

Relationship to Robotics



Stimulus Enhancement

An observer is drawn to objects others interact with.



Emulation

An observer witnesses someone produce a particular result on an object.



?



?

Object

Action

Result



?



Object

Action

Result

Stimulus Enhancement Same Object



Mimicking

The observer copies the actions of others without an appreciation of their purpose.



Emulation Same Object, Same Results

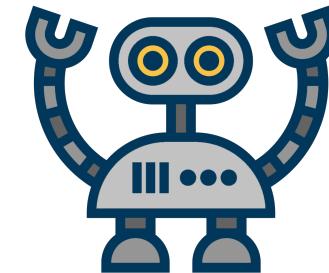


Imitation

The observer reproduces the actions of others to obtain the same results with the same goal.



Can **robots** benefit from **social learning**? If so, which one is the “**best**” one?





Learning is Social



Exploiting Social Partners in Robot Learning

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Human-Robot Co-Creativity: Task Transfer on a Spectrum of Similarity

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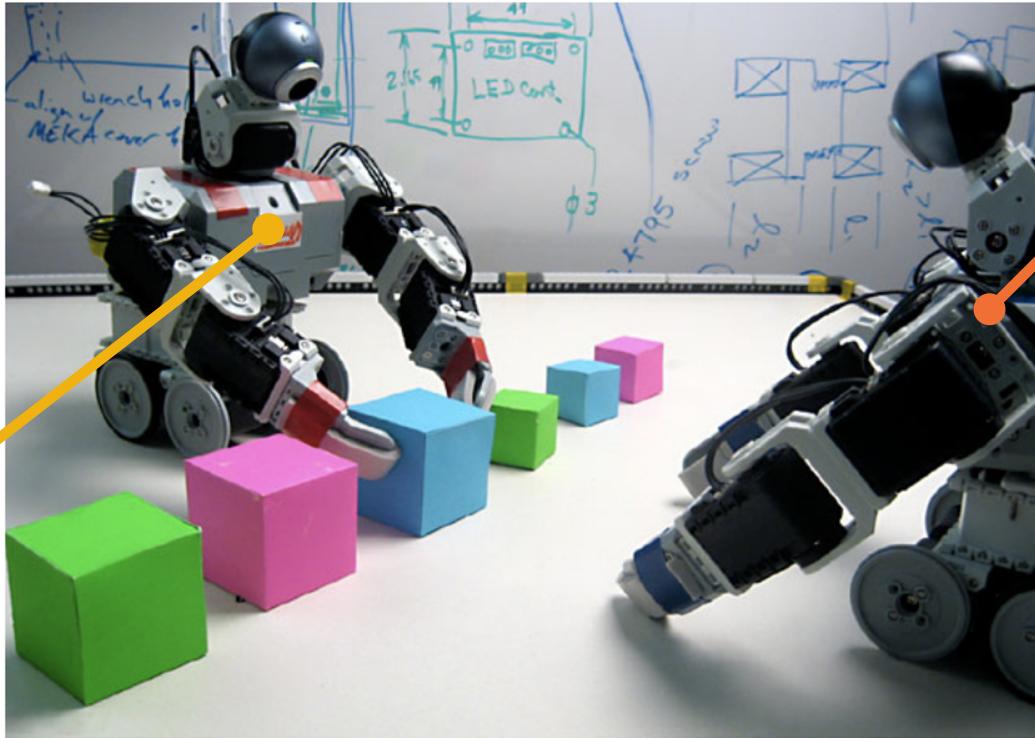


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Learning a “sound-making” affordance for different objects in the environments



