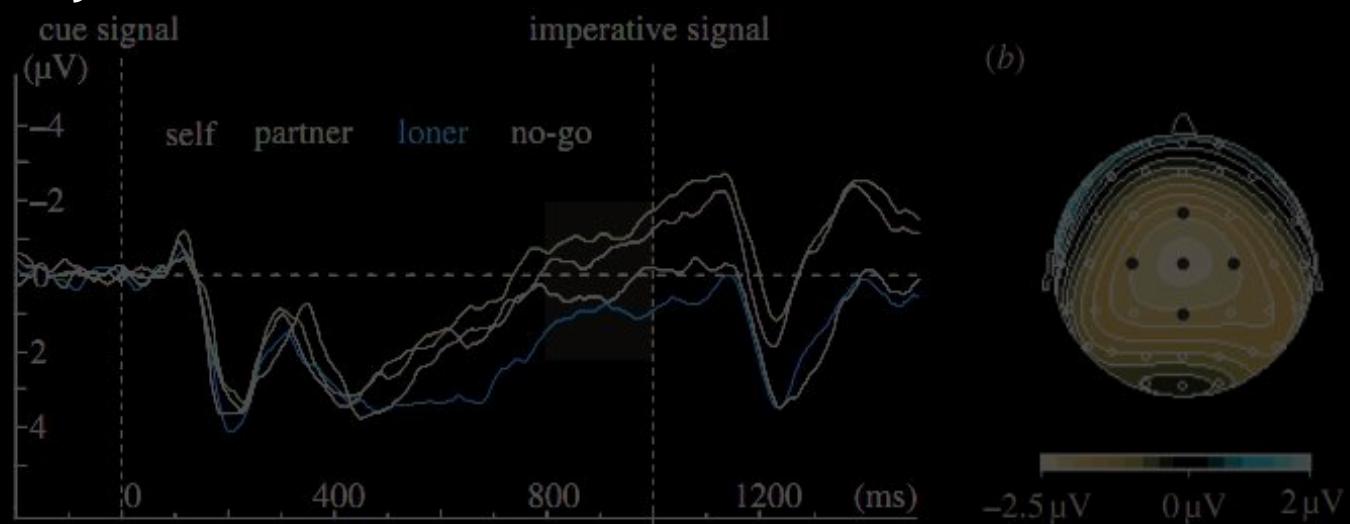
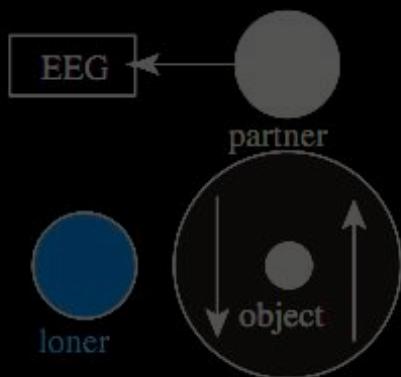


Kourtis, Sebanz & Knoblich (2010)

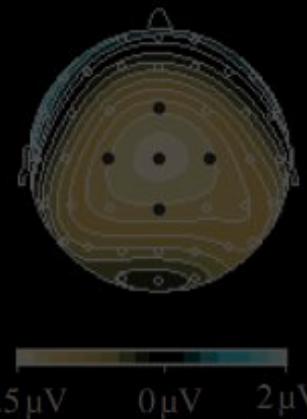
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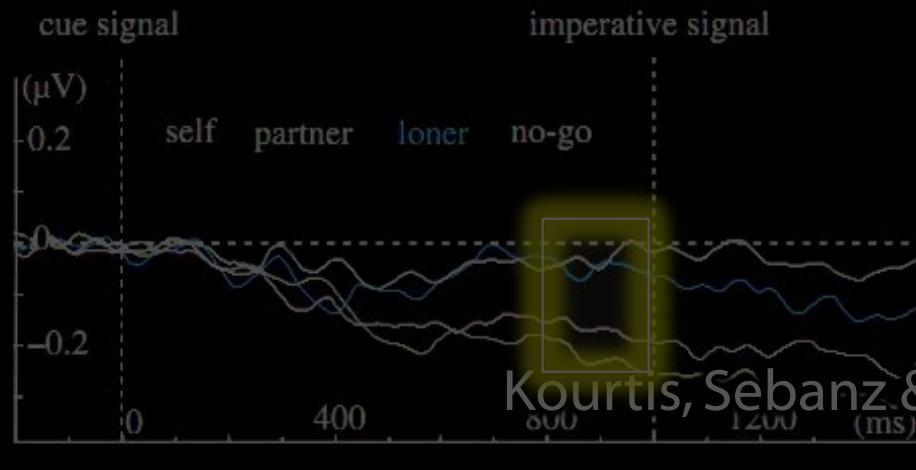
(a)



(b)



(c)



Kourtis, Sebanz & Knoblich (2010)

Kourtis et al., subm.



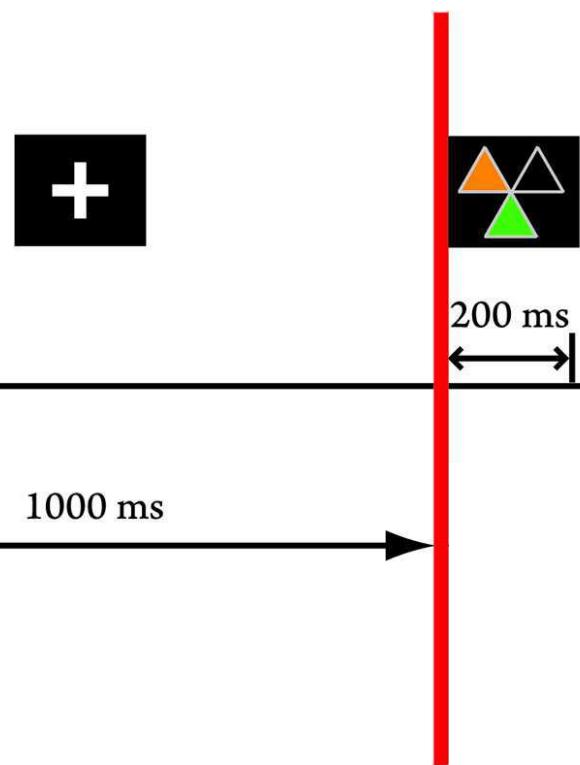
Kourtis et al., subm.



Kourtis et al., subm.



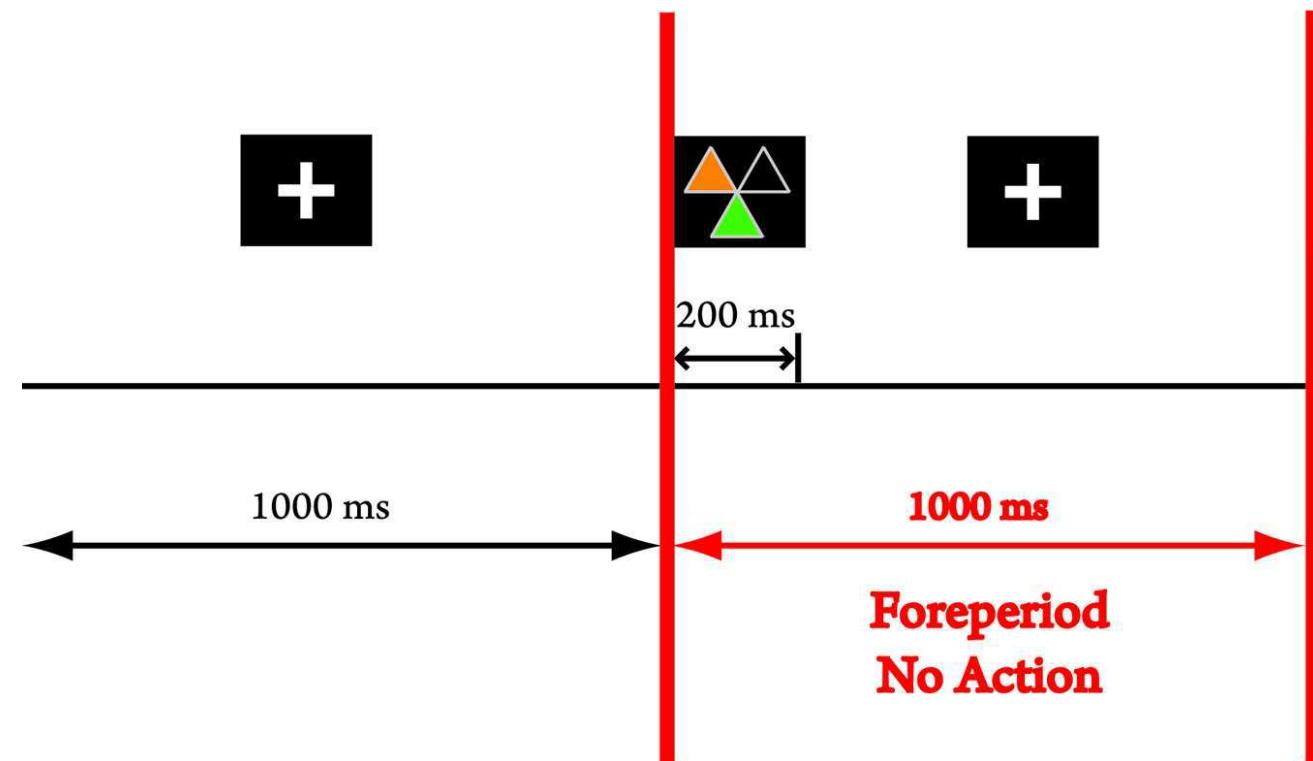
Cue Stimulus



Kourtis et al., subm.



