

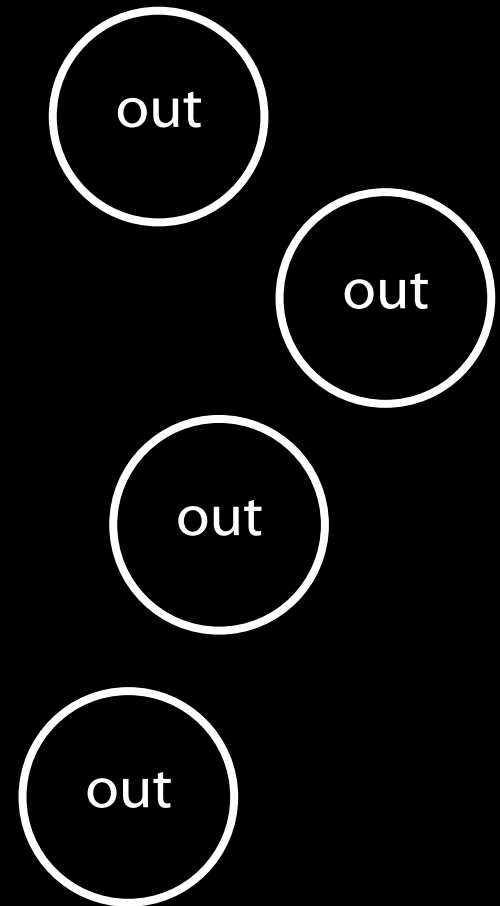
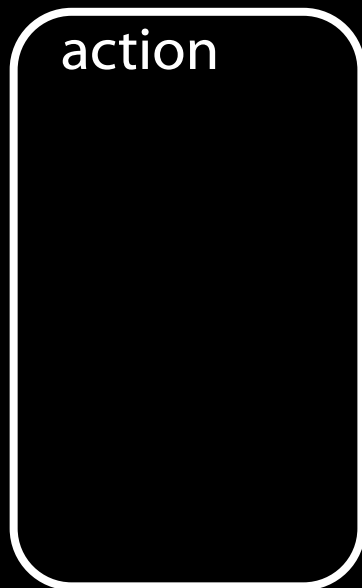
Intention and Motor Representation in Action Explanation

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

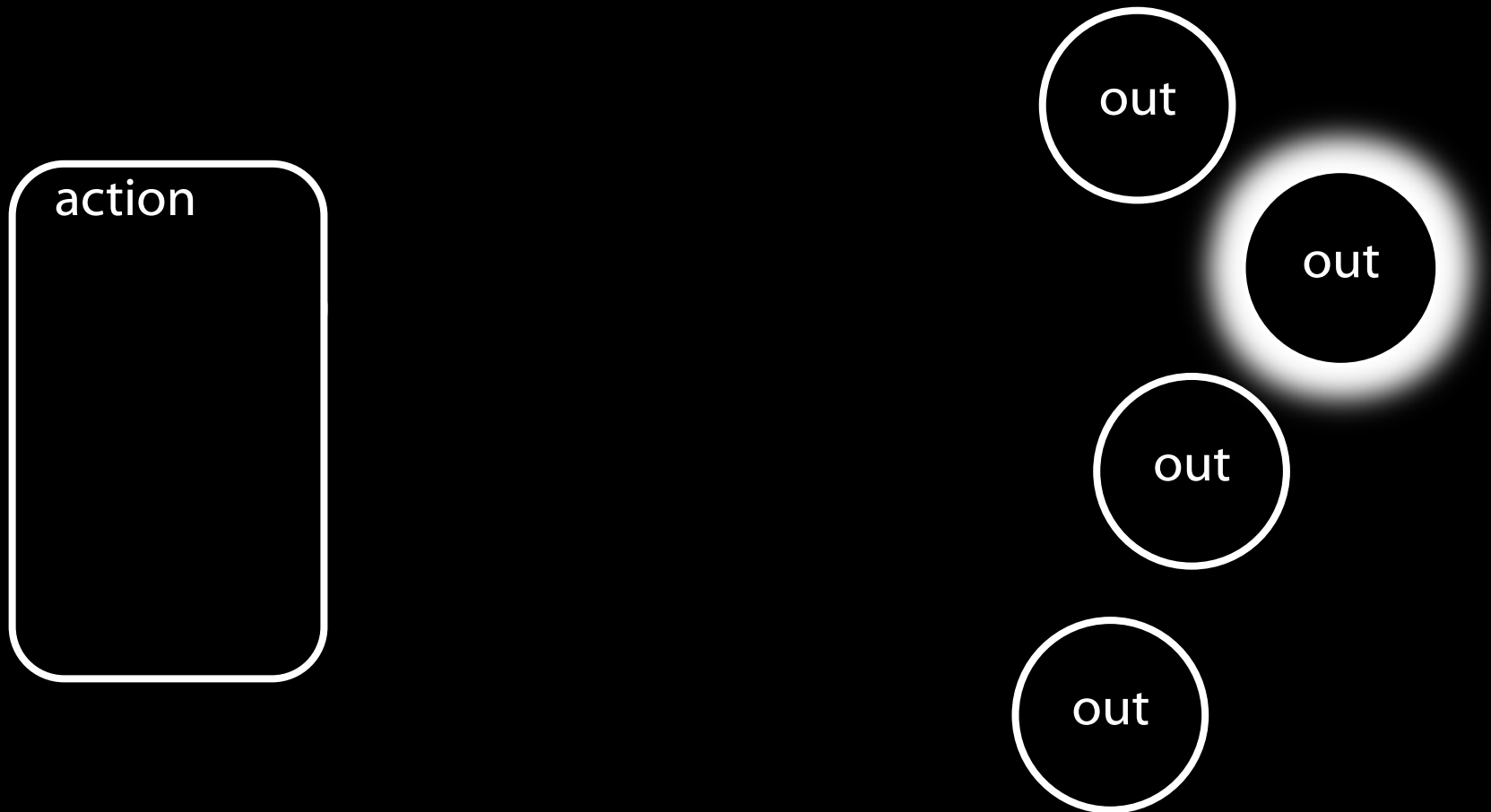


What is the relation between a purposive action and the outcome or outcomes to which it is directed?

