

5. Theory of Mind

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Theory of mind

Understanding of another person's wrong belief requires explicit representation of the wrongness of this person's belief in relation to one's own knowledge. ... [Wimmer 1983]

[Theory of mind: an ability to] impute[] mental states to themselves and others. A system of inferences of this kind is properly viewed of as a theory because such states are not directly observable, and the system can be used to make predictions about the behavior of others. As to the mental states ... for example, purpose, or intention, as well as knowledge, belief, thinking, doubt, guessing, pretending, liking, and so forth. ... [Premack 1978]

Theory of mind – false belief test



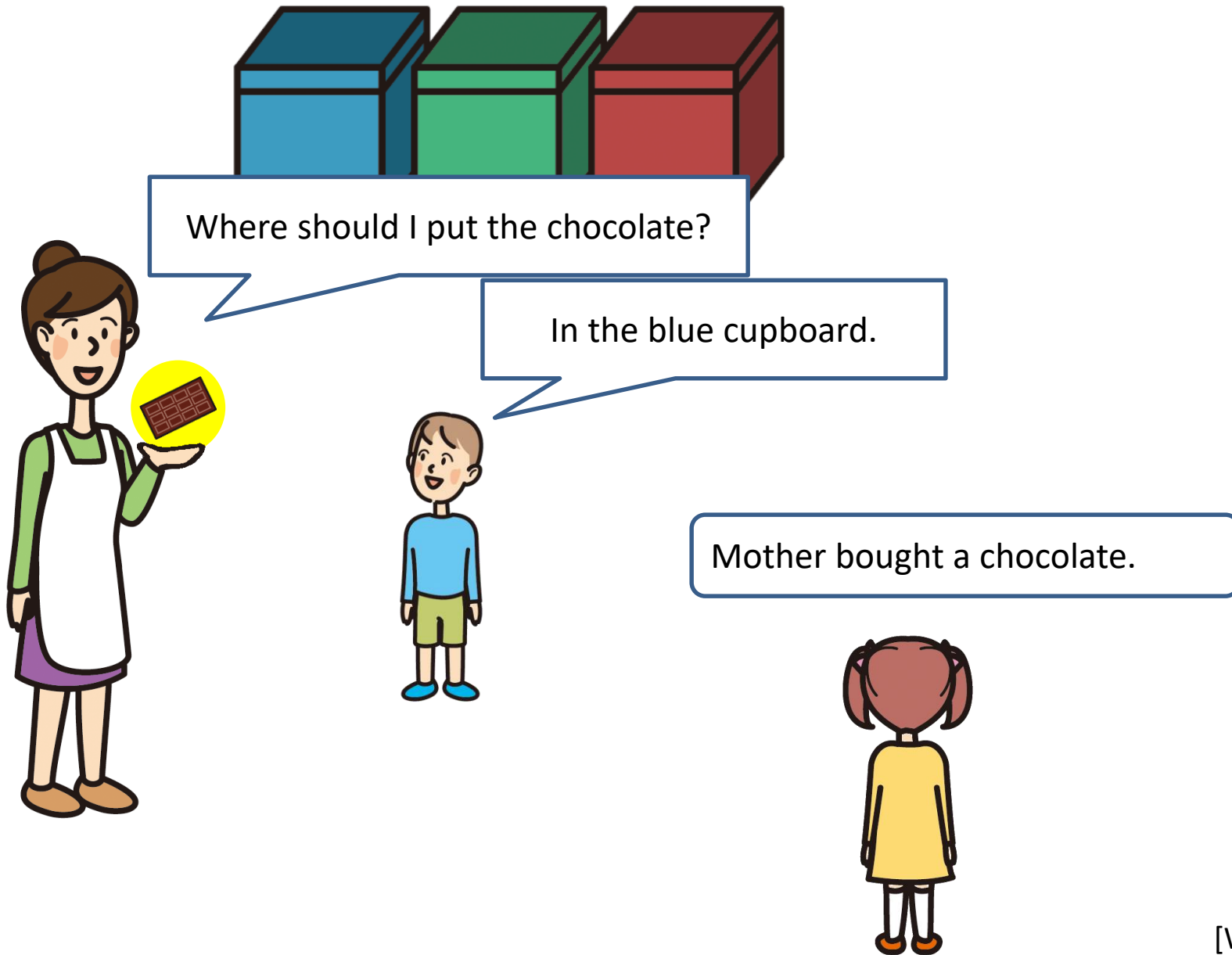
Maxi

Maxi is a boy who likes chocolate.