Cue Stimulus

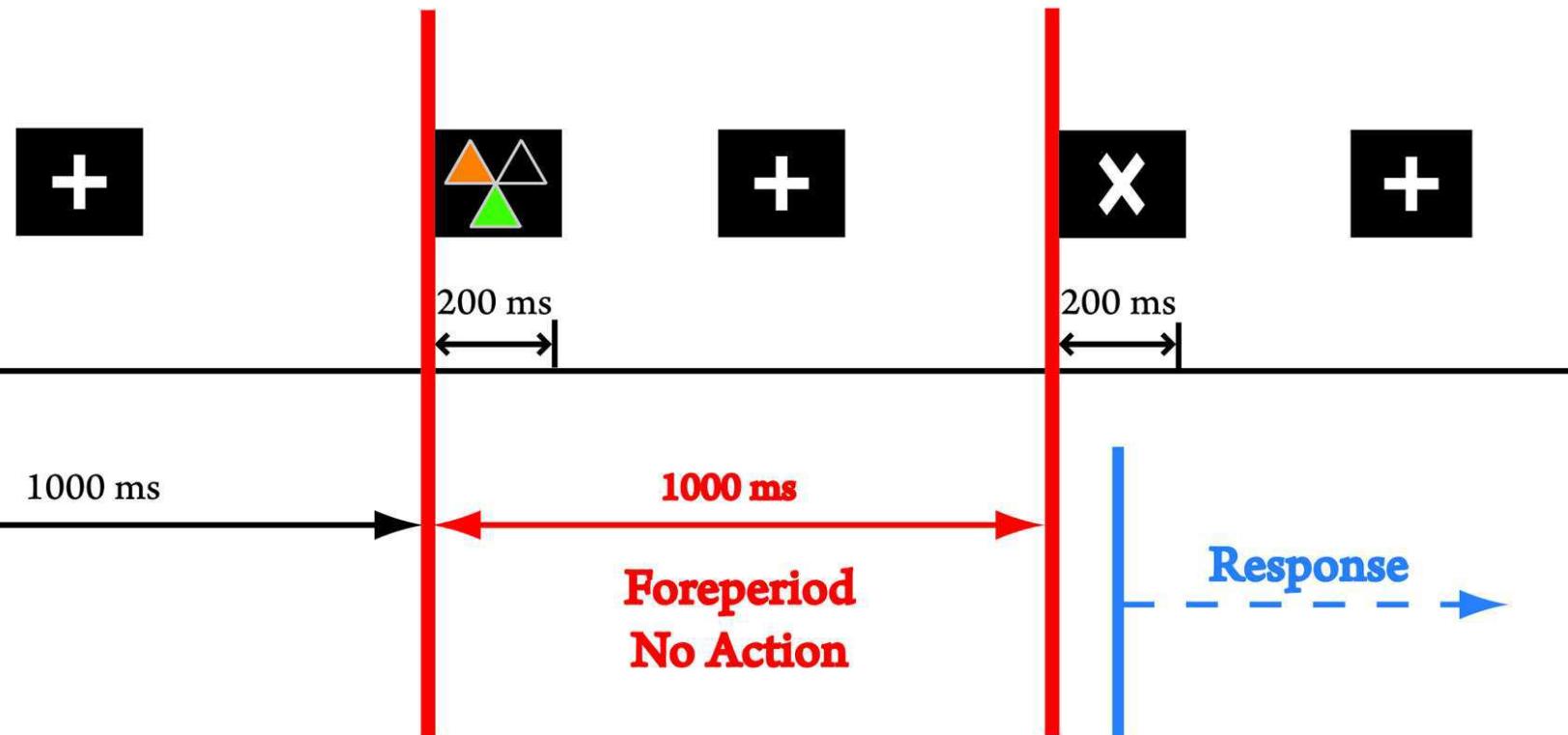


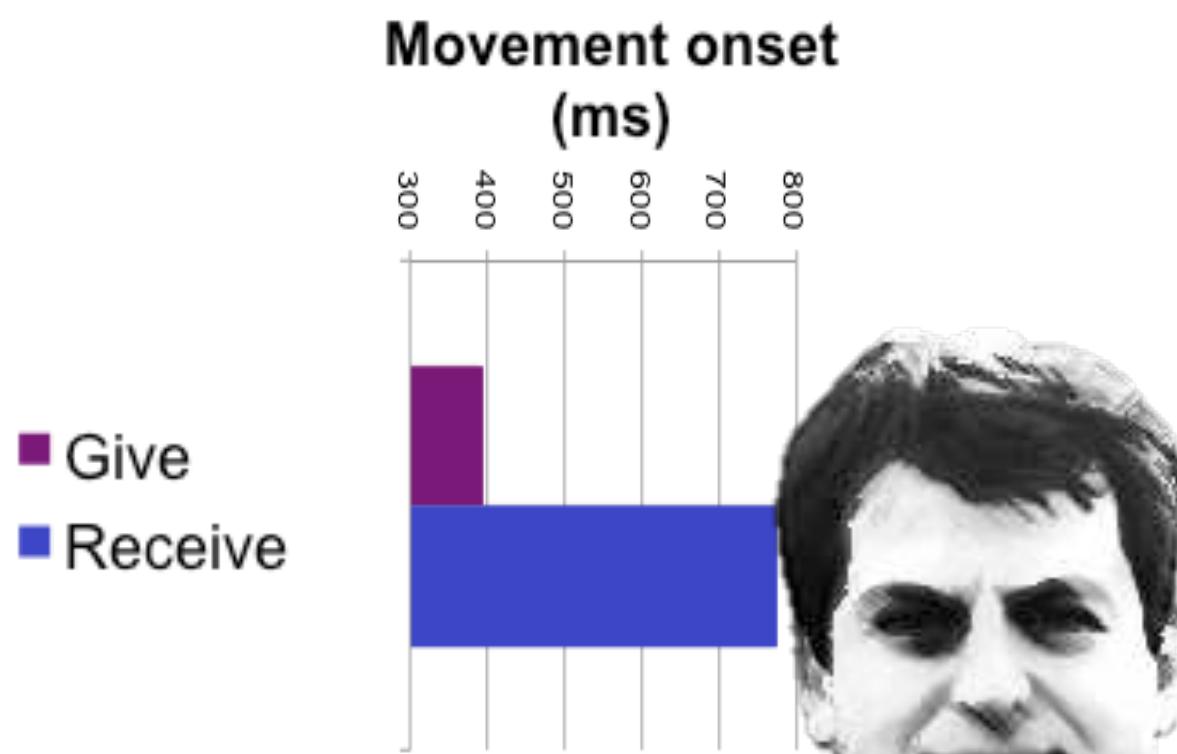
Kourtis et al., subm.

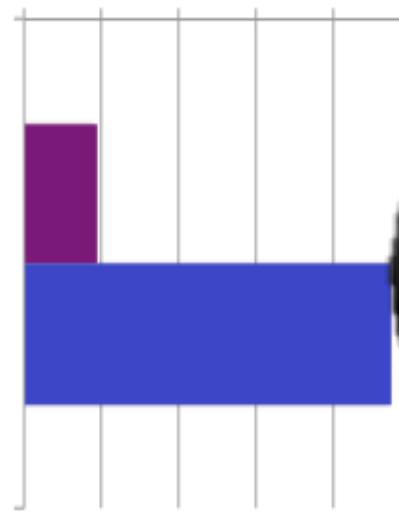
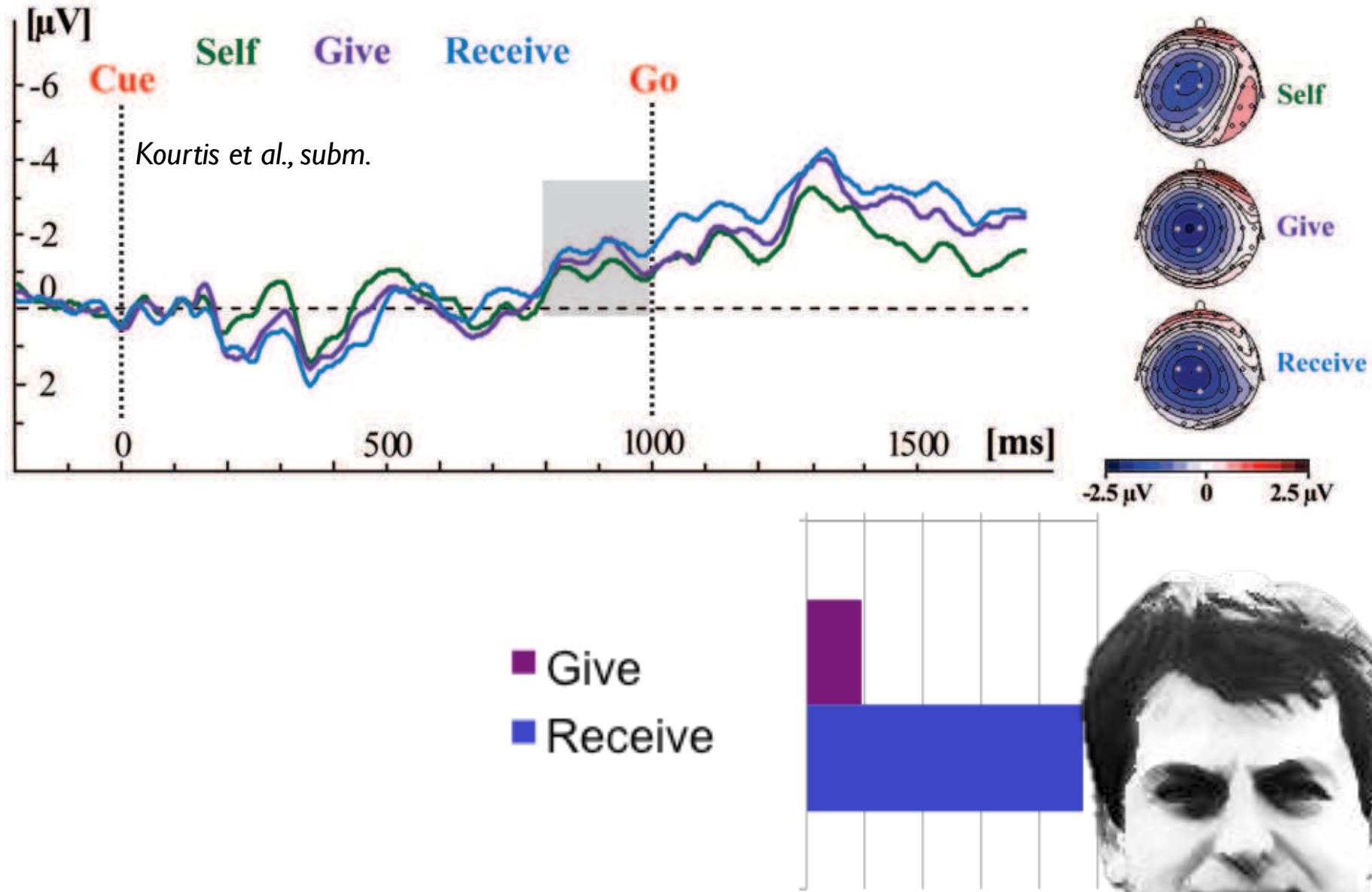