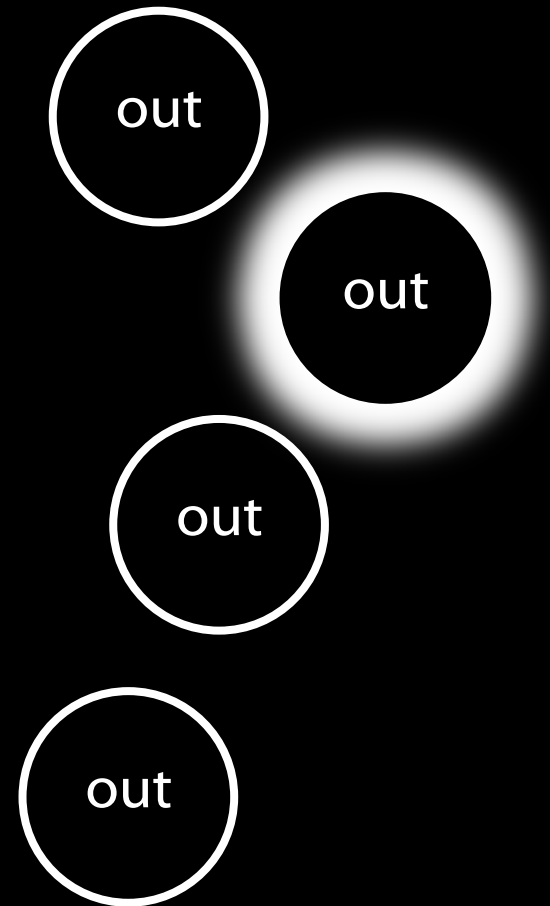
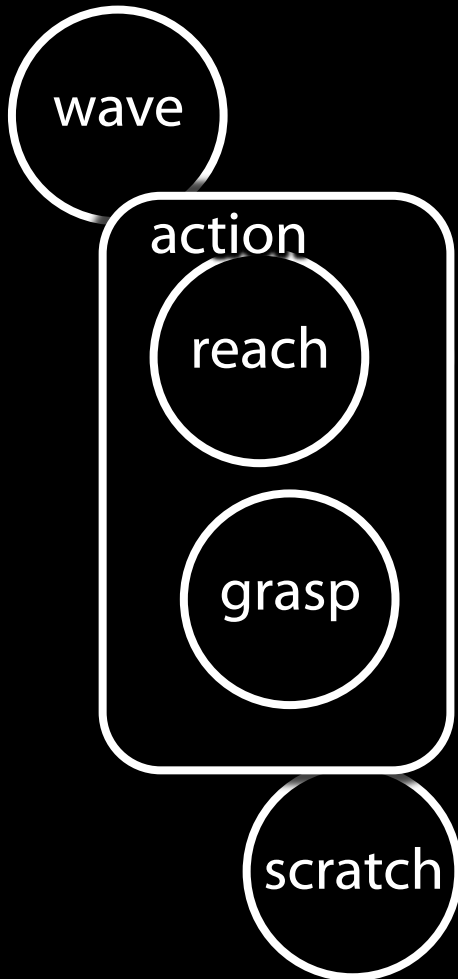
What is the relation between a purposive action and the outcome or outcomes to which it is directed?



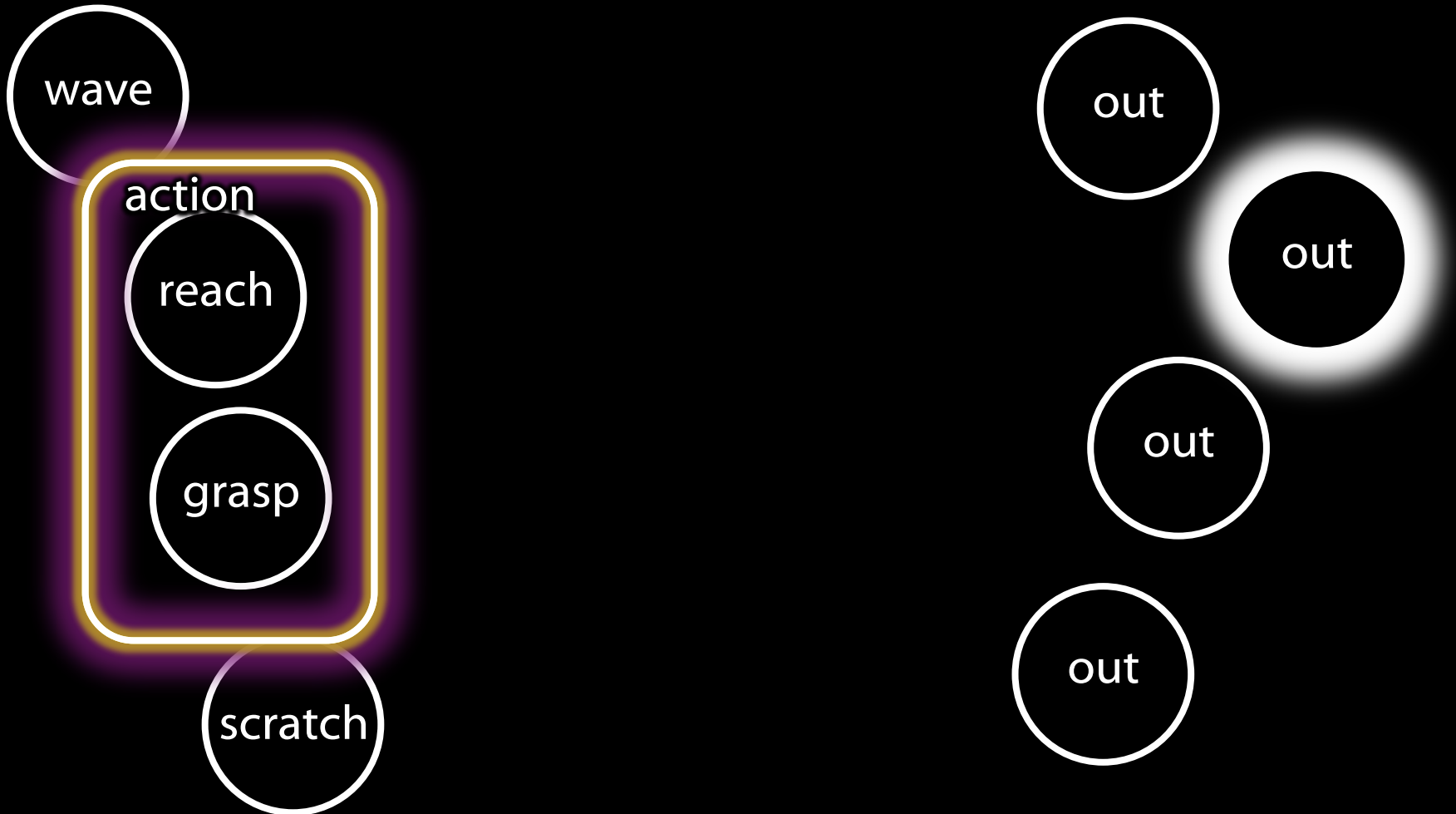
What is the relation between a purposive action and the outcome or outcomes to which it is directed?