**Social
Partner
(Teacher)**



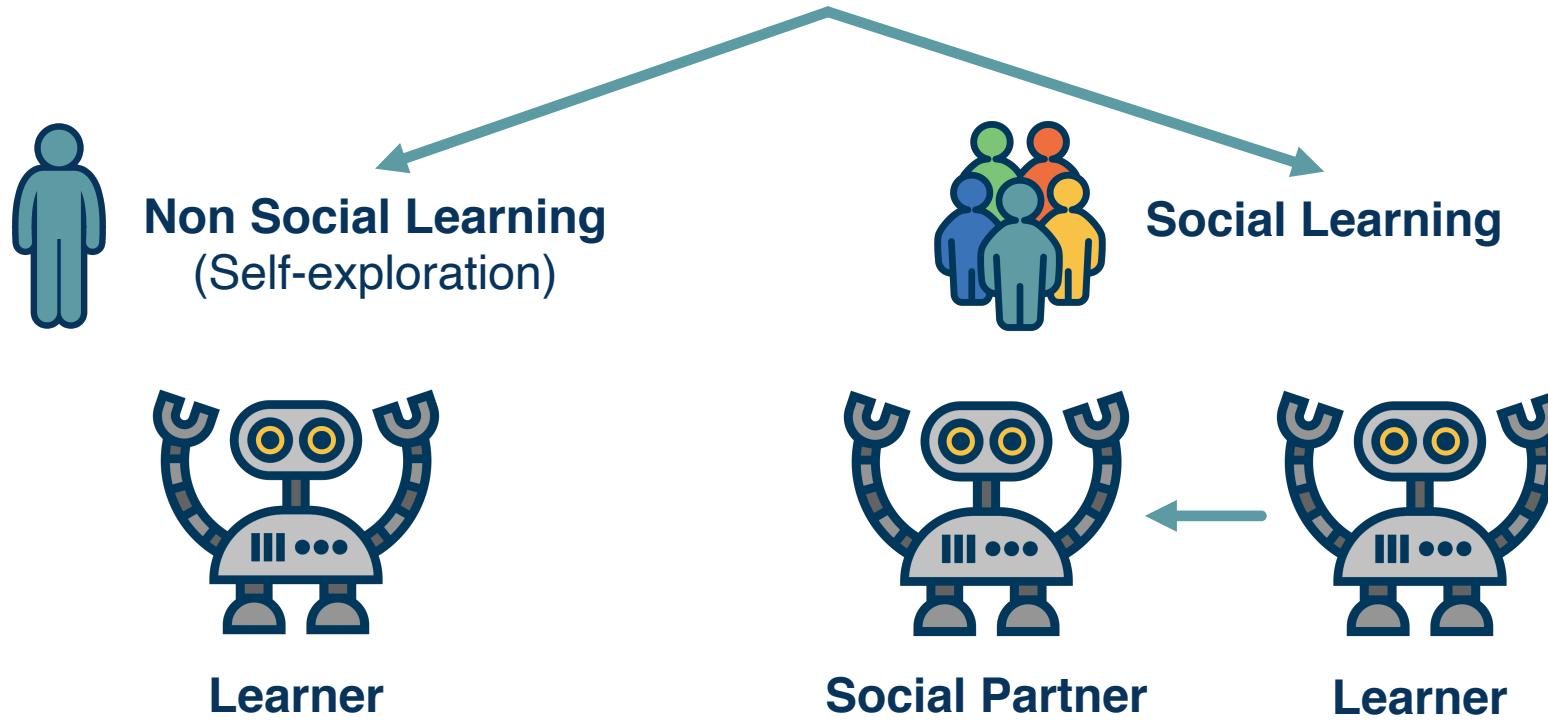
**Observer
(Learner)**

Experiment

Image from Cakmak et al., 2010

Georgia Tech

Learning a “sound-making” affordance for different objects in the environments



Experiment



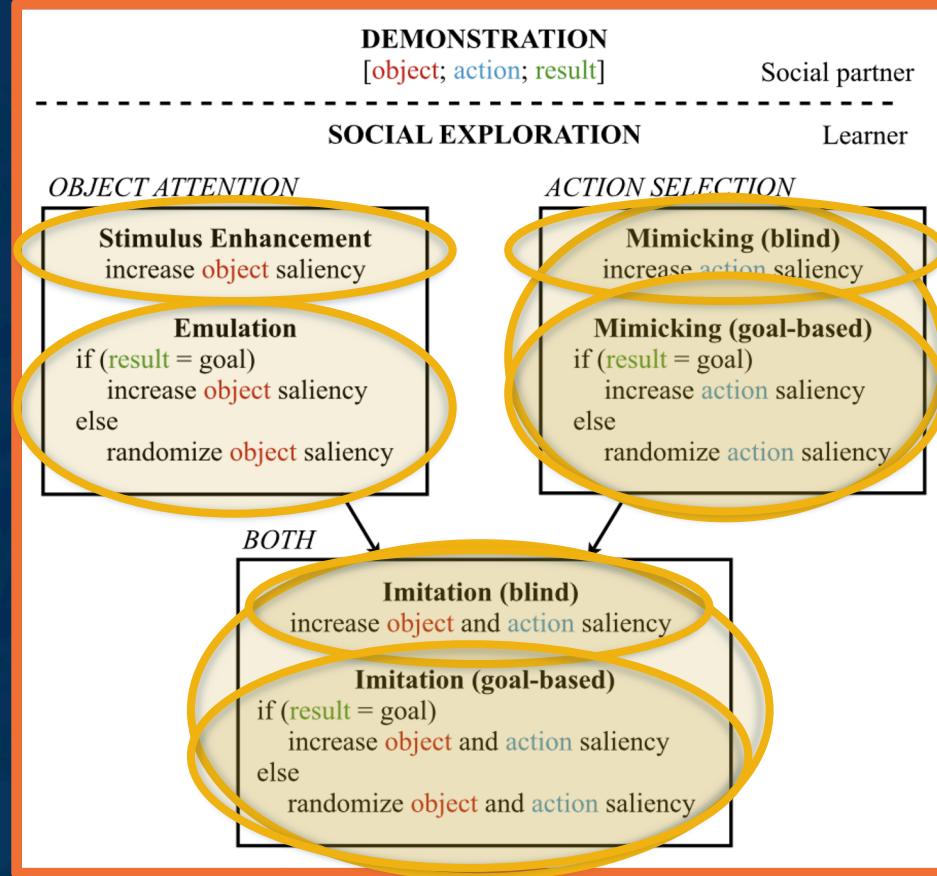
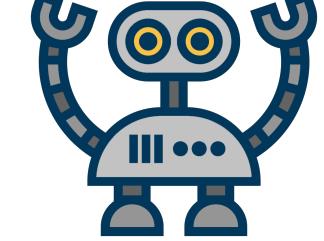