Cue Stimulus

Imperative Stimulus

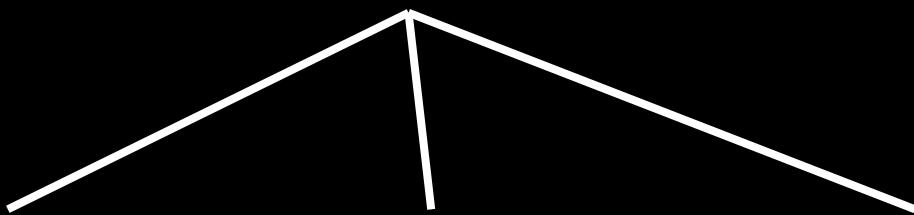




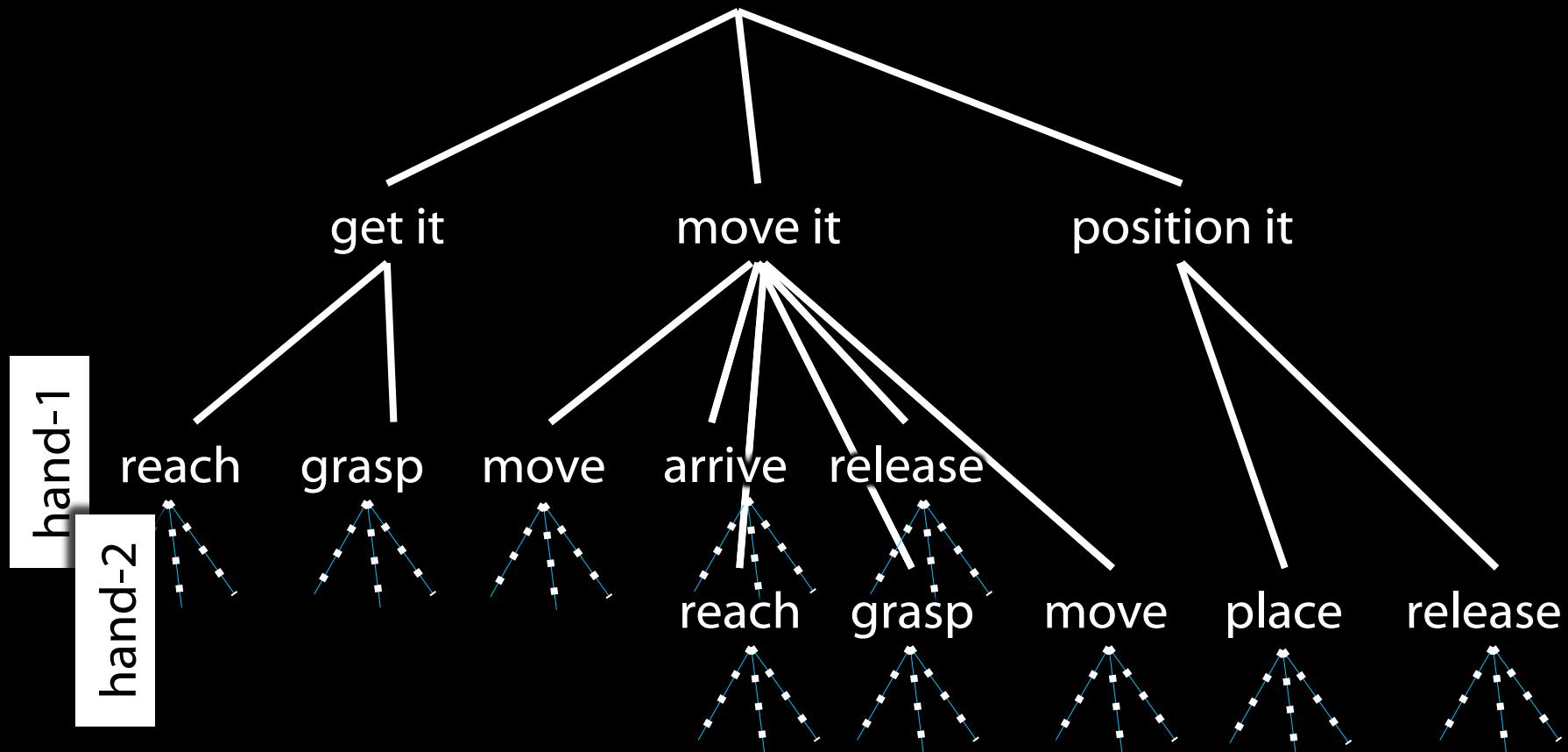


How could reciprocal agent-neutral motor representation ever enable any joint action?