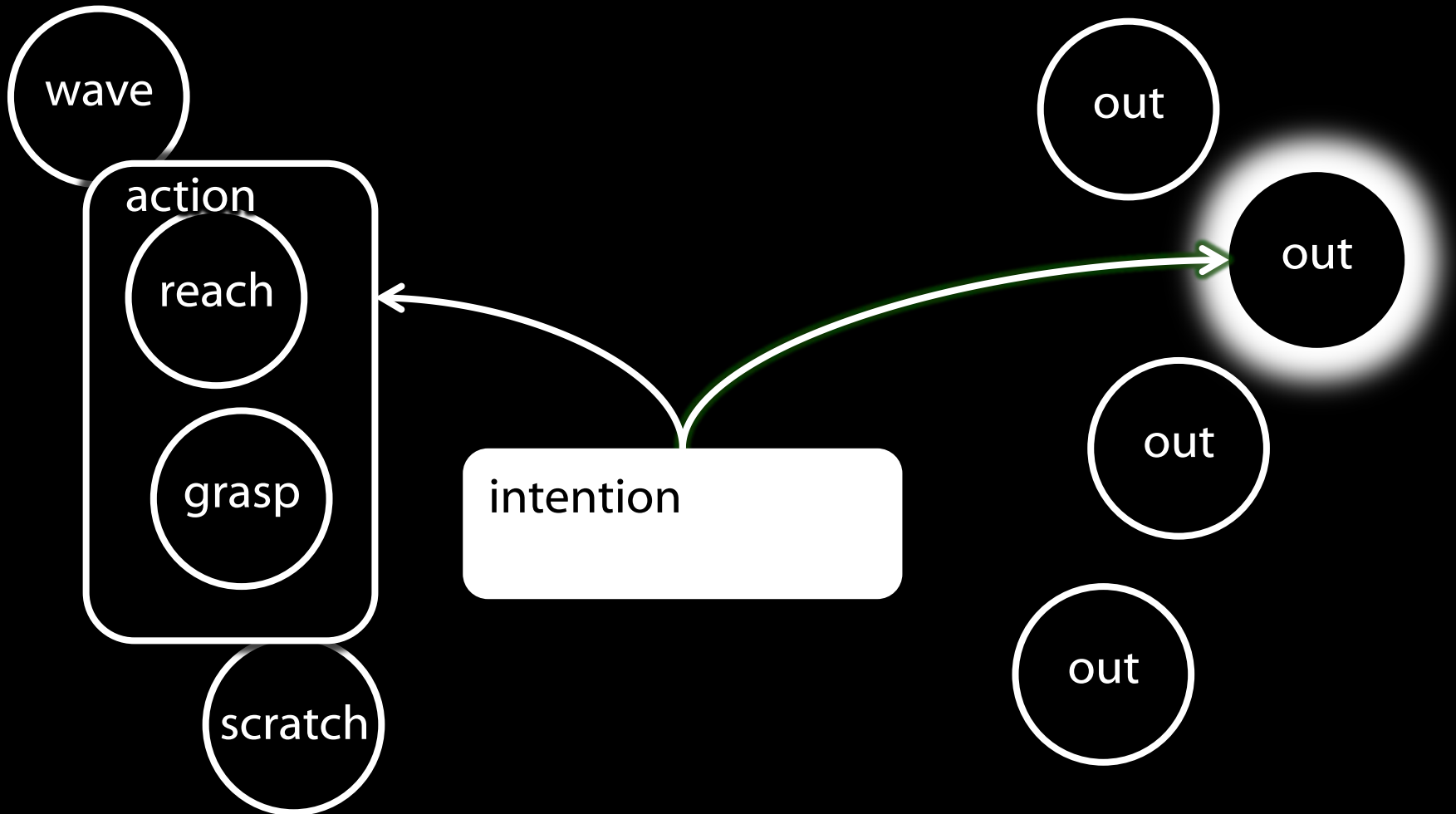
What is the relation between a purposive action and the outcome or outcomes to which it is directed?



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

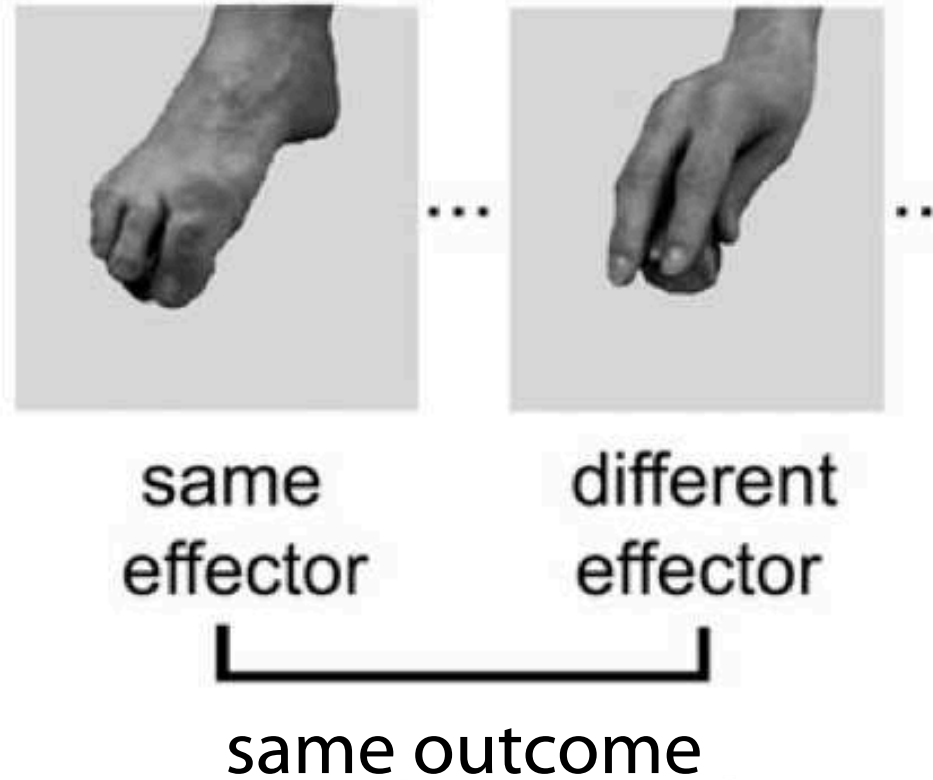


What is the relation between a purposive action and the outcome or outcomes to which it is directed?



Some motor representations carry
information about outcomes.

Some motor representations carry information about outcomes.



Cattaneo et al (2010)

Some motor representations carry information about outcomes.