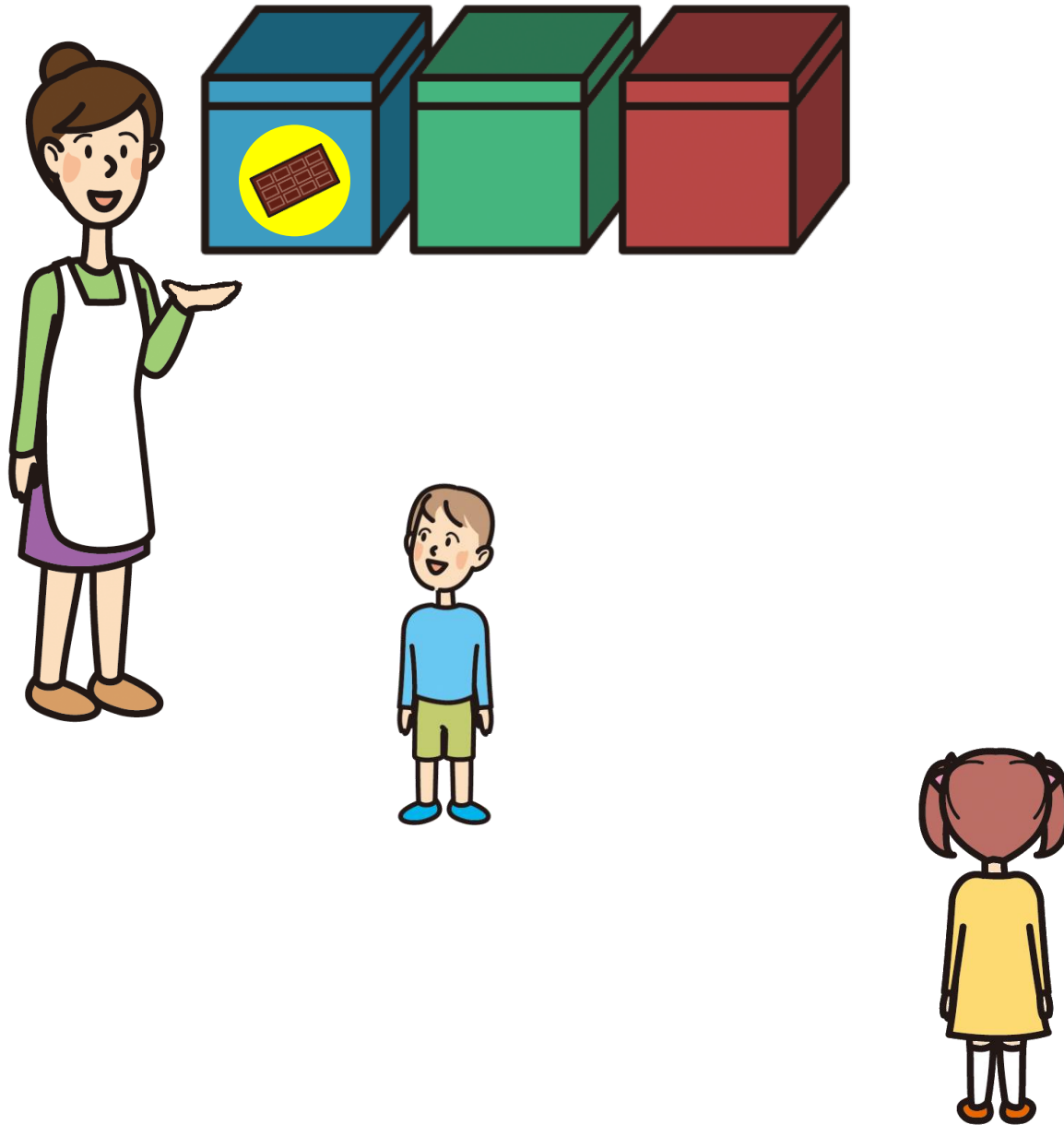


Participant

Theory of mind – false belief test



Theory of mind – false belief test



Theory of mind – false belief test



Theory of mind – false belief test



Maxi leaves for the playground.