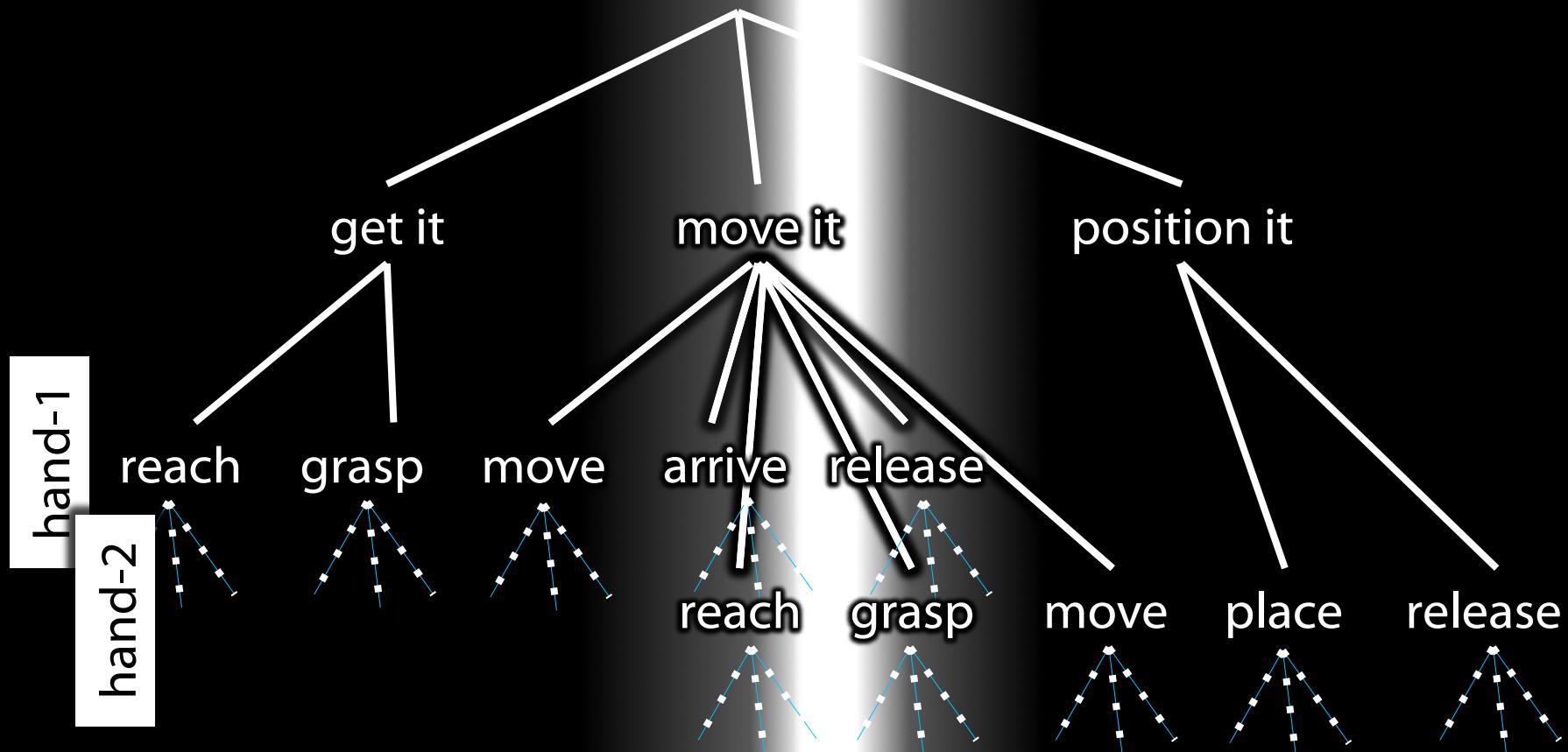
Move it from there to here



Move it from there to here

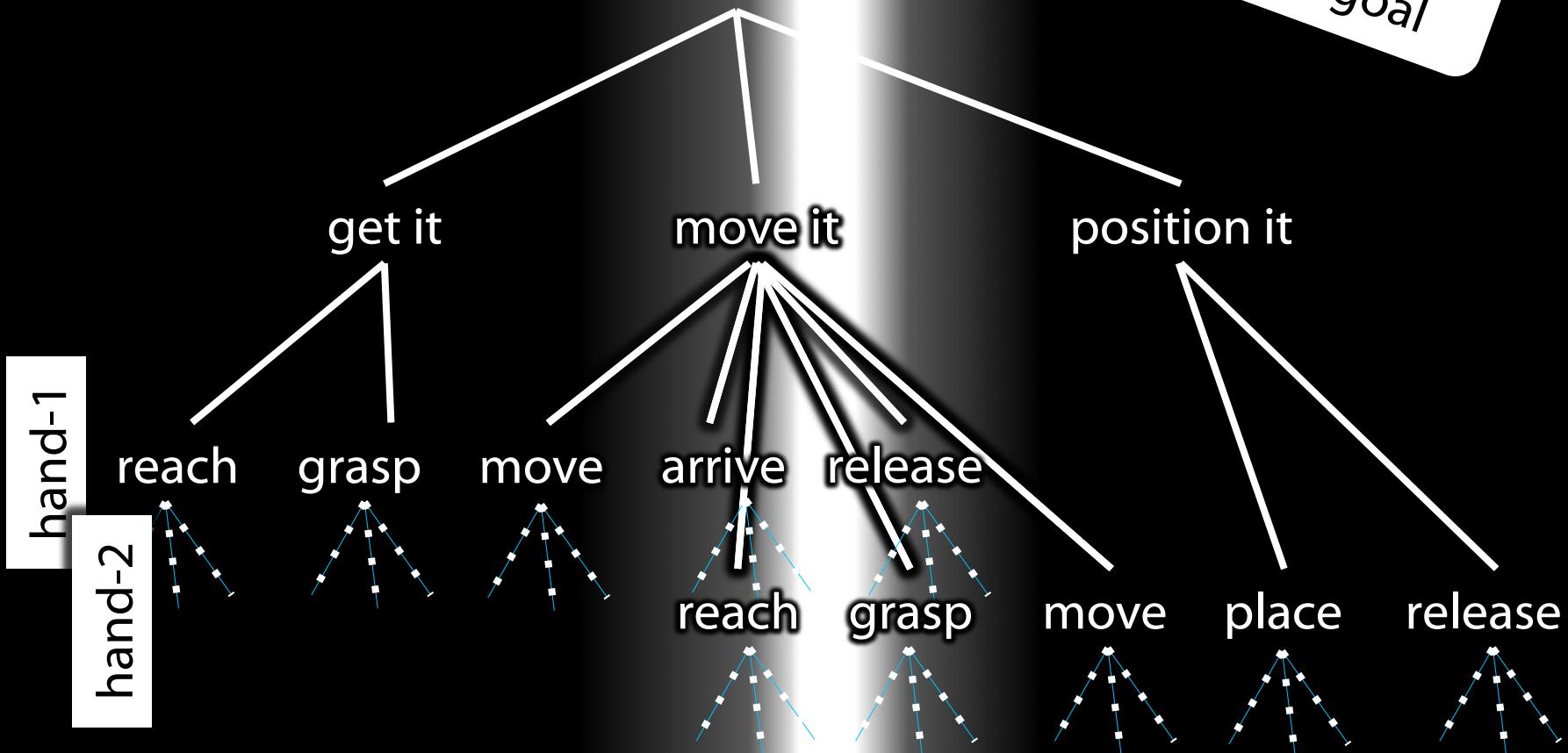


Move it from there to here



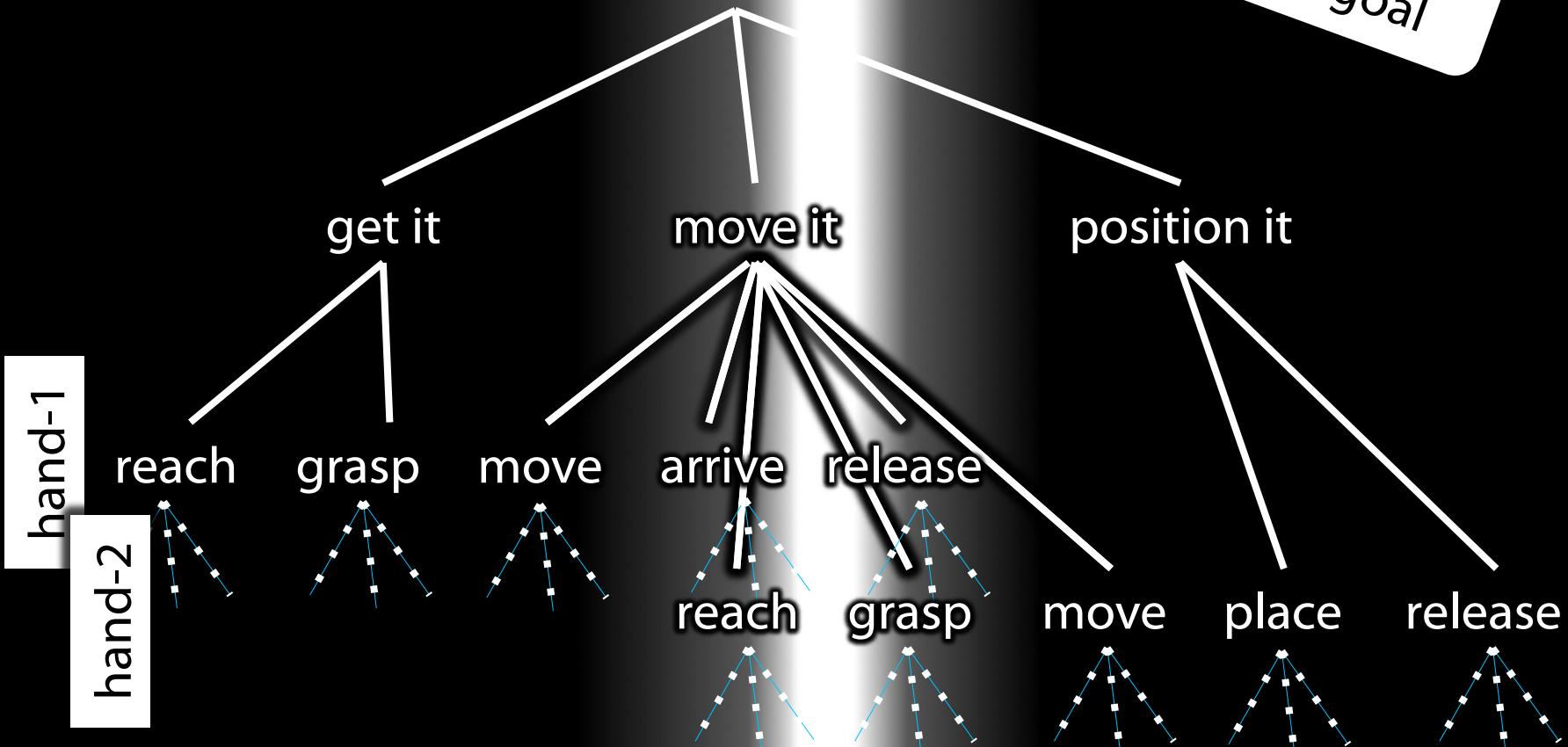
*joint action:
same goal*

Move it from there to here



Move it from there to here

joint action:
same goal



similar timing
problem

Move it from there to here

joint action:
same goal

get it

move it

position it

hand-1

reach

grasp

move

arrive

release

hand-2

reach

grasp

move

place

release

similar timing
problem

same
planning

Move it from there to here

joint action:
same goal

get it

move it

position it

hand-1

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move

place

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prevention
needed

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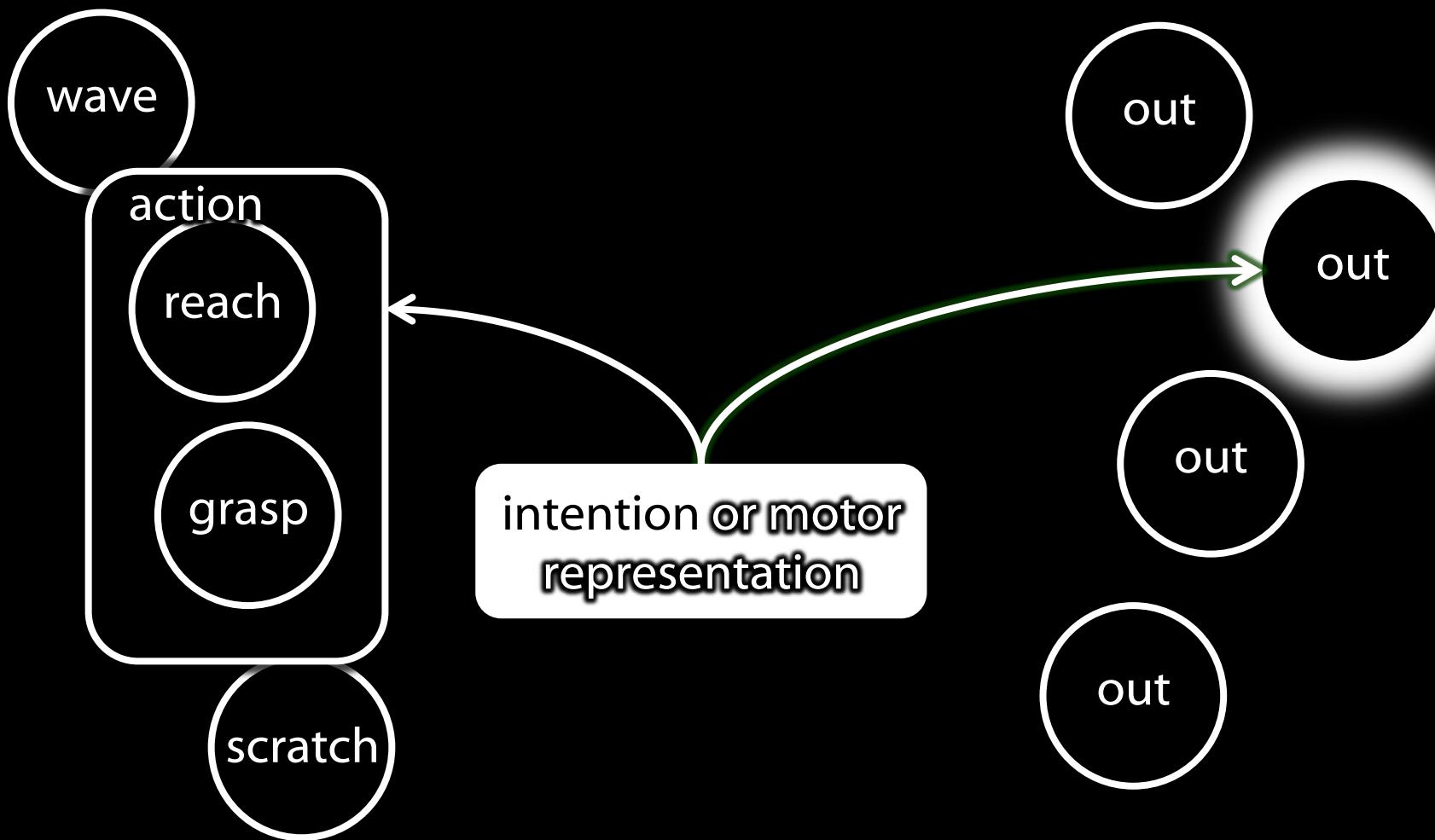
question:

Does reciprocal agent-
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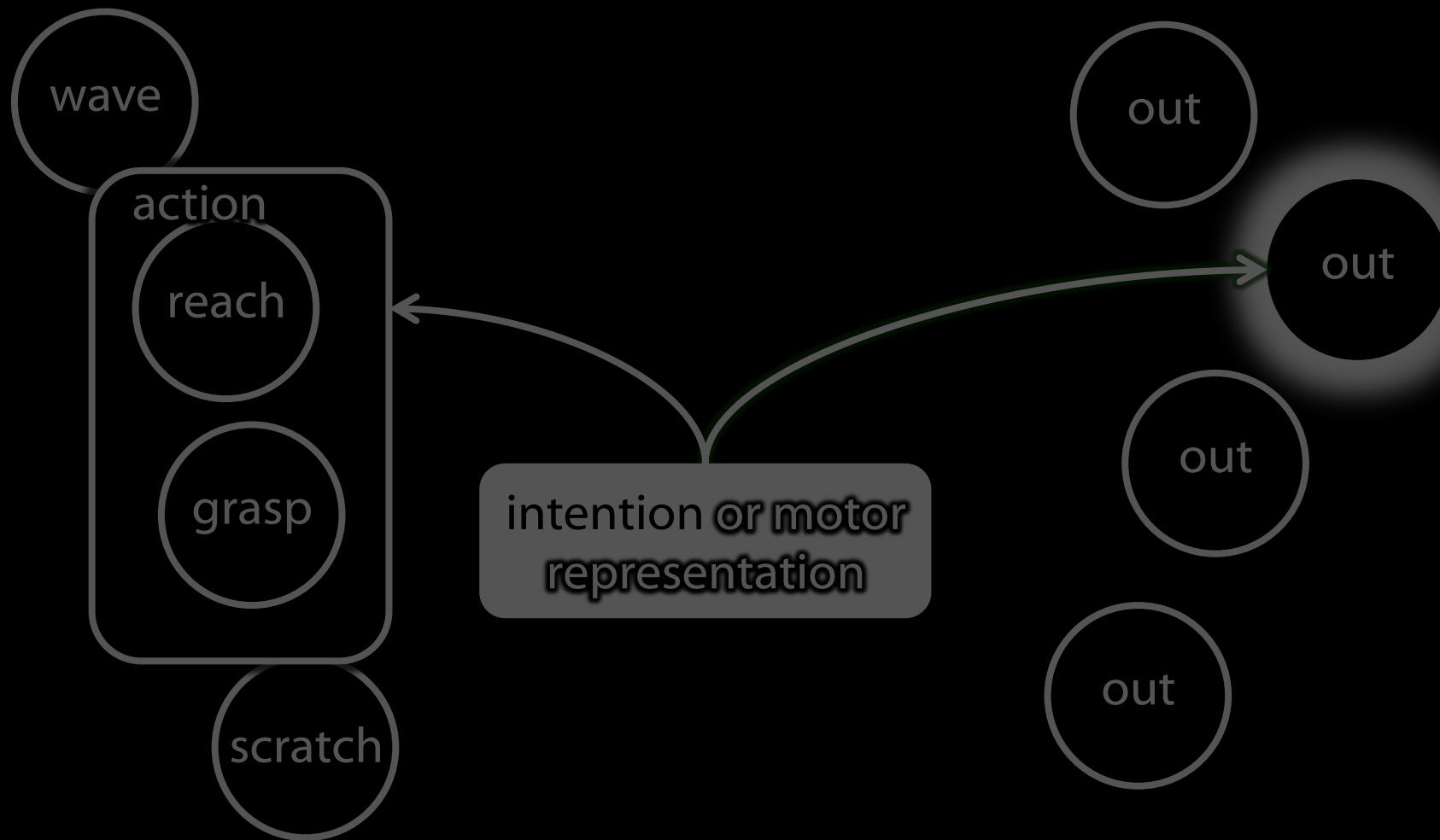
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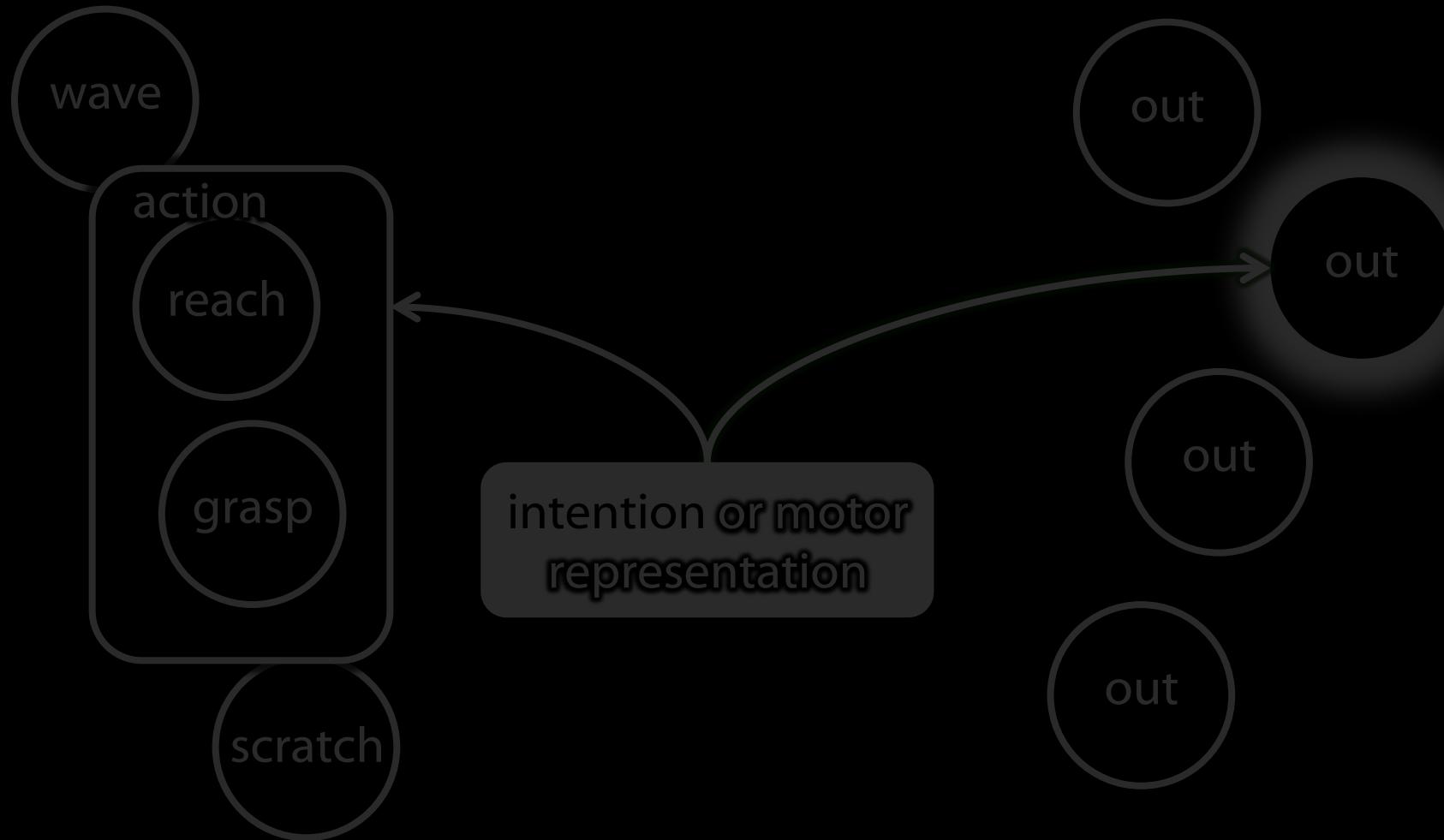
What is the relation between a purposive action and the outcome or outcomes to which it is directed?



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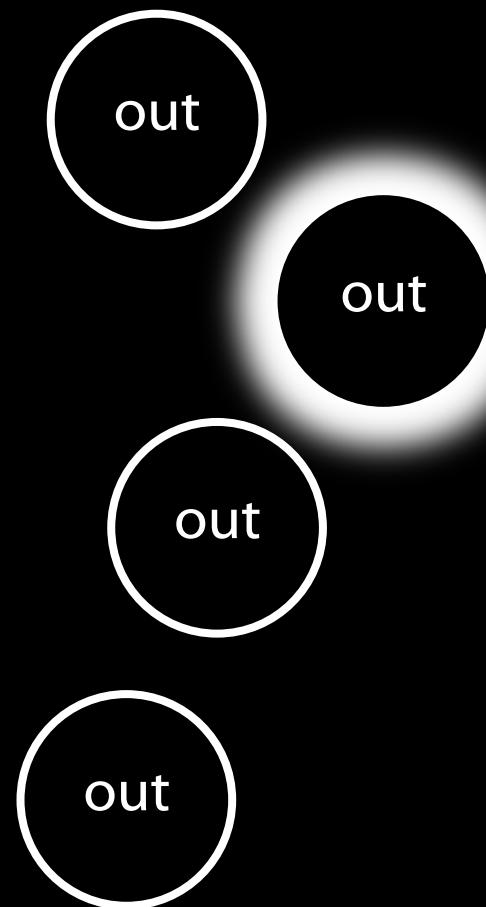