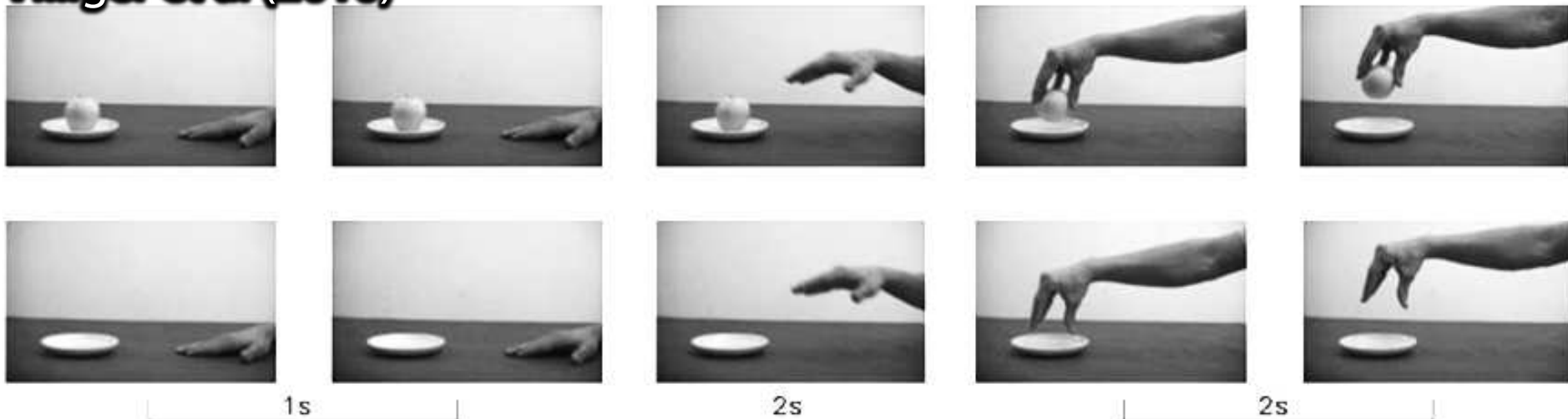
same
effector

different
effector

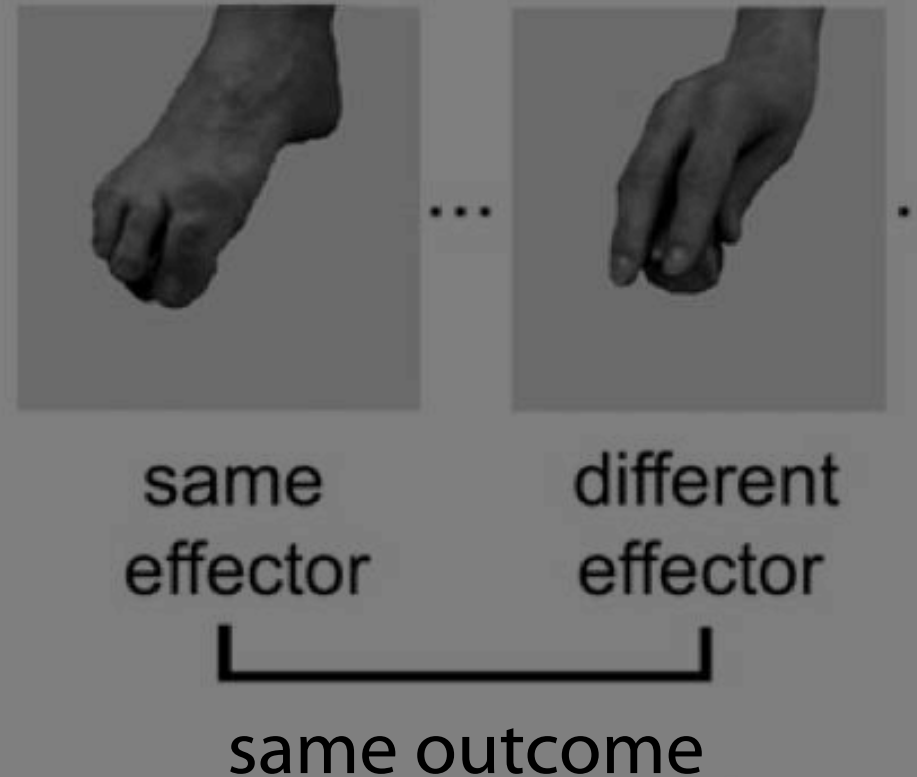
same outcome

Cattaneo et al (2010)

Villiger et al (2010)



Some motor representations carry information about outcomes.



Cattaneo et al (2010)

Villiger et al (2010)

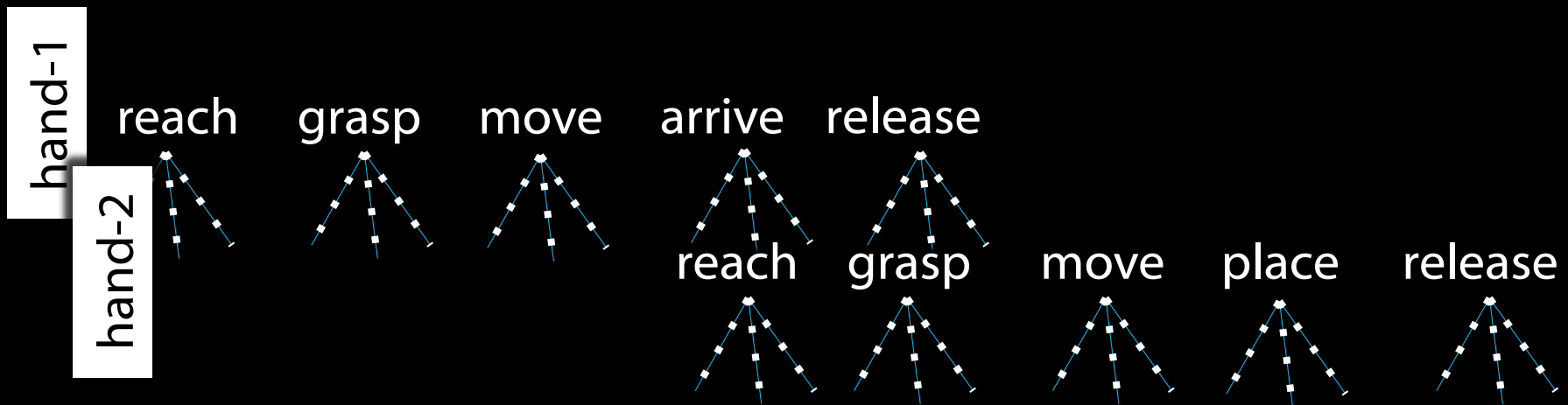


Some motor representations carry information about outcomes.

Information about outcomes guides planning.

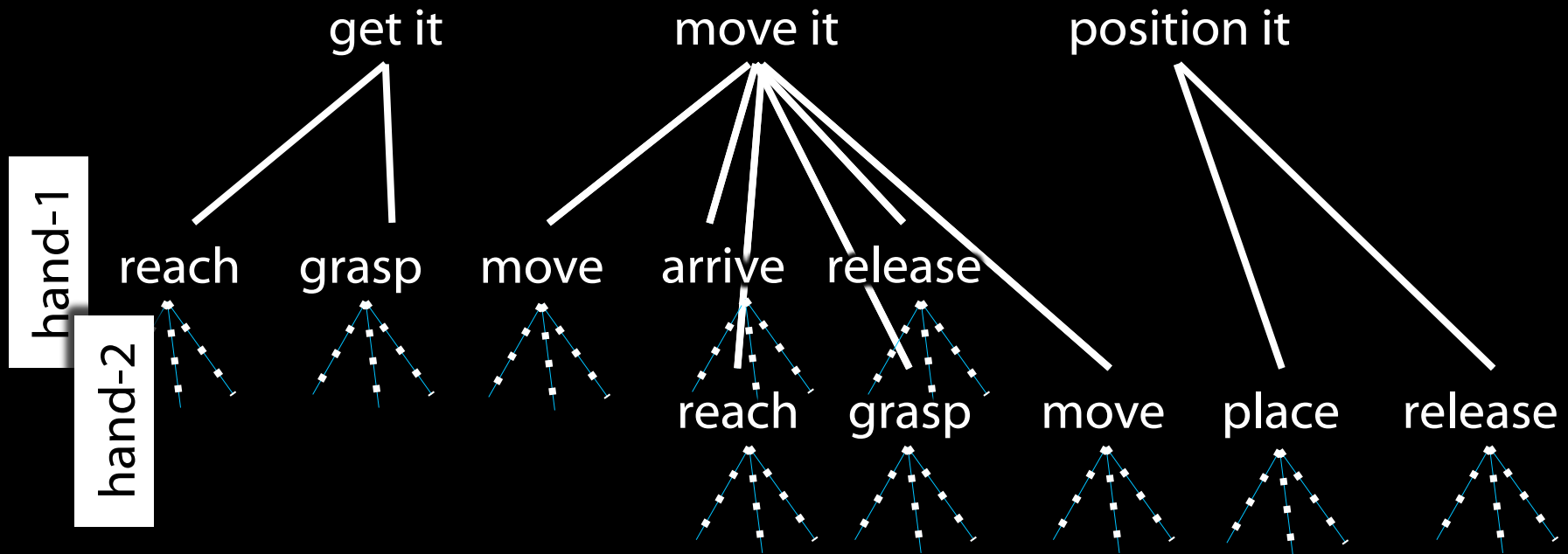
Some motor representations carry information about outcomes.

Information about outcomes guides planning.



Some motor representations carry information about outcomes.

