Part 1: From Embodied Representation to Co-Regulation

Part 2: Imitation and the Correspondence Problem

Presented by Mike Datko

Cog Sci 171

Subjects as Passive Observers

Current research focuses on subjects that perform:

Reception - perception of a stimulus is integrated into action-observation circuits

Reproduction - Subjects may imitate perceived/received action

Representation - Subjects activate representations associated with perceived/received/reproduced action

…but don't interact!

Shared Manifold Hypothesis (Gallese)

"shared meaningful interpersonal space"

Below the level of declarative representation

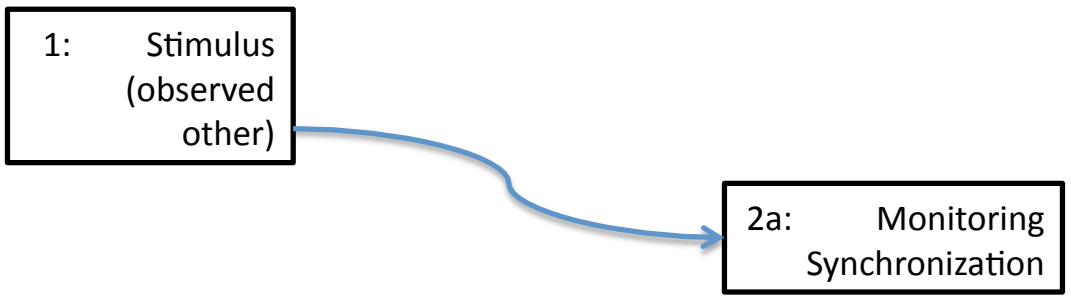
Facilitates mutual understanding of another agent's (person's) actions and emotions

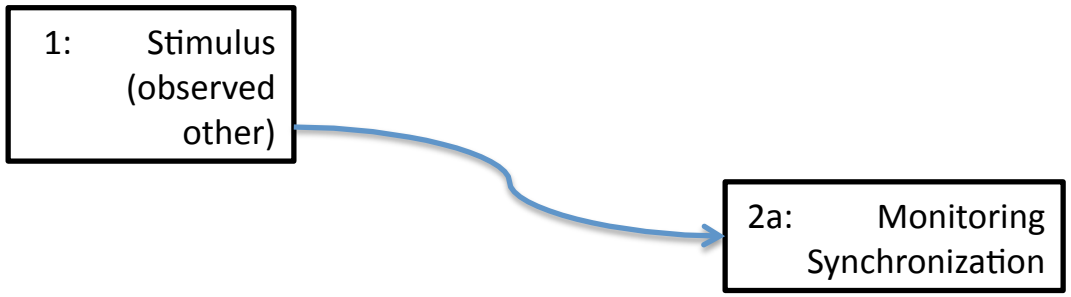
Assists in the prediction of future events

Co-regulation model

Explains how reception, reproduction, and representation are coordinated between individuals

New goals and properties can emerge from simultaneous monitoring, synchronization, and representation