Image from Cakmak et al., 2010

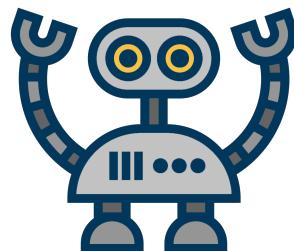
Implementation of Social Learning Mechanisms



Social Partner



(Same Goal)

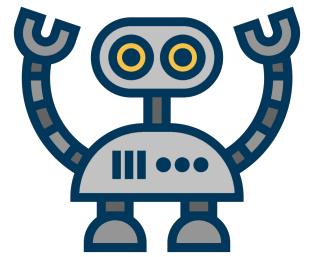


Learner



Stimulus Enhancement
Emulation
Imitation

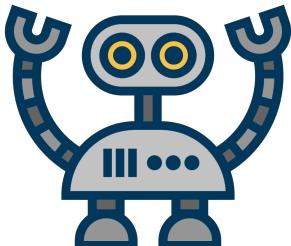
Behavior of Social Partner



Social Partner



(Different
Goal)

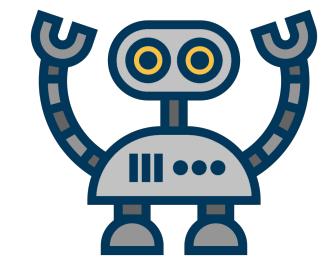


Learner



Stimulus Enhancement
Emulation
Imitation

Behavior of Social Partner



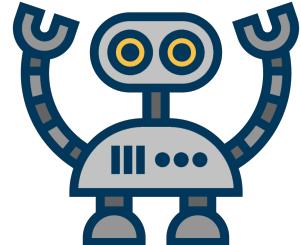
Social Partner



Poke



Grasp



Learner



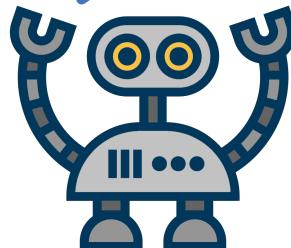
Mimicking
Imitation

Environment

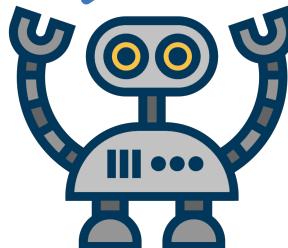
Environment: Action Selection



Imitation is not always possible



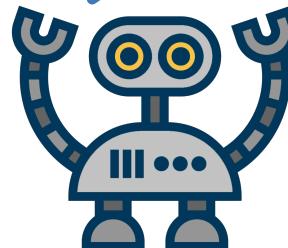
Social
Partner



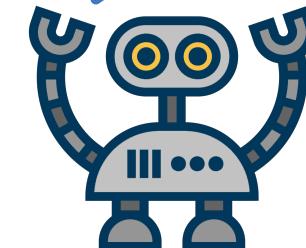
Learner



Imitation does not take full advantage of a social partner



Social
Partner



Learner

Is *Imitation* the “Best” Social Learning Strategy?

Discussion:

What are the assumptions of social learning and what are the limitations of them? What happens when those assumptions fail?



Is the teacher
rational, ethical,
and trustworthy?



Is it culturally
situated?