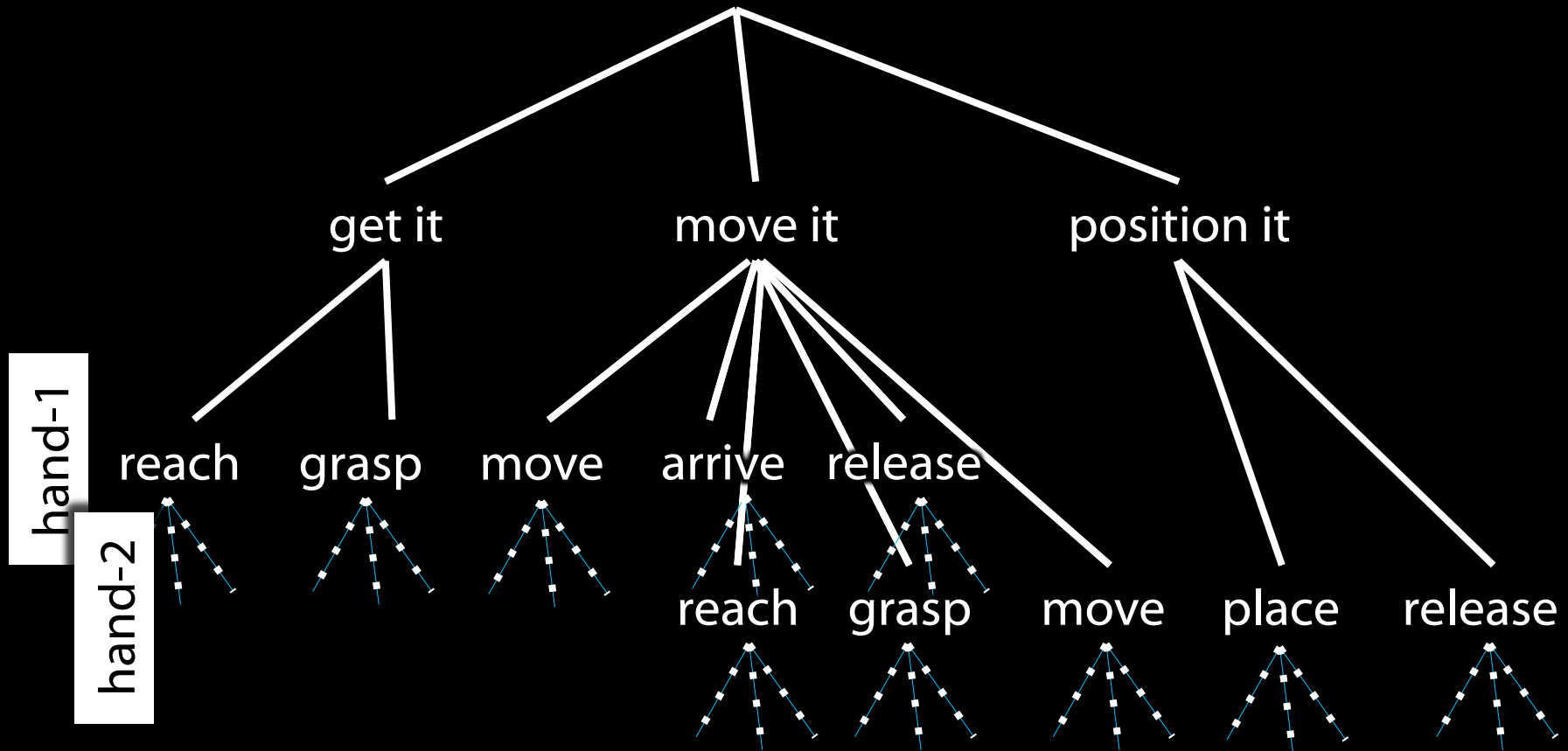
Information about outcomes guides planning.



Some motor representations carry information about outcomes.

Information about outcomes guides planning.

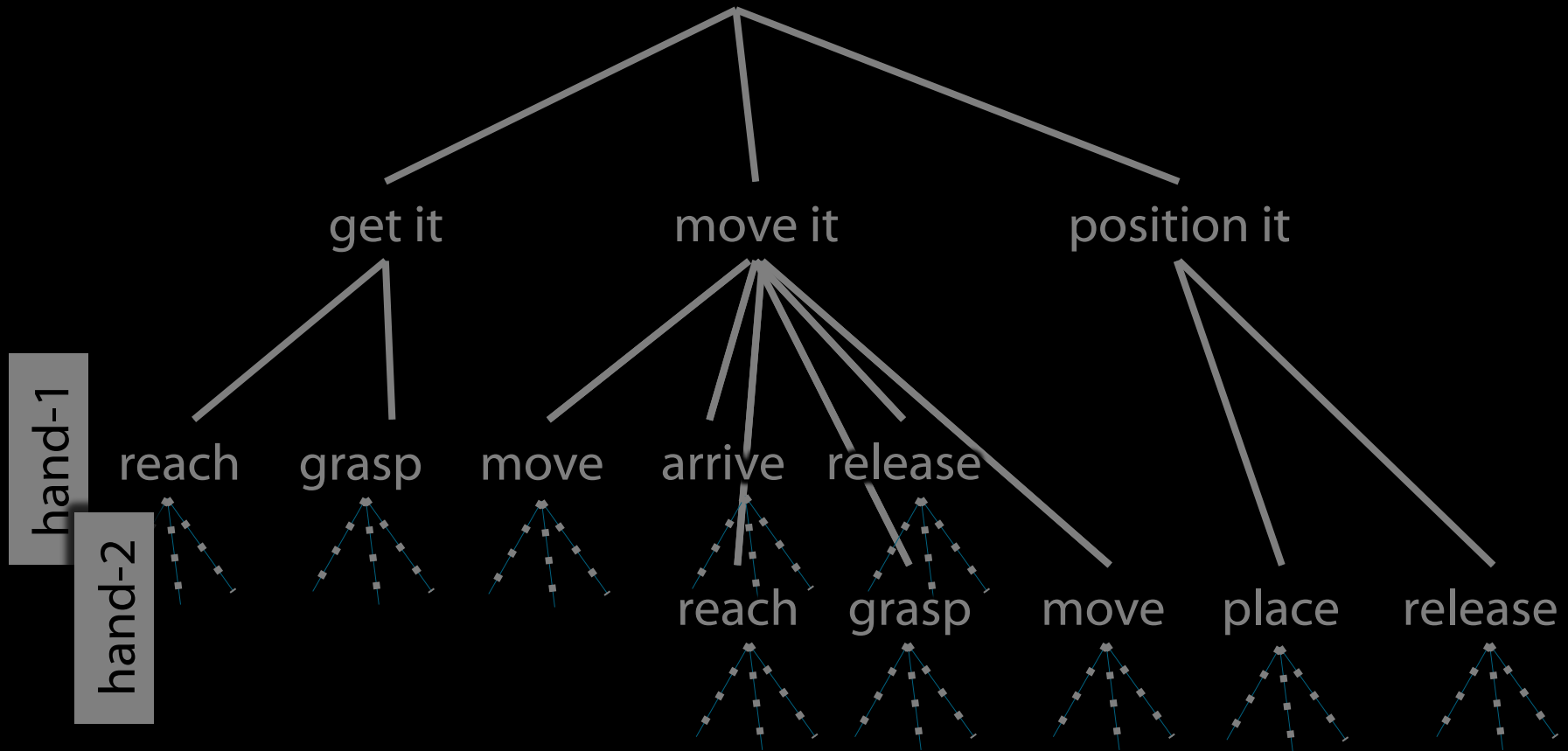
Move it from there to here



Some motor representations carry information about outcomes.

Information about outcomes guides planning.

Move it from there to here



Information about outcomes guides planning.