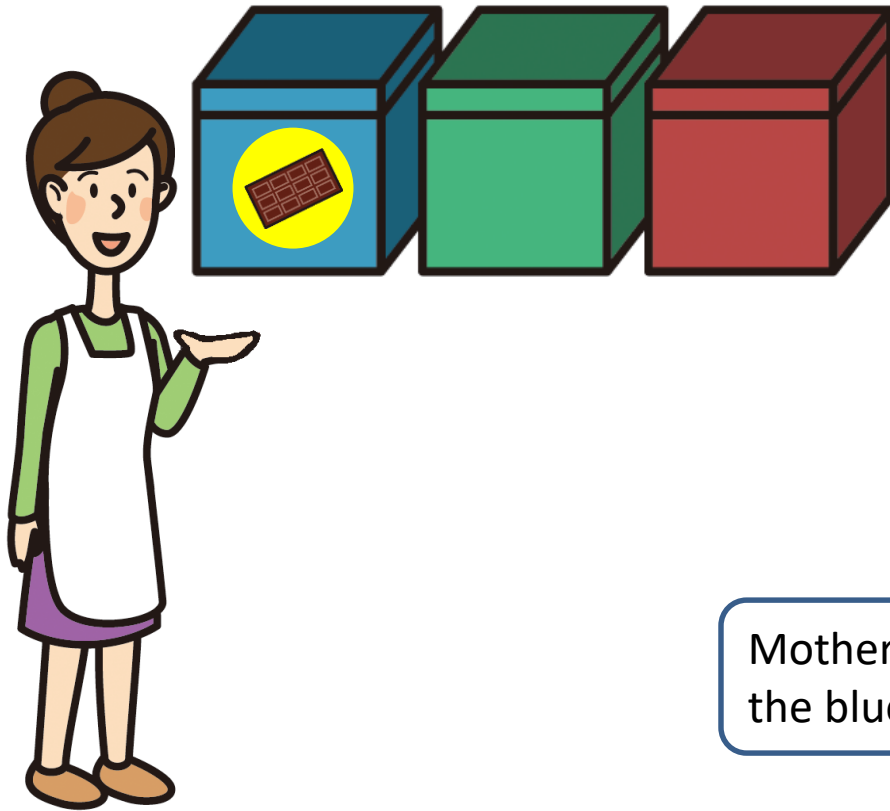
Theory of mind – false belief test



Theory of mind – false belief test



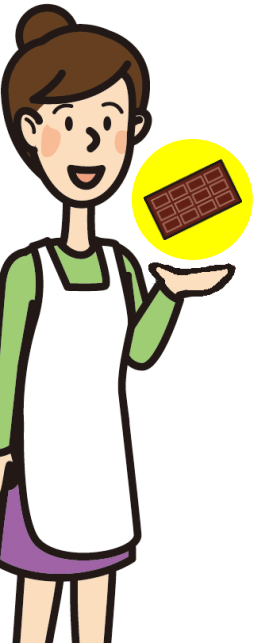
Theory of mind – false belief test



Mother takes chocolate out of the blue cupboard.