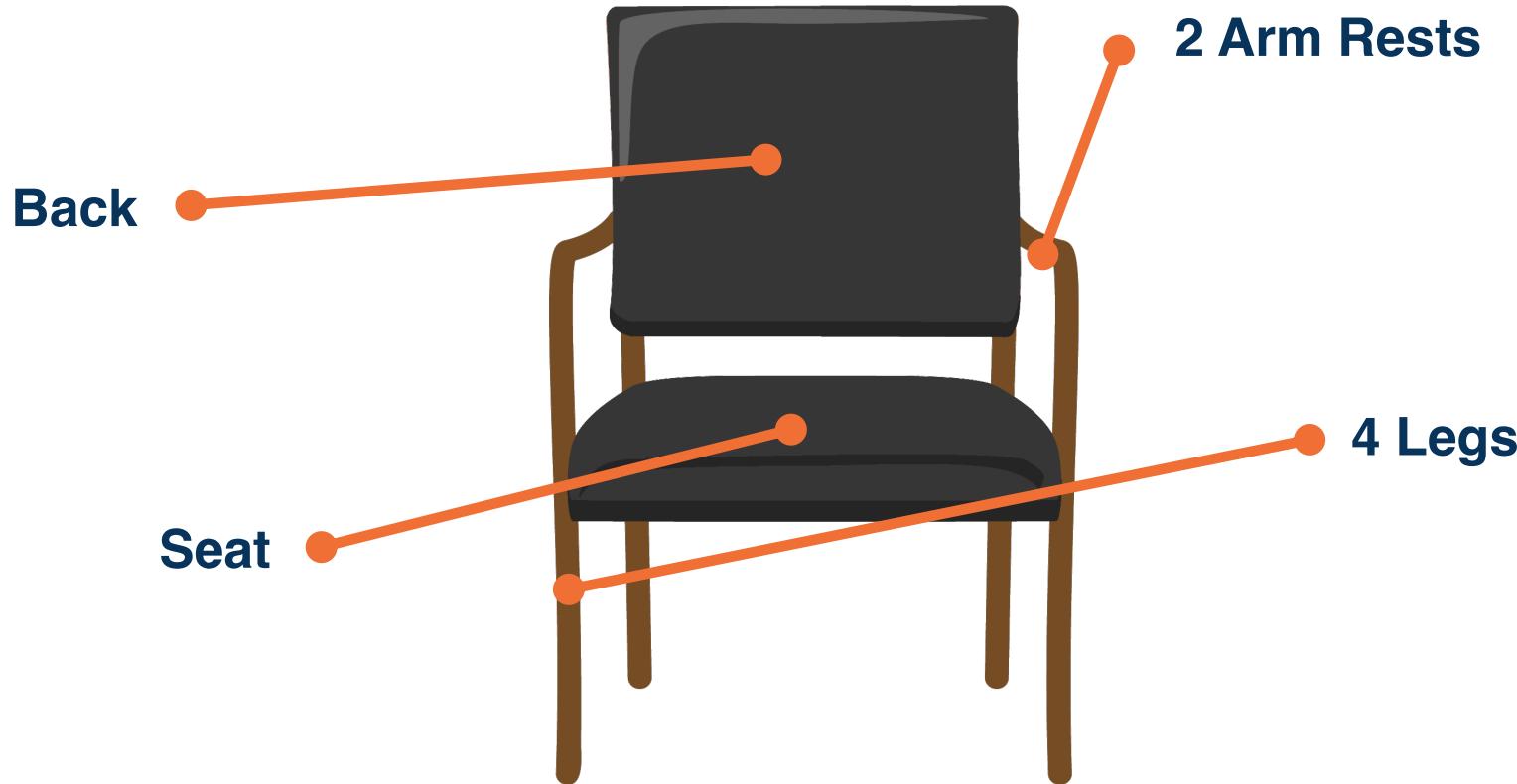


Are behaviors
observable and
learnable?