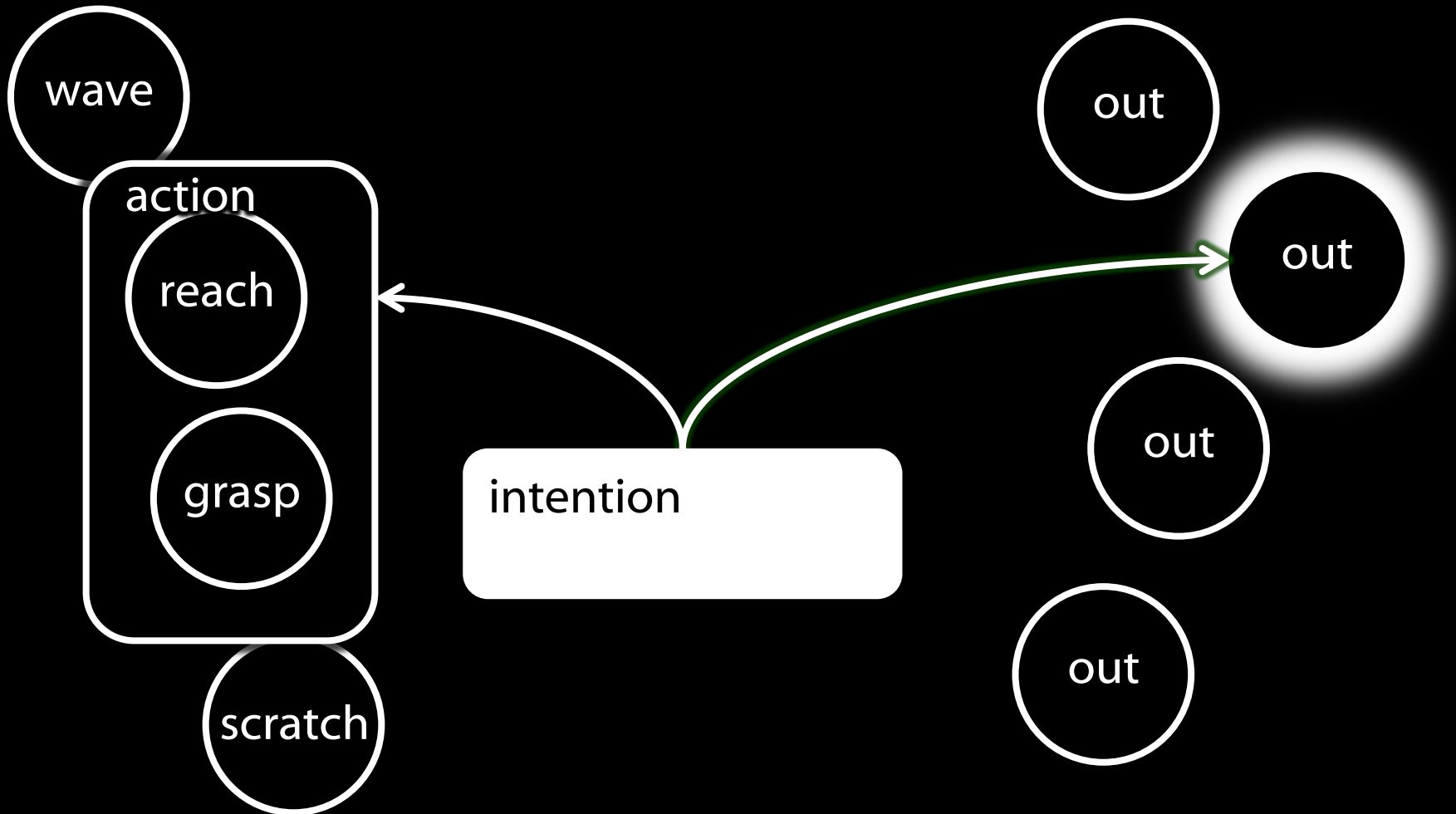
Some motor representations represent outcomes

The diagram illustrates a hierarchical task decomposition for a two-handed robotic system. The root node branches into three main categories: 'get it', 'move it', and 'position it'. Each category further decomposes into specific actions for 'hand-1' and 'hand-2'.

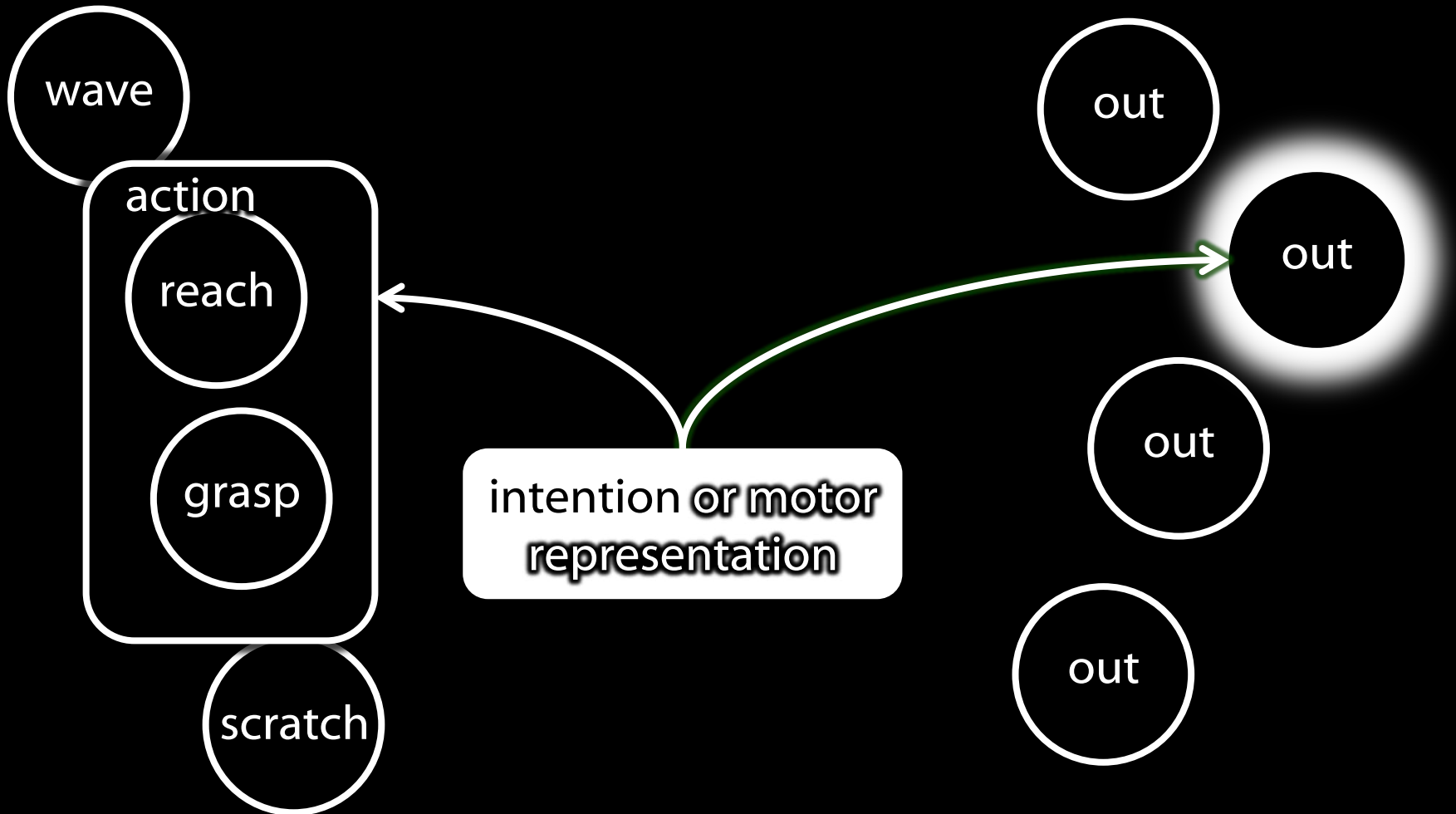
- get it**
 - hand-1: reach
 - hand-2: grasp
- move it**
 - hand-1: move
 - hand-2: arrive
 - hand-1: release
 - hand-2: reach
 - hand-1: grasp
 - hand-2: move
 - hand-1: place
 - hand-2: release
- position it**
 - hand-1: move
 - hand-2: place
 - hand-1: release

Each sub-task is represented by a small diagram of a hand with fingers and a wrist, indicating the specific pose or action required for that task.