What is the relation between a purposive ^{joint}
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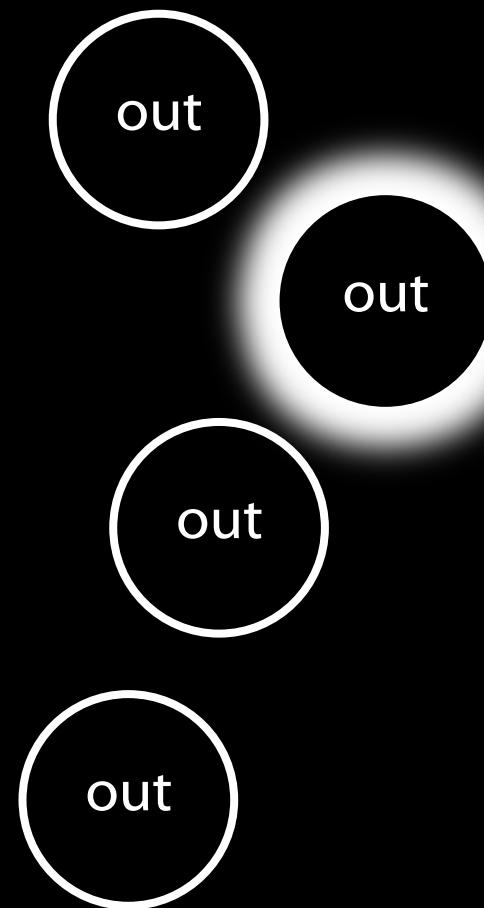
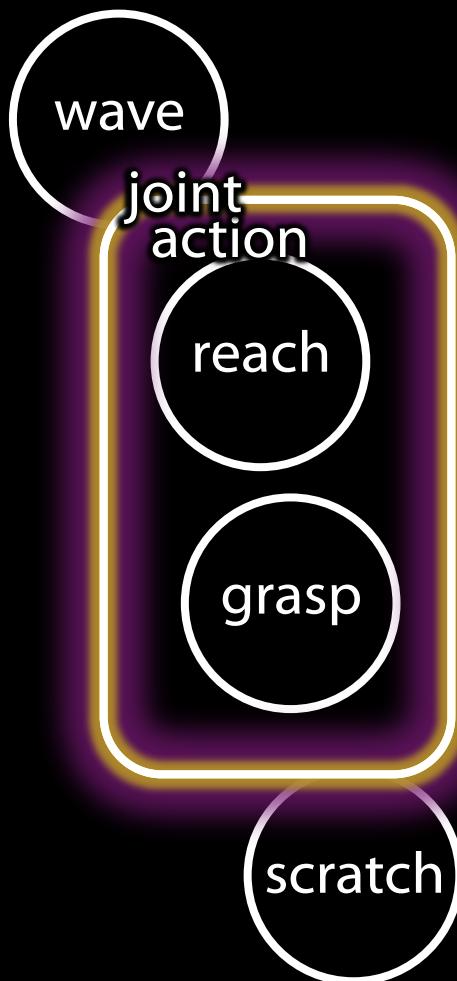


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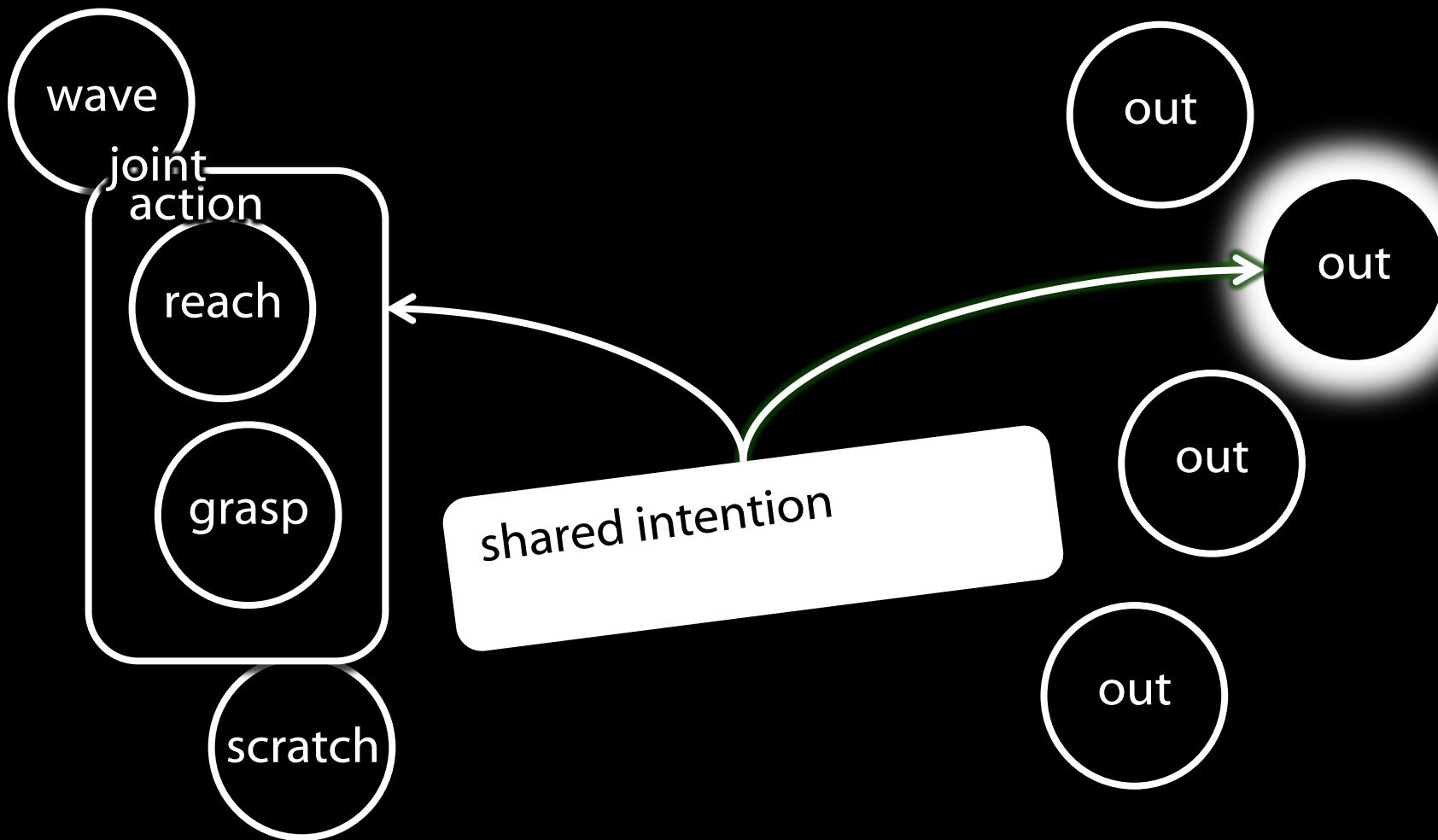
joint
action