1: Stimulus (observed other)
2a: Monitoring Synchronization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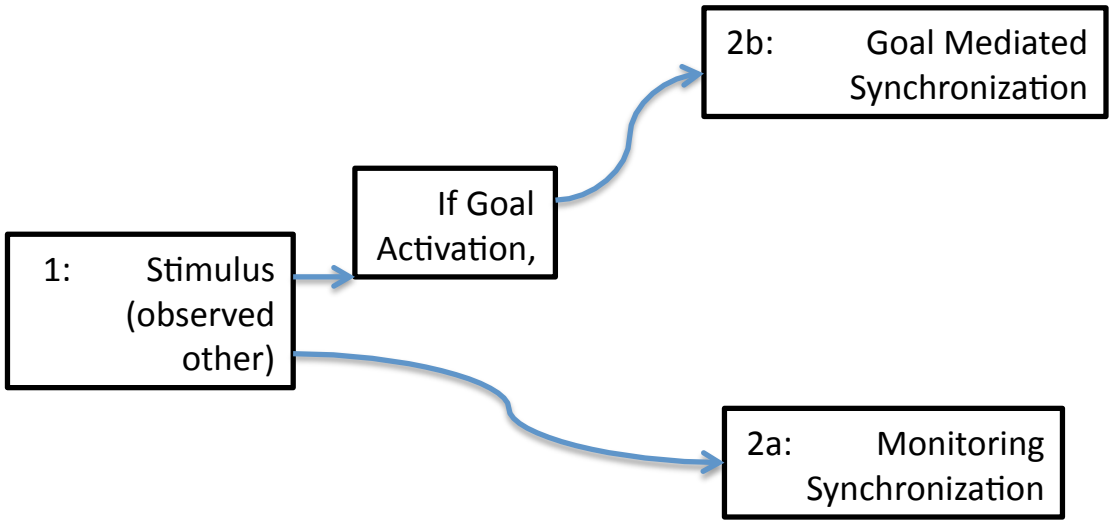
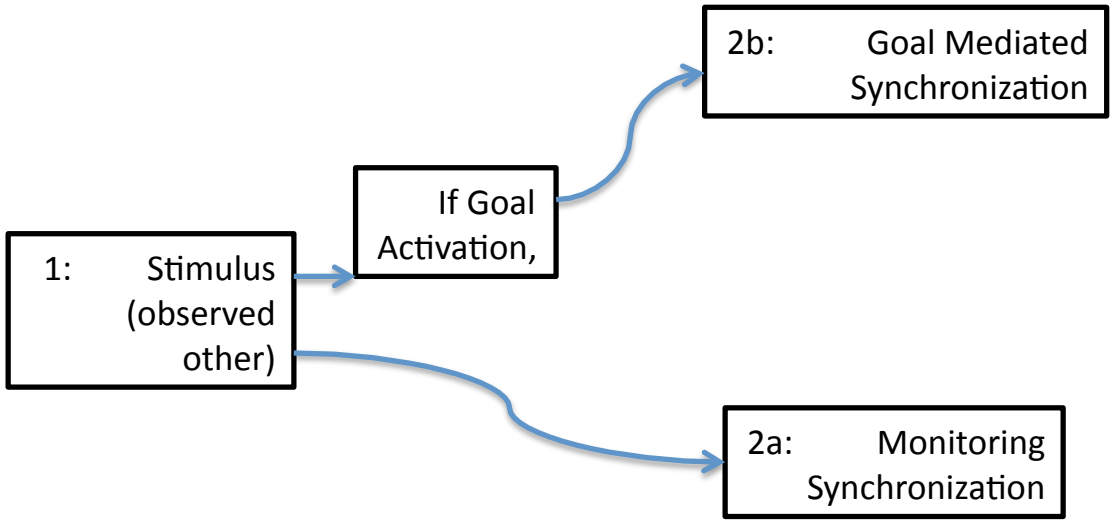
- Synchronization = jointly and simultaneously recruited sensory motor processes that are evident in a neurophysiological mirroring of the producer by the perceiver.
- Time locked to the observed stimulus.