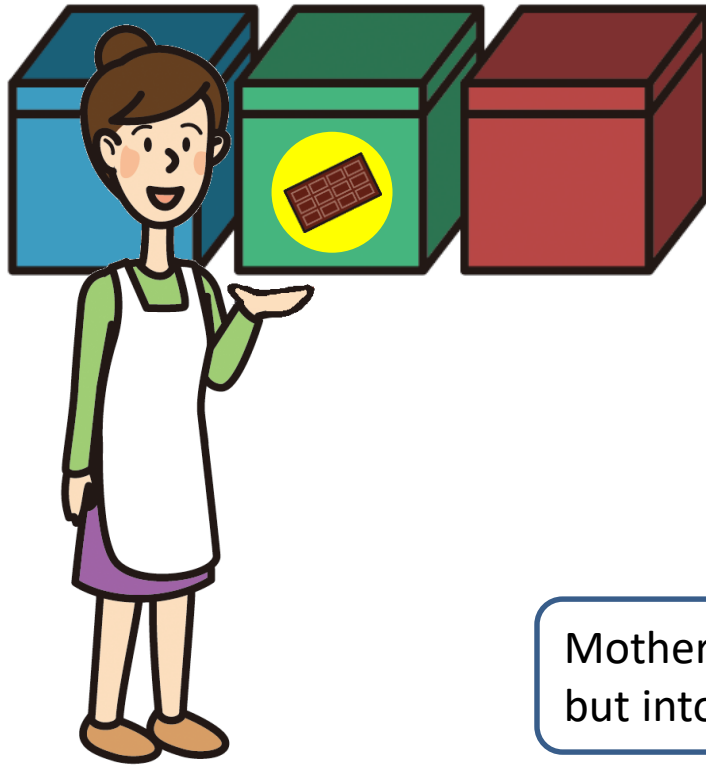
Theory of mind – false belief test



Mother grates a bit into the dough.



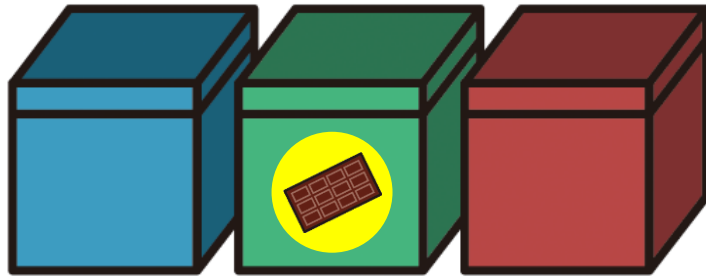
Theory of mind – false belief test



Mother does not put it back to the blue but into the green cupboard.



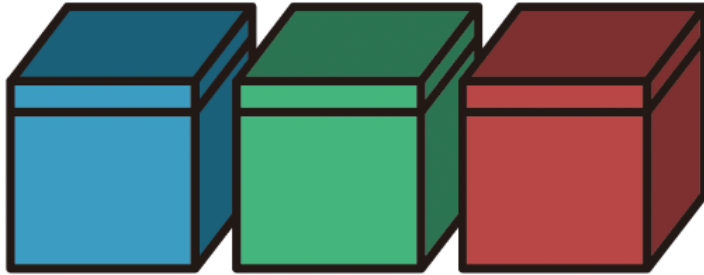
Theory of mind – false belief test



Theory of mind – false belief test



Theory of mind – false belief test



There comes Maxi back from the playground, hungry, and he wants some chocolate.

[BELIEF-question] Where will Maxi look for the chocolate?



Theory of mind – false belief test



Cooperative version



Grandpa



There comes Grandpa.
Maxi says: "Please help me get the chocolate"
Grandpa asks: "Which cupboard?"

[UTTERANCE-question] Where will Maxi say the chocolate is?

[REALITY-question] [MEMORY-question]



Theory of mind – false belief test



Competitive version



Big brother



His big brother comes into the kitchen.
He asks Maxi where the chocolate is.
Maxi wants to tell him something wrong.

[UTTERANCE-question] Where will Maxi say the chocolate is?

[REALITY-question] [MEMORY-question]



The computational architecture of theory of mind

Visual, auditory and tactile cues

Visual cues

Intention Detector (ID)

Interprets motion stimuli (stimuli with self-propulsion and direction) in terms of the mental states of goal and desire.

Eye Direction Detector (EDD)

Detects the presence of eye-like stimuli, detects the direction of eyes, and interprets gaze as seeing (attribution of perceptual states).

[Agent likes chocolate] ...

[Agent sees mother's-first-act]

[Agent not-see mother's-second-act]

Shared Attention Mechanism (SAM)

Allows to build triadic representations: relations between an agent, the self, and a third object.

Joint attention:
eye direction in terms of intention

[I see [Agent sees chocolate-in-blue-cupboard]]

[I see [Agent not-see chocolate-in-green-cupboard]]

Theory of Mind Mechanism (ToMM)

Represents the full range of mental states and allows one to make sense of an agents current behavior and predict an agents future action.