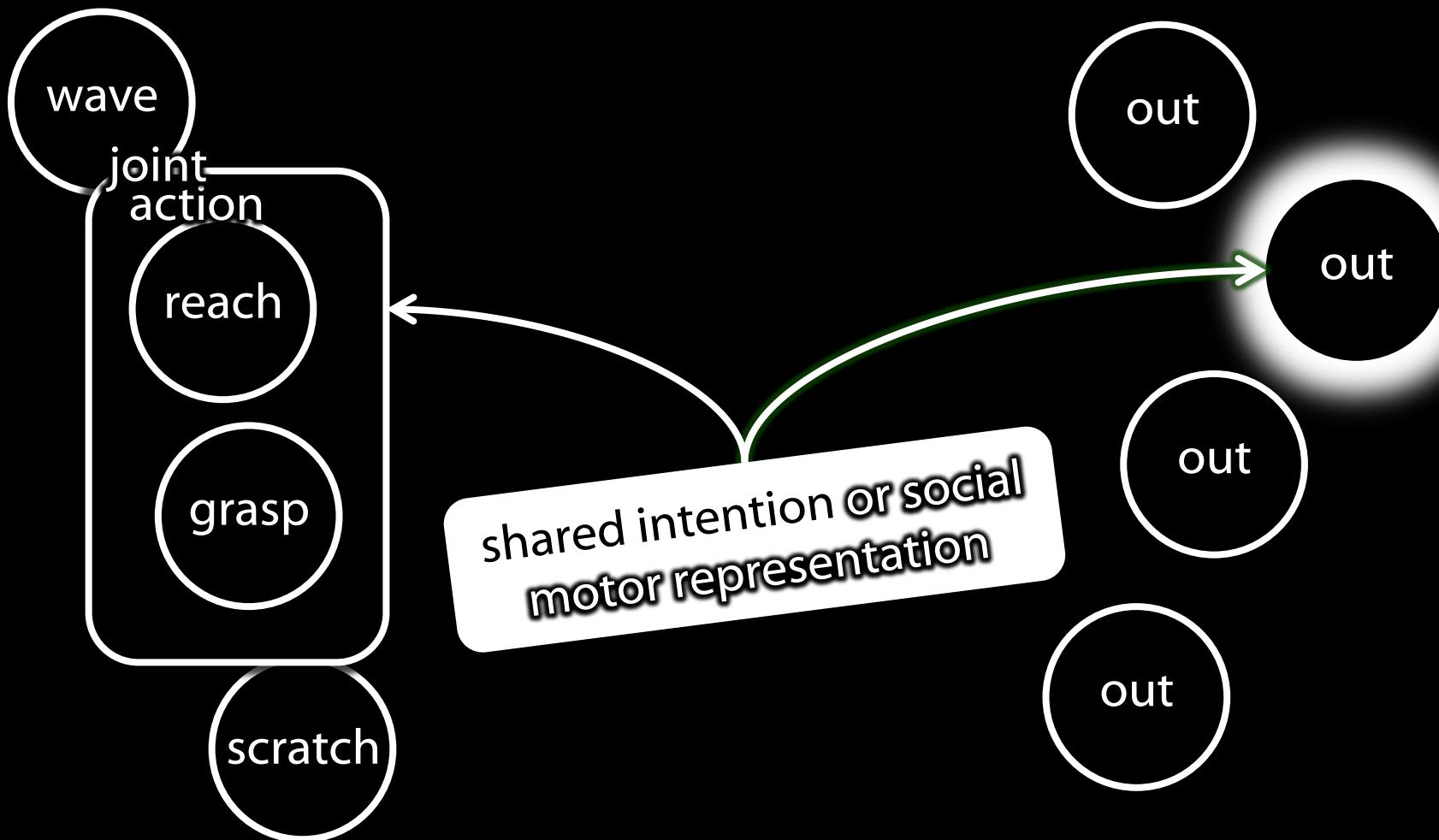
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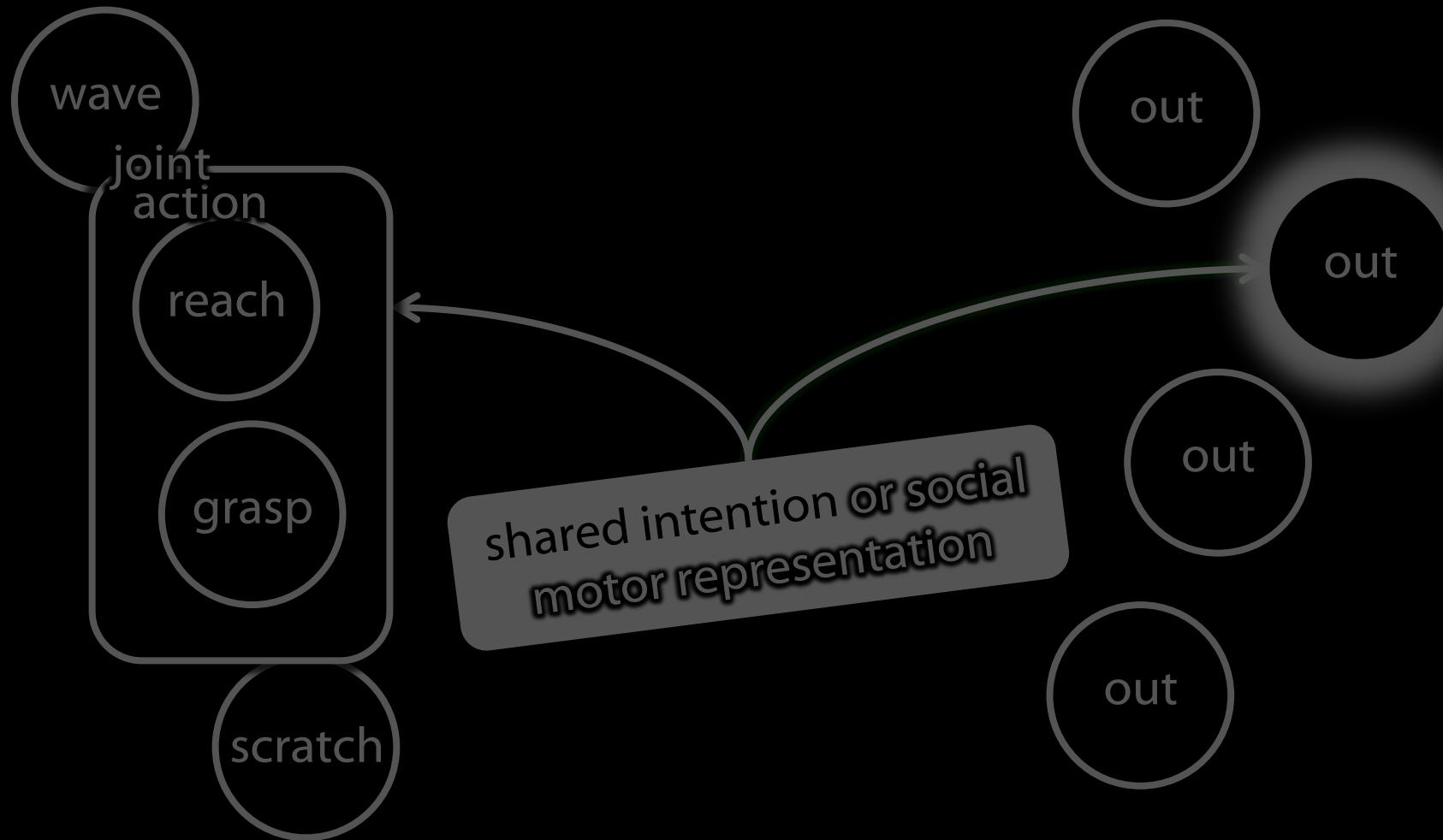
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Goal-directed joint action: an event with two or more agents which, taken as a whole, is directed to a goal.

G is a distributive goal: it is an outcome to which each agent's actions are individually directed and it is possible that: all actions succeed relative to this outcome.

G is a collective goal

- (a) it is a distributive goal;
- (b) the actions are coordinated; and
- (c) coordination of this type would normally facilitate occurrences of outcomes of this type.

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- (a) it is a distributive goal;
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- (c) coordination of this type would normally facilitate occurrences of outcomes of this type.

The agents have reciprocal, agent-neutral motor representations of the outcome which is the distributive goal.

Each expects the other to do part of the action.

A black and white portrait of Michael Bratman, a man with dark hair and glasses, wearing a plaid shirt, looking slightly to the right.

Sufficient conditions

We have a shared intention
that we J if

“1. (a) I intend that we J and
(b) you intend that we J

“2. I intend that we J in
accordance with and
because of la, lb, and
meshing subplans of la and
lb; you intend [likewise] ...

“3. 1 and 2 are common
knowledge between us”

(Bratman 1993:View 4)

A black and white portrait of Michael Bratman, a man with glasses and short hair, wearing a plaid shirt, looking slightly to the right.

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We have a shared intention
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A black and white photograph of Michael Bratman, a middle-aged man with dark hair and glasses, wearing a plaid shirt, looking slightly to his left.

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“it seems reasonable to suppose that in shared intention the fact that each has the relevant attitudes is itself out in the open, is public.”

(Bratman 1993 [1999], p. 117)

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Does reciprocal agent-
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How could social motor
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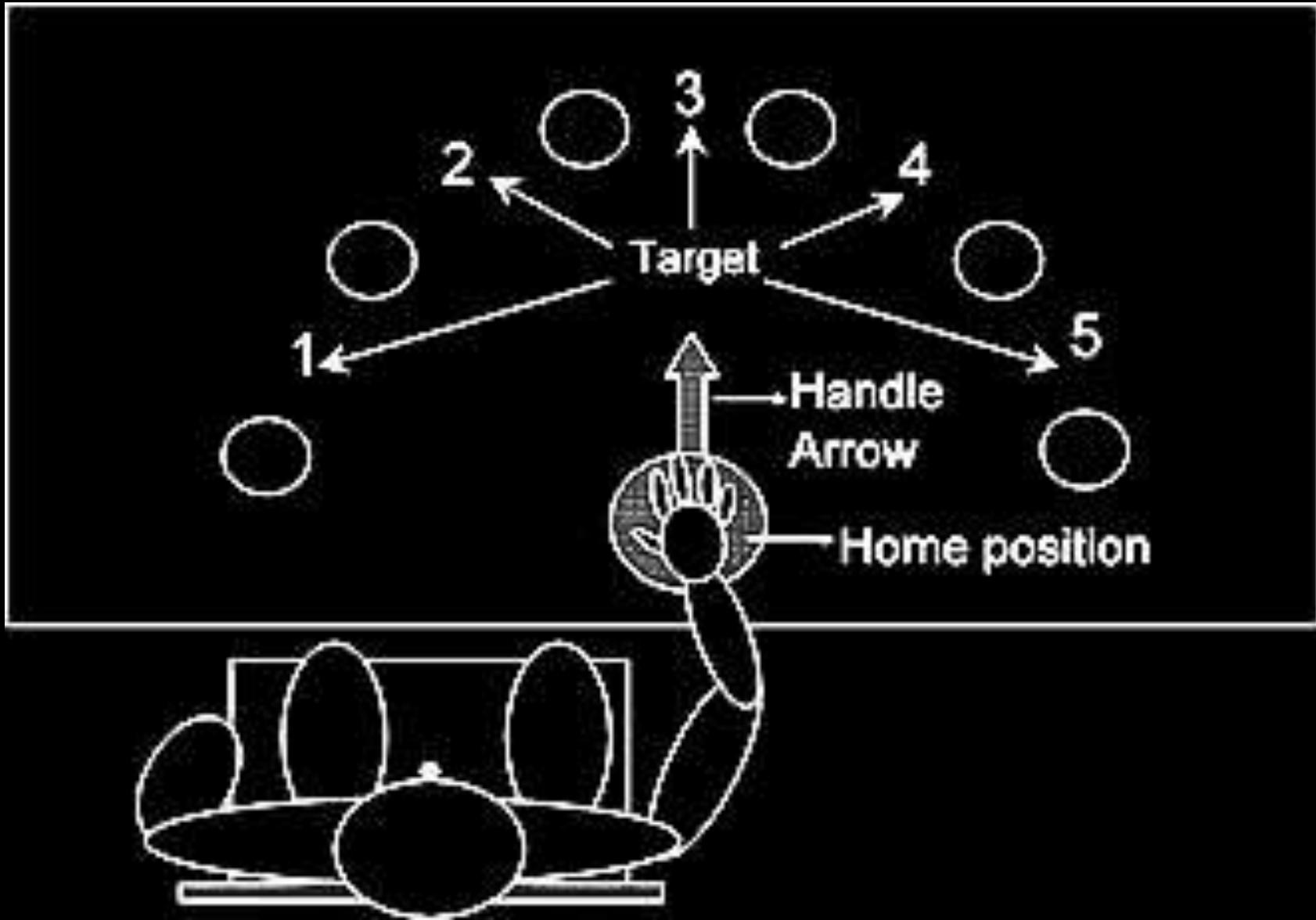
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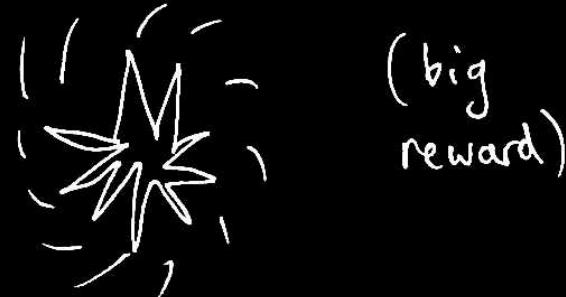
reciprocal agent-neutral
motor representation
= shared intention?