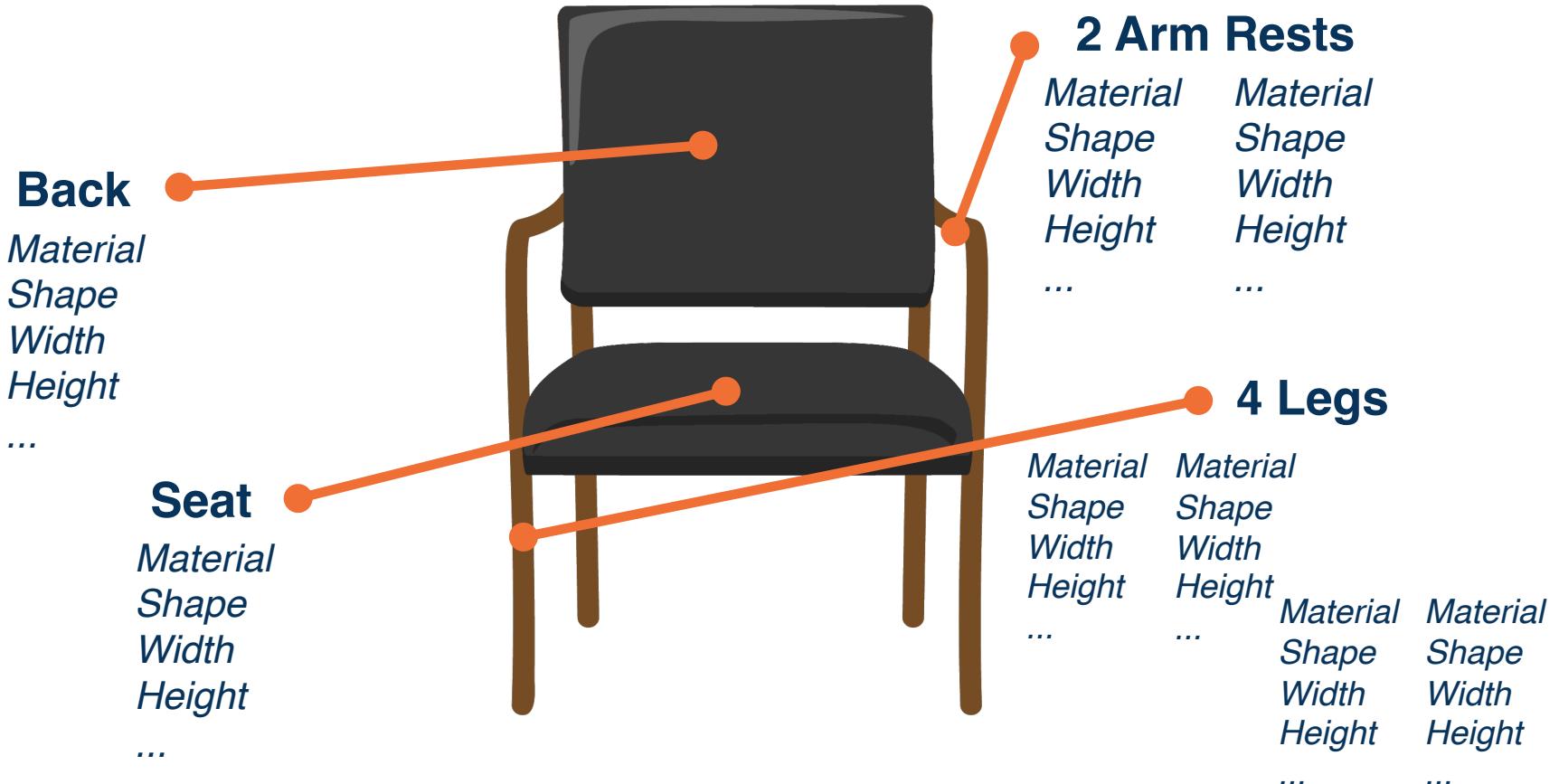


Is there one
single goal?