1: Stimulus (observed other)
If Goal Activation,
2b: Goal Mediated Synchronization
2a: Monitoring Synchronization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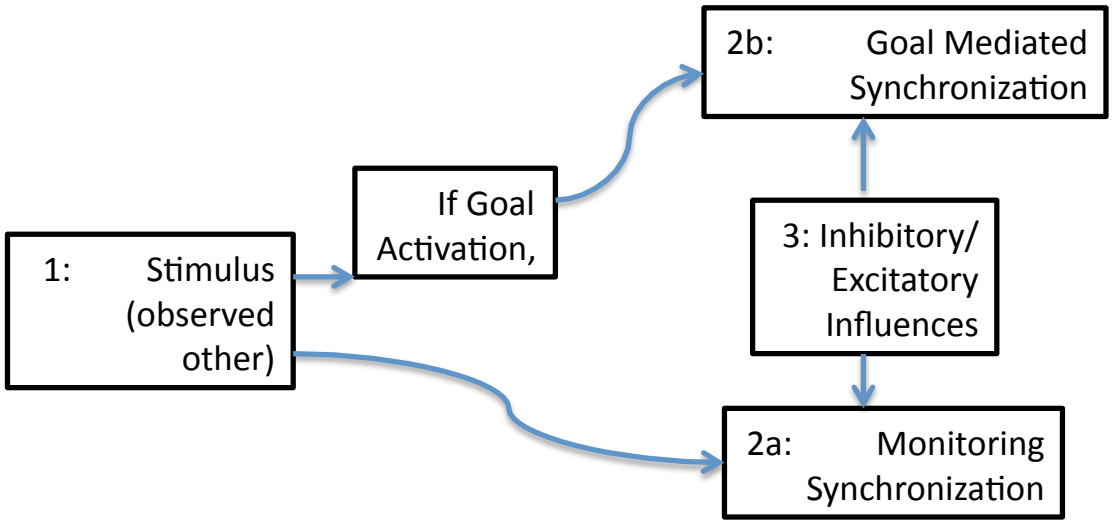
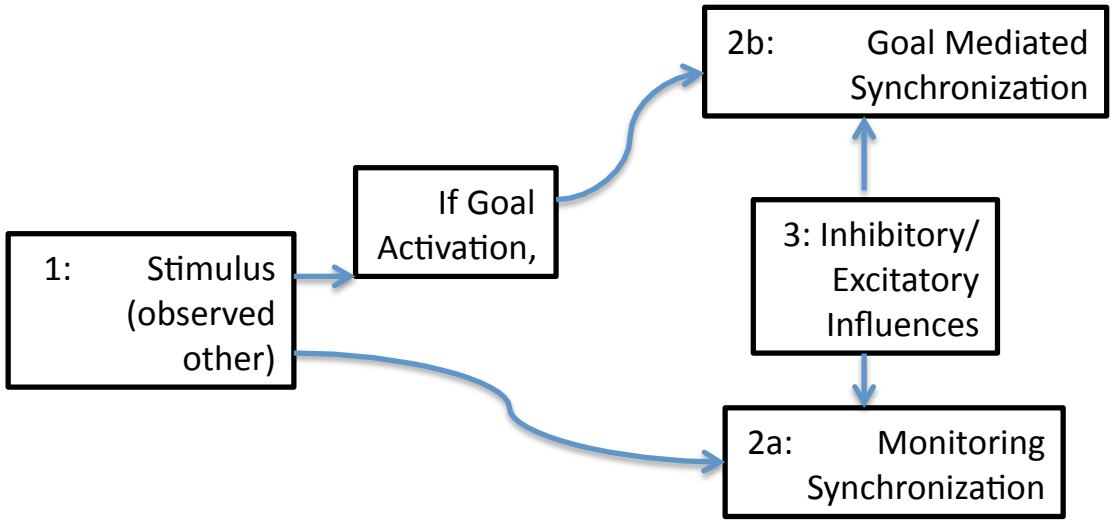
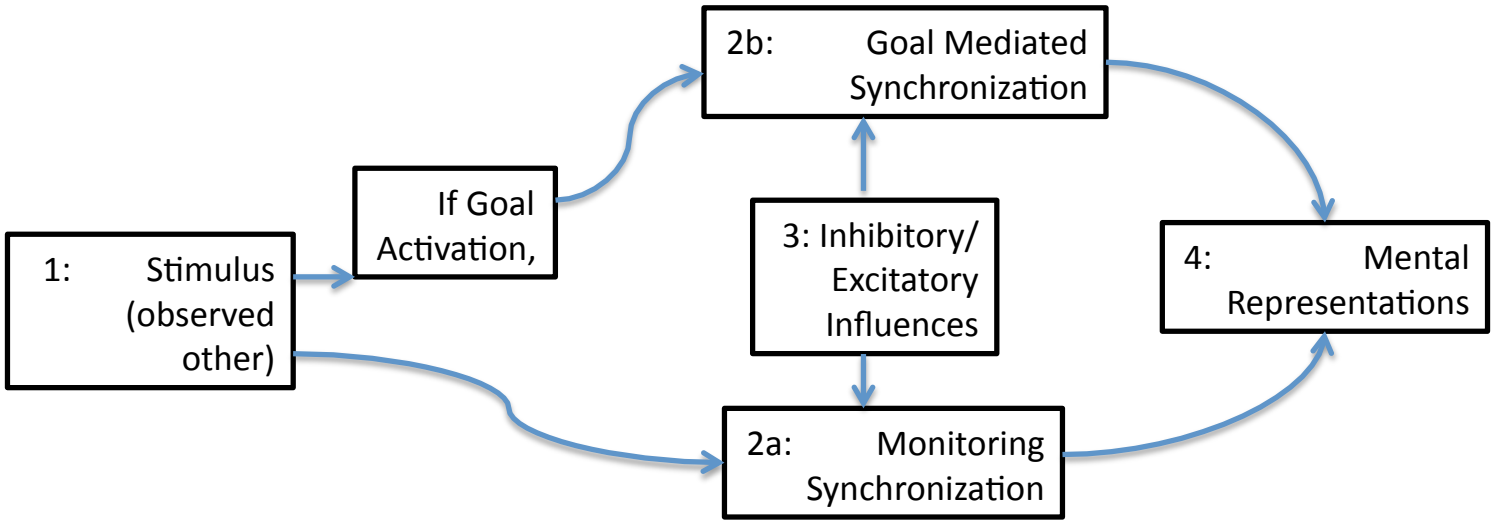
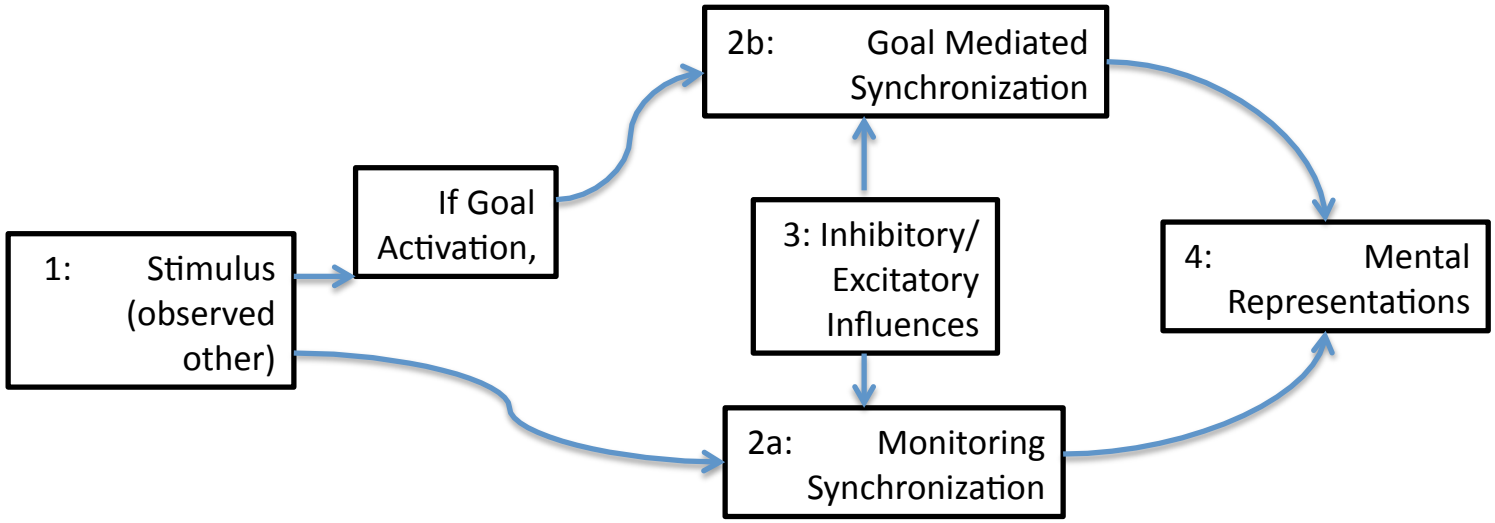


Excitatory/inhibitory influences ensure that correspondence between agents is partial




2b: Goal Mediated Synchronization
If Goal Activation,
3: Inhibitory/ Excitatory Influences
4: Mental Representations
1: Stimulus (observed other)
2a: Monitoring Synchronization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