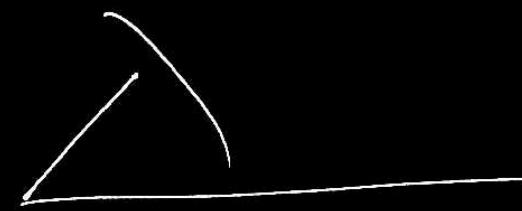
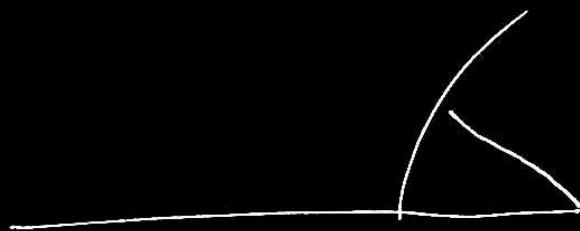
What are intentions for?



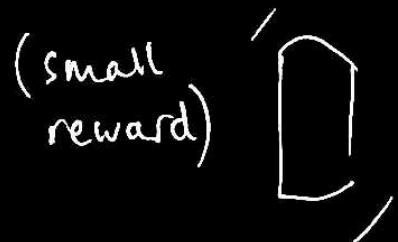
(Zhang and Rosenbaum 2007)



(big
reward)



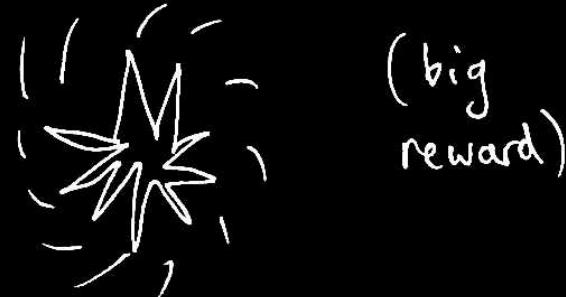
↑
ONE
WAY



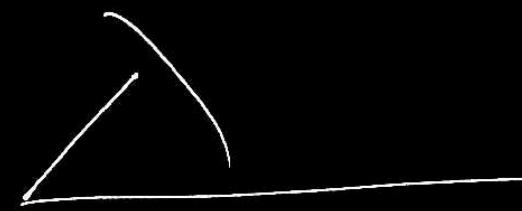
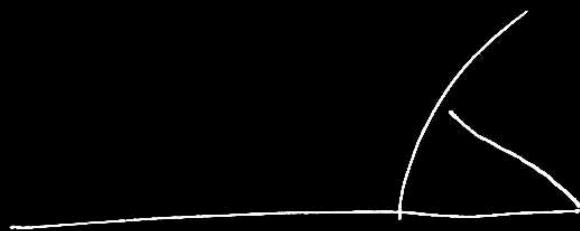
(small
reward)

X start here

What are ^{shared}
intentions for?



(big
reward)



↑
ONE
WAY



(small
reward)

X start here

moving an object together

(Kourtis et al 2010)



tidying up the toys together

(Behne et al 2005)

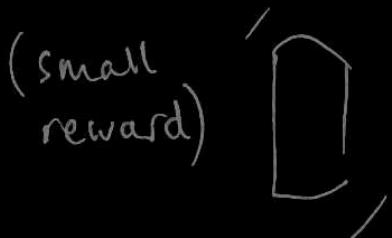
cooperatively pulling
handles in sequence to
make a dog-puppet sing

(Brownell et al 2006)

bouncing a cube on a large
trampoline together

(Tomasello & Carpenter 2007)

ONE
WA
pretending to row a boat
together



X

start here

premise:

Reciprocal agent-neutral motor representation
enables some joint actions

question:

Does reciprocal agent-
neutral motor
representation also play a
role in explaining what
joint action is? [Yes]

challenge:

How could social motor
representation and
shared intention

reciprocal agent-neutral
motor representation
= shared intention?



< different content >



< different content >

Head southeast on Rue Cujas toward Rue Victor Cousin. Turn right onto Rue Saint-Jacques...

Take RER B and get out at the Luxembourg station, from there it's less than 5 minutes walk.



< different format >

Head southeast on Rue
Cujas toward Rue
Victor Cousin. Turn
right onto Rue Saint-
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==



?

Only representations with a common format can be inferentially integrated.

Any two intentions can be inferentially integrated in practical reasoning.

My intention that I visit Paris on Friday is a propositional attitude.

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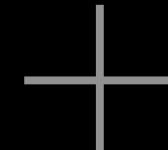
All intentions are propositional attitudes.

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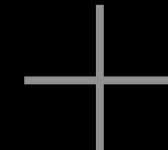
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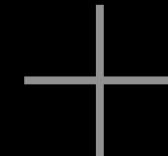
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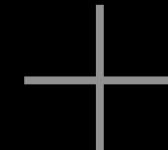
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The Interface Problem

The Interface Problem

Some joint actions involve both shared intention and reciprocal agent-neutral motor representation

The Interface Problem

Reciprocal agent-neutral
motor representations:

- i. represent outcomes;
- ii. ground the
purposiveness of some
joint actions

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both shared intention and
reciprocal agent-neutral
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The Interface Problem

Reciprocal agent-neutral
motor representations:

- i. represent outcomes;
- ii. ground the
purposiveness of some
joint actions

Two outcomes, A and B,
match in a particular context
just if, in that context, either
the occurrence of A would
normally constitute or cause,
at least partially, the
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The Interface Problem: How are non-accidental matches possible?

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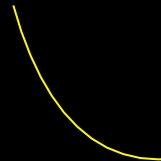
Follow that route

=



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Follow that route

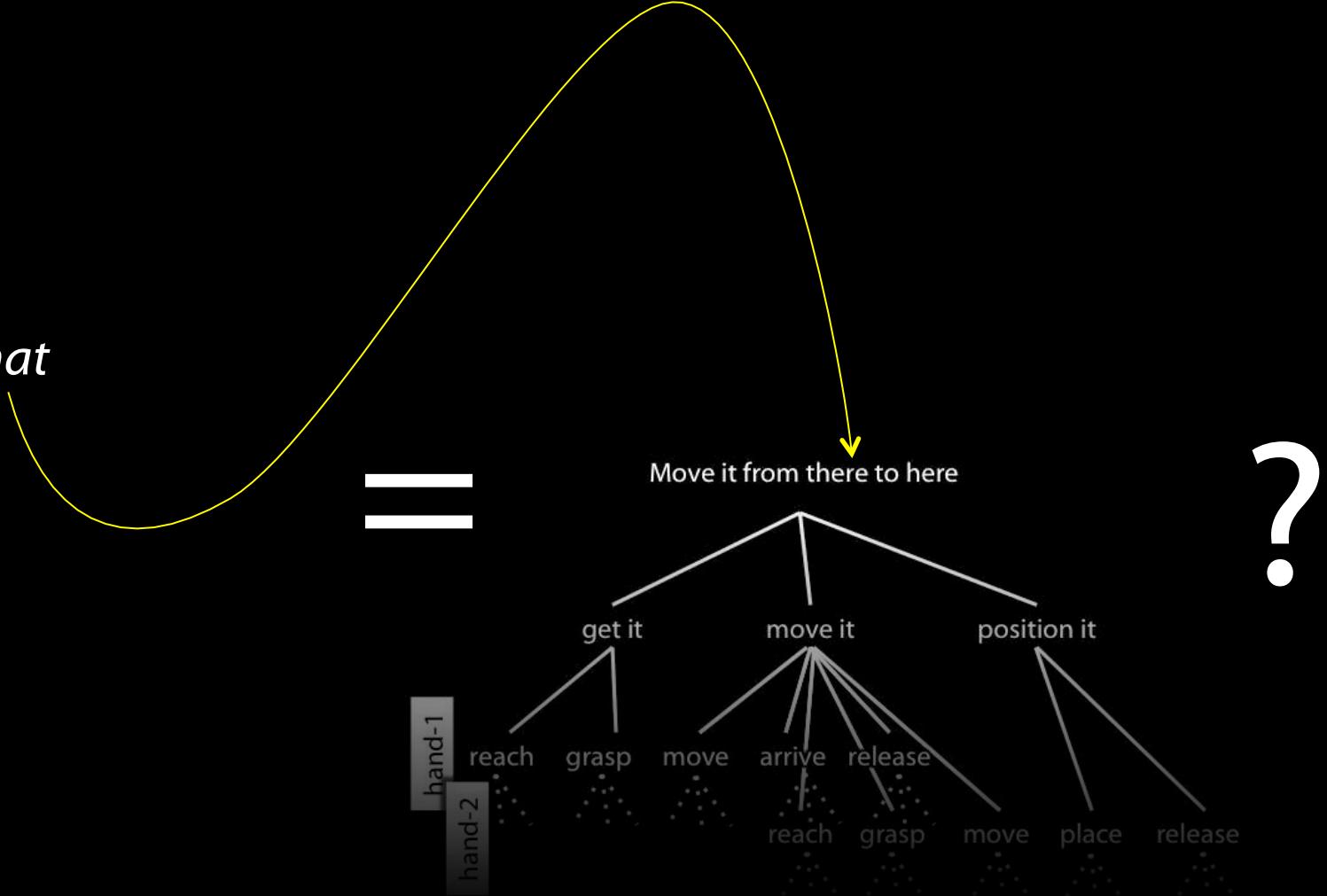


=



?

Do that



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A black and white photograph of two young children, a boy and a girl, standing close together and smiling. The boy is in the foreground, wearing overalls, and the girl is behind him, wearing a patterned top. They appear to be in a playful or happy mood.

challenge

Explain the emergence, in evolution or development, of sophisticated forms of theory of mind cognition.

conjecture

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

2nd objection

Joint action presupposes sophisticated theory of mind cognition