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



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



motor representation = intention ? No !

< different content >



< different content >

< different format >

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.



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

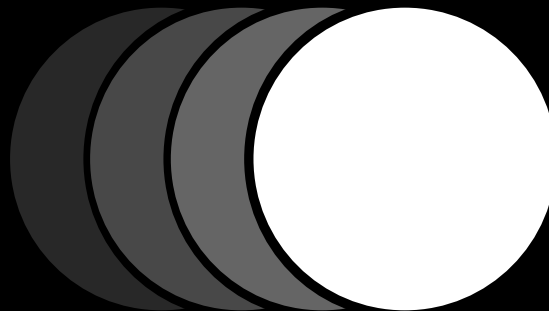


imagine

actually

seeing

seeing



imagine

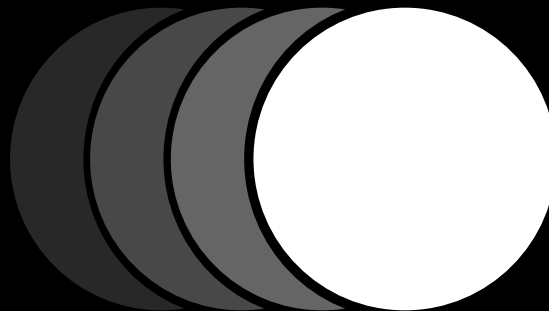
actually

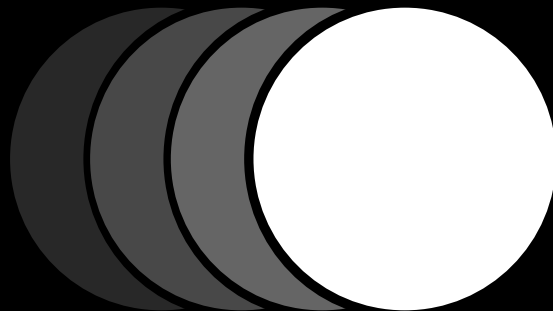
seeing

acting

seeing

acting





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.

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.



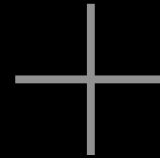
All intentions are propositional attitudes.

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.

All intentions are propositional attitudes.



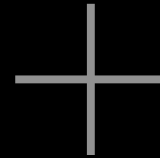
No motor representations are propositional attitudes.

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.

All intentions are propositional attitudes.



No motor representations are propositional attitudes.

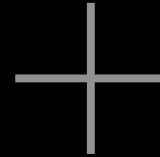
No motor representations are intentions

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.

All intentions are propositional attitudes.



No motor representations are propositional attitudes.

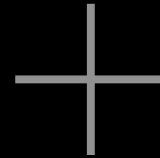
No motor representations are intentions

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.

All intentions are propositional attitudes.



No motor representations are propositional attitudes.

No motor representations are intentions

The Interface Problem

The Interface Problem

Some actions involve both
intention and motor
representation

The Interface Problem

motor representations:

i. represent outcomes;

ii. ground the
purposiveness of some
joint actions

Some actions involve both
intention and motor
representation

The Interface Problem

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
occurrence of B or vice versa.

Some actions involve both
intention and motor
representation

The Interface Problem: How are non-accidental matches possible?

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
occurrence of B or vice versa.

Some actions involve both
intention and motor
representation

The Interface Problem: How are non-accidental matches possible?

motor representations:

i. represent outcomes;

ii. ground the
purposiveness of some
joint actions; and

iii. differ in format from
intentions.

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
occurrence of B or vice versa.

Some actions involve both
intention and motor
representation

The Interface Problem: How are non-accidental matches possible?

motor representations:

i. represent outcomes;

ii. ground the
purposiveness of some
joint actions; and

iii. differ in format from
intentions.

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
occurrence of B or vice versa.

Some actions involve both
intention and motor
representation

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



?

Follow *that* route

=



?

Follow *that* route

=



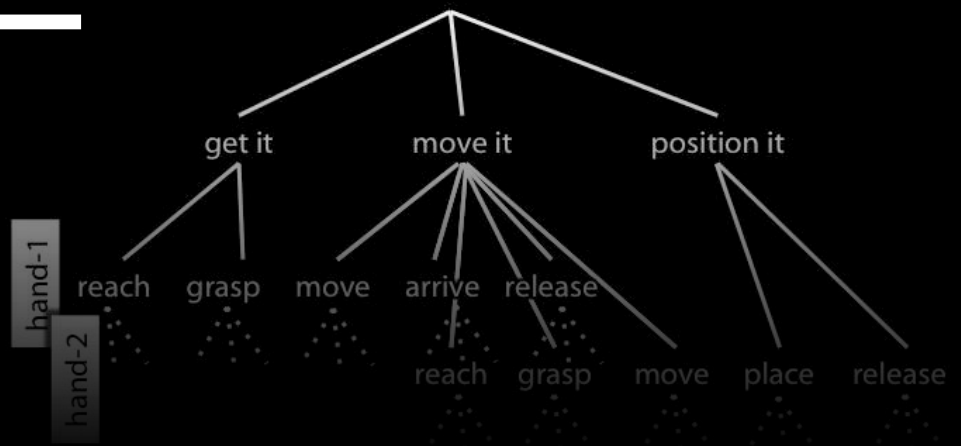
?