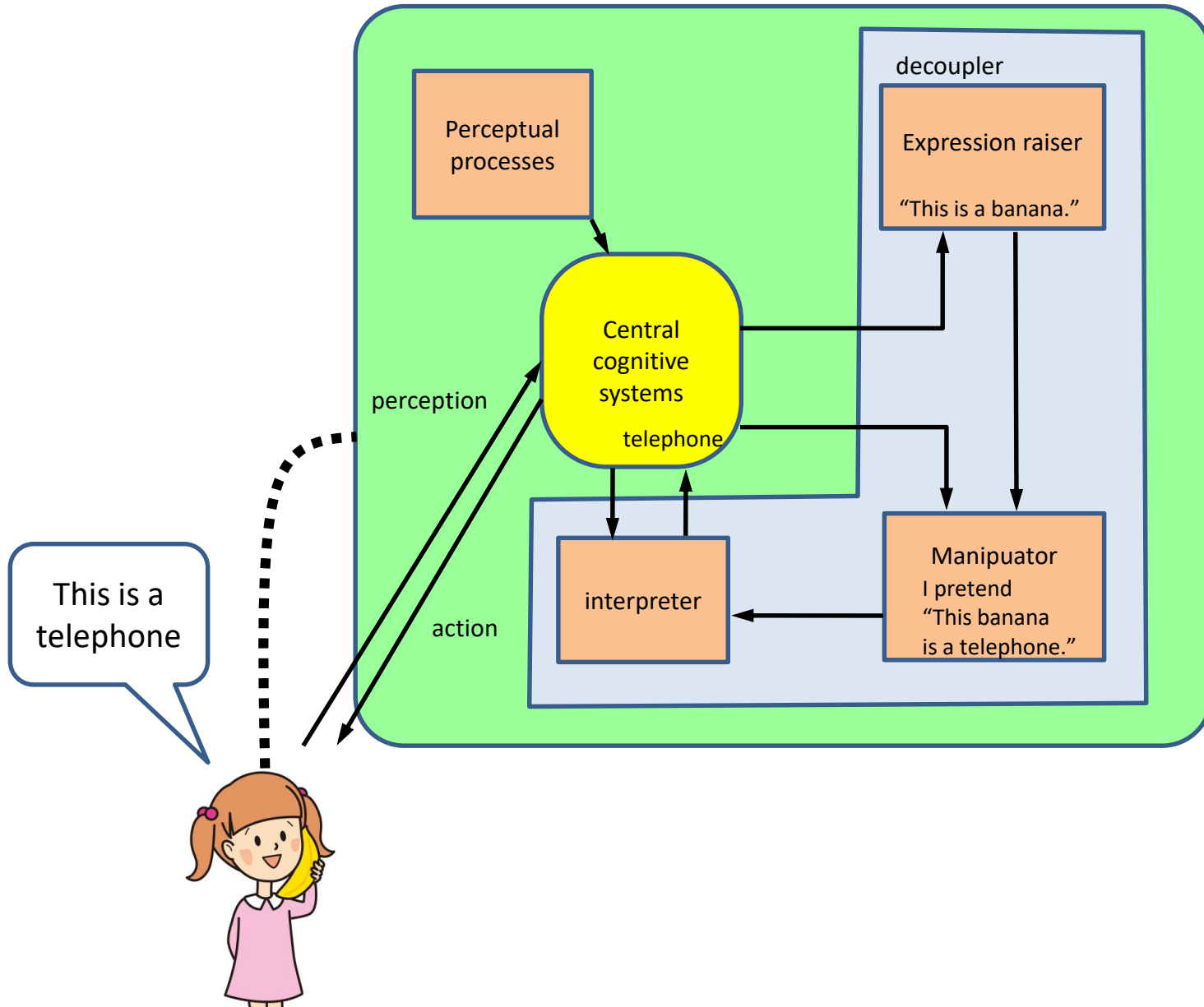
Referential opacity:
Separation of mental from physical

[Agent believes chocolate-in-blue-cupboard]

[Agent falsely-believes chocolate-in-blue-cupboard]

[Baron-Cohen 1995]

Theory of mind



References

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