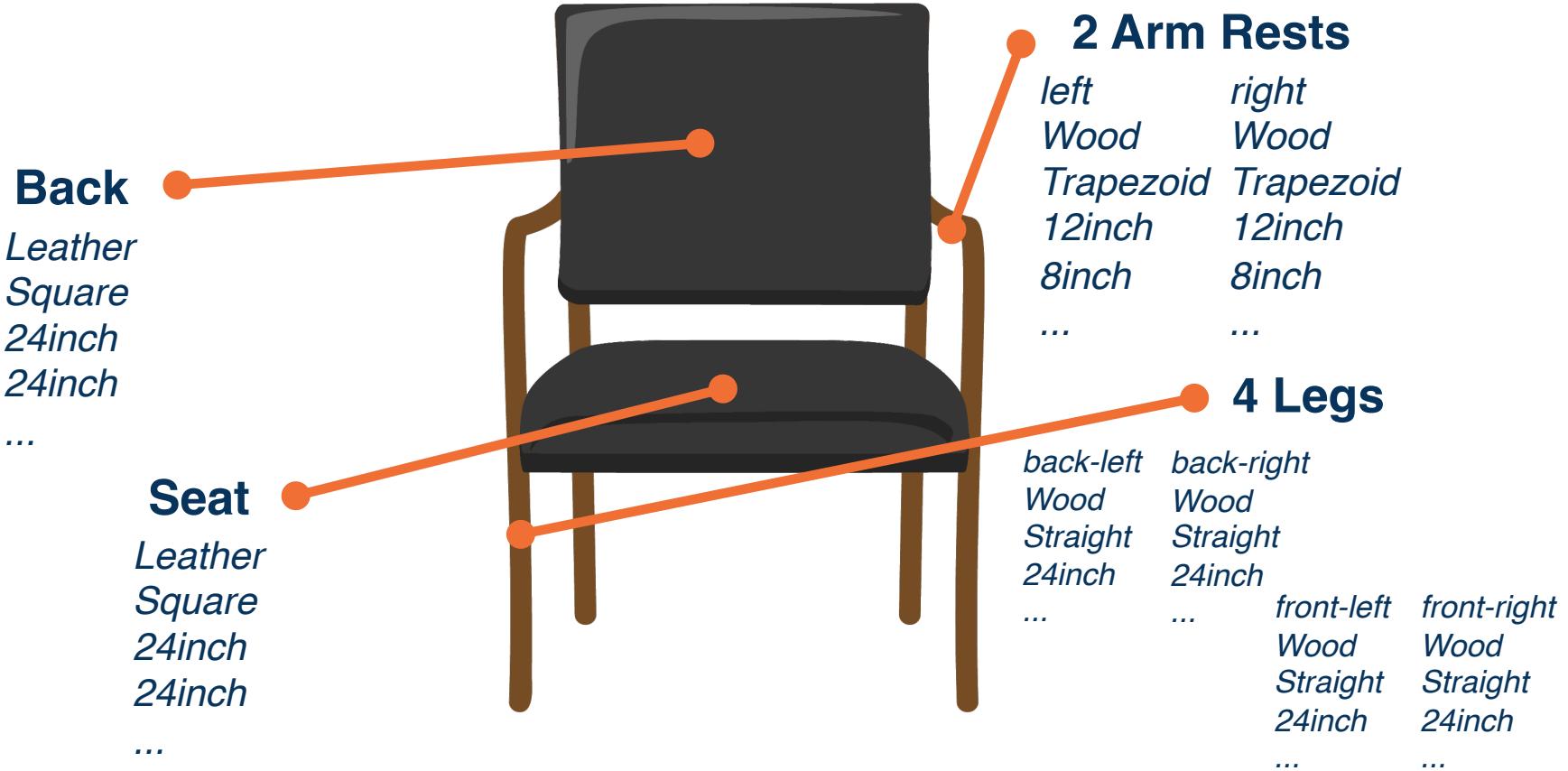
Assumptions about Social Learning



Discussion: Building a Chair



Discussion: Building a Chair



Discussion: Building a Chair

Value Change: Chair with Short Legs

Back

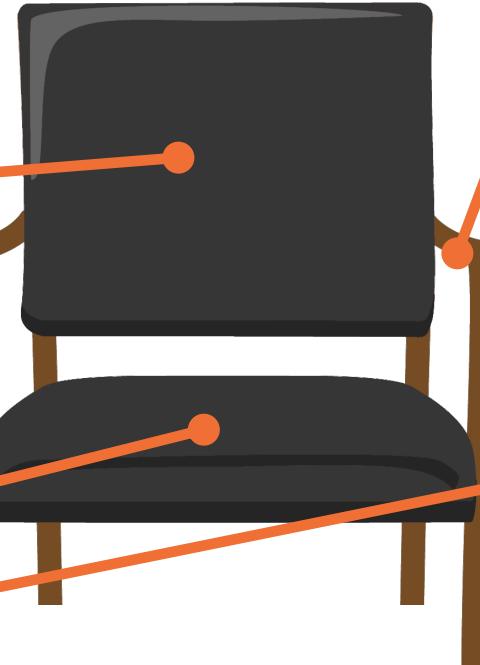
Leather
Square
24inch
24inch

...

Seat

Leather
Square
24inch
24inch

...



2 Arm Rests

left	right
Wood	Wood
Trapezoid	Trapezoid
12inch	12inch
8inch	8inch
...	...

4 Legs

back-left	back-right	front-left	front-right
Wood	Wood	Wood	Wood
Straight	Straight	Straight	Straight
12inch	12inch	12inch	12inch
...

Low Creativity

Variable Change: Chair Made of Gold

Back

Gold

Square

24inch

24inch

...