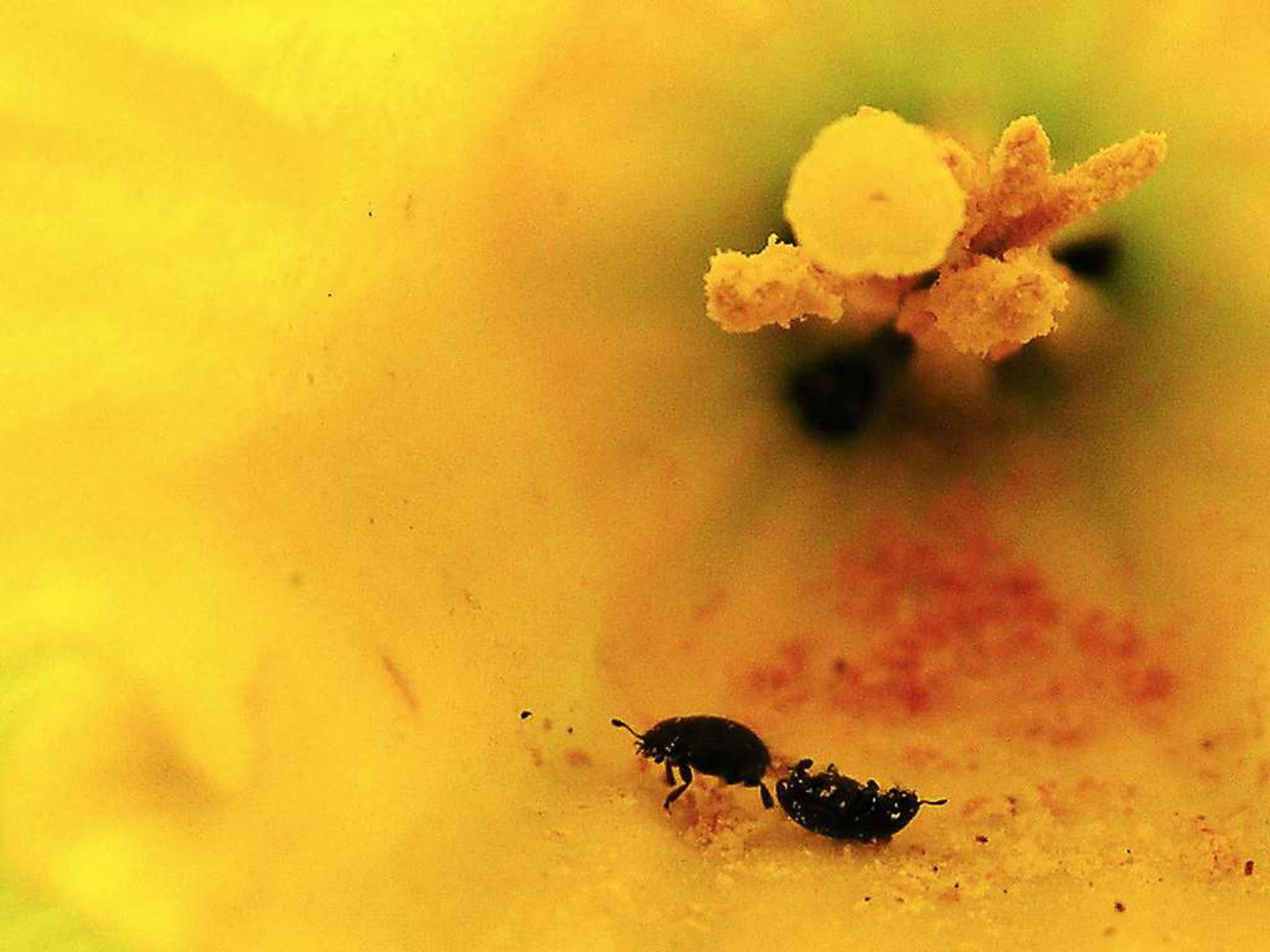
Do that

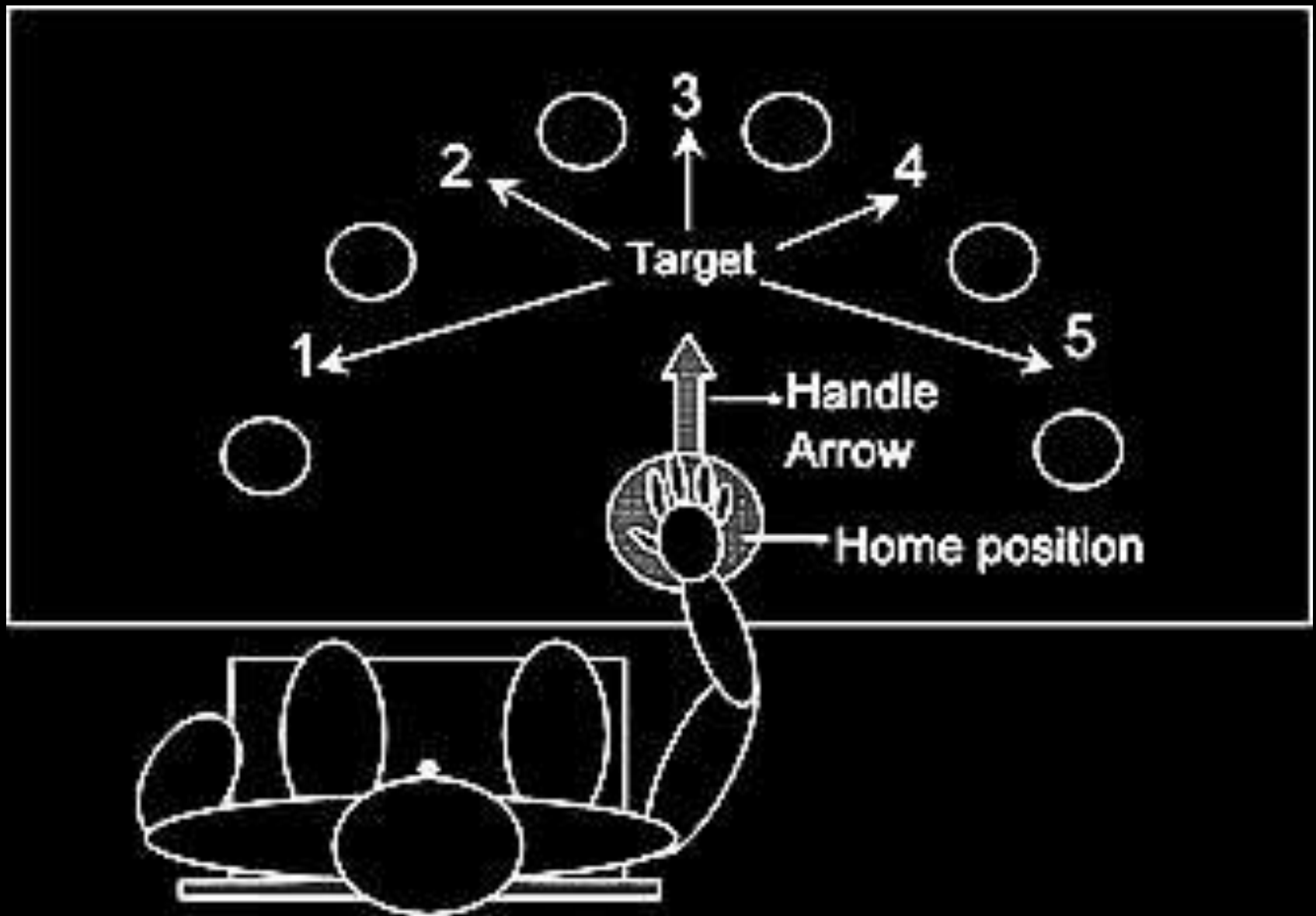
=

Move it from there to here

?



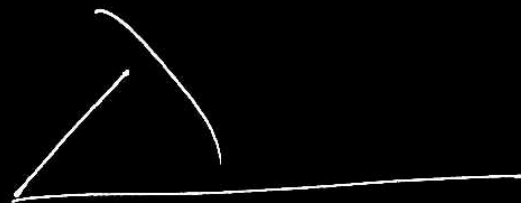
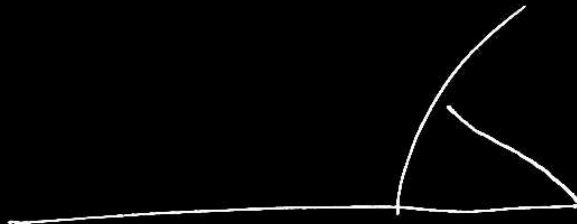




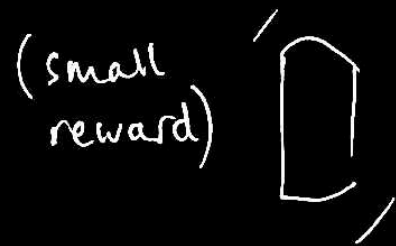
(Zhang and Rosenbaum 2007)



(big
reward)



↑
ONE
WAY



x

start here