Seat

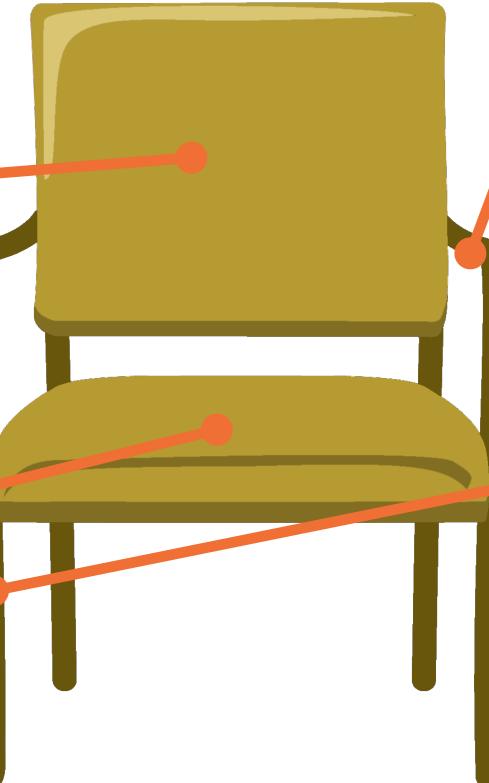
Gold

Square

24inch

24inch

...



2 Arm Rests

left

Gold

Trapezoid

12inch

8inch

...

right

Gold

Trapezoid

12inch

8inch

...

4 Legs

back-left

Gold

Straight

24inch

...

back-right

Gold

Straight

24inch

...

front-left

Gold

Straight

24inch

...

front-right

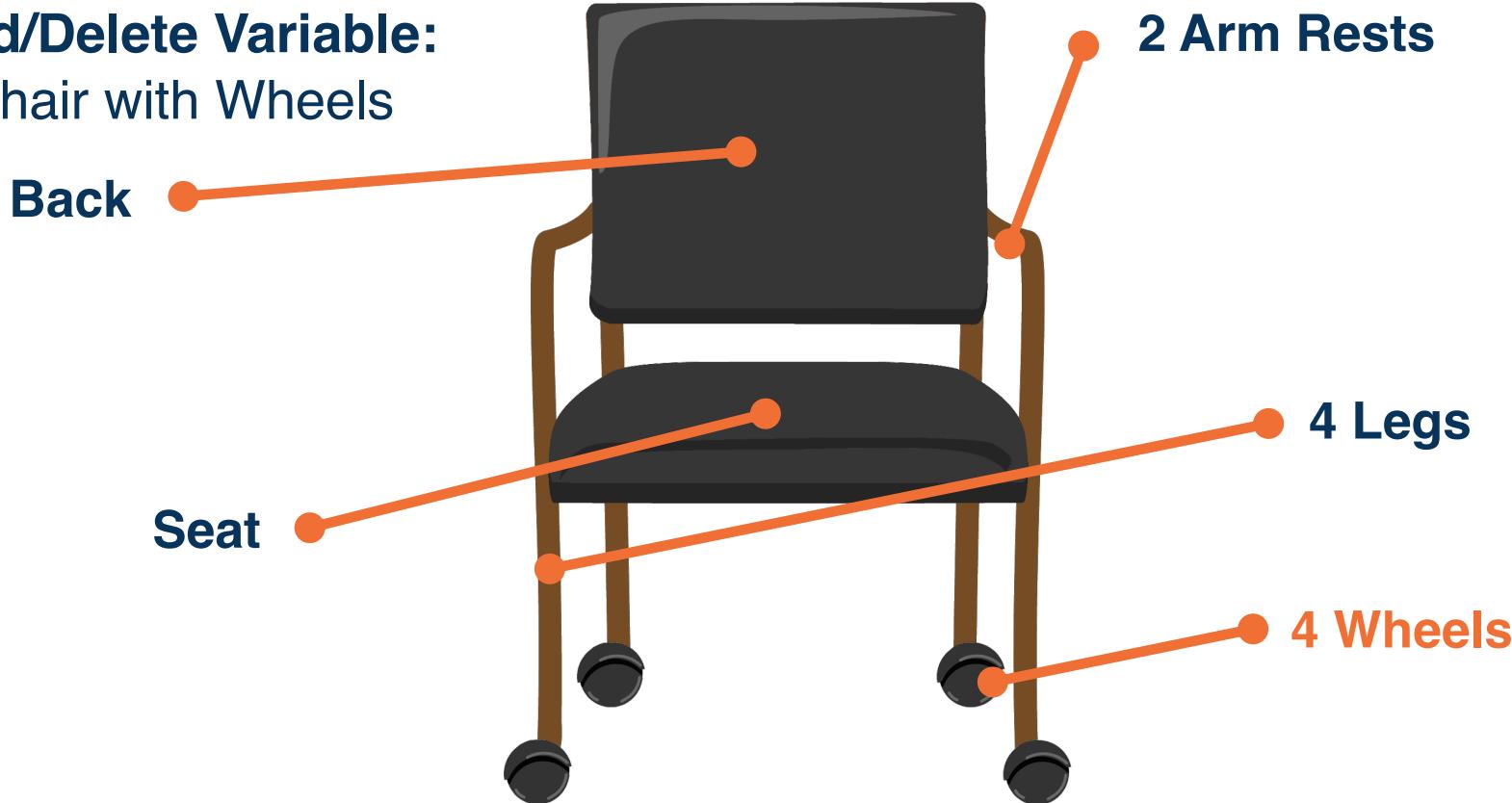
Gold

Straight

24inch

...

Add/Delete Variable: Chair with Wheels



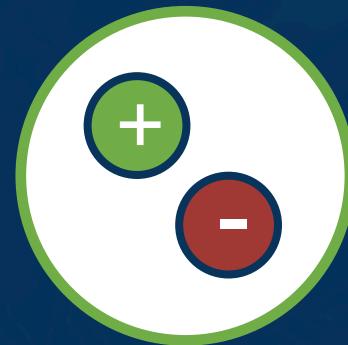
High Creativity



Change of
variable values



Change of
variable category



Addition or Deletion
of variable

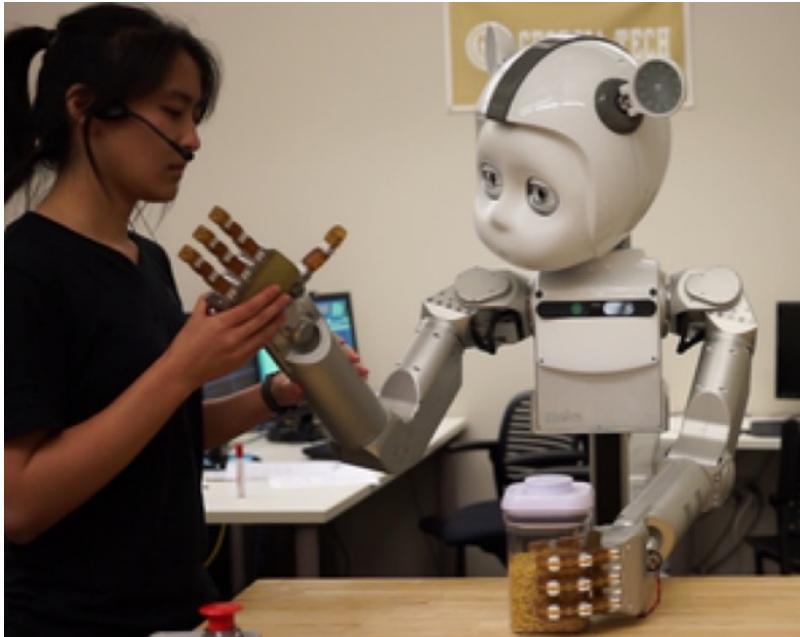


Low

High

Creativity Spectrum

Transfer the learned task to a new environment



Learn from Human Teacher



Task

Transfer the learned task to a new environment

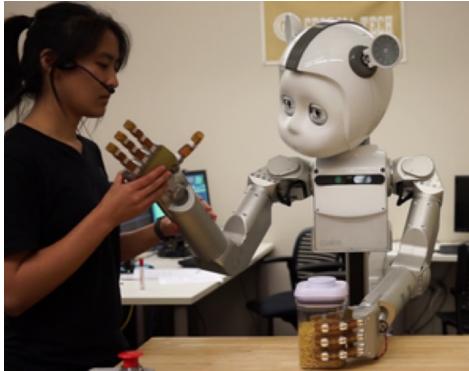


Original Environment



Target Environment
Displaced

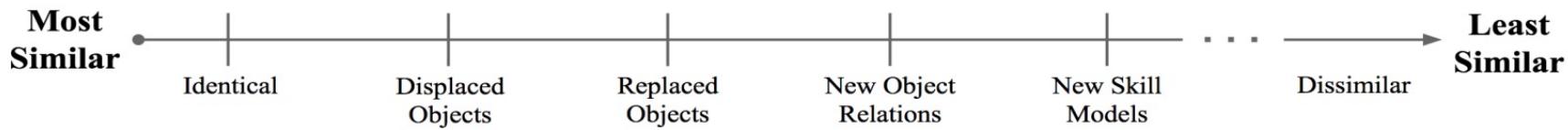
Transfer the learned task to a new environment



Reason over
past task
knowledge



Produce a new
sequence of
actions



What is **creativity**?



Novelty



Usefulness (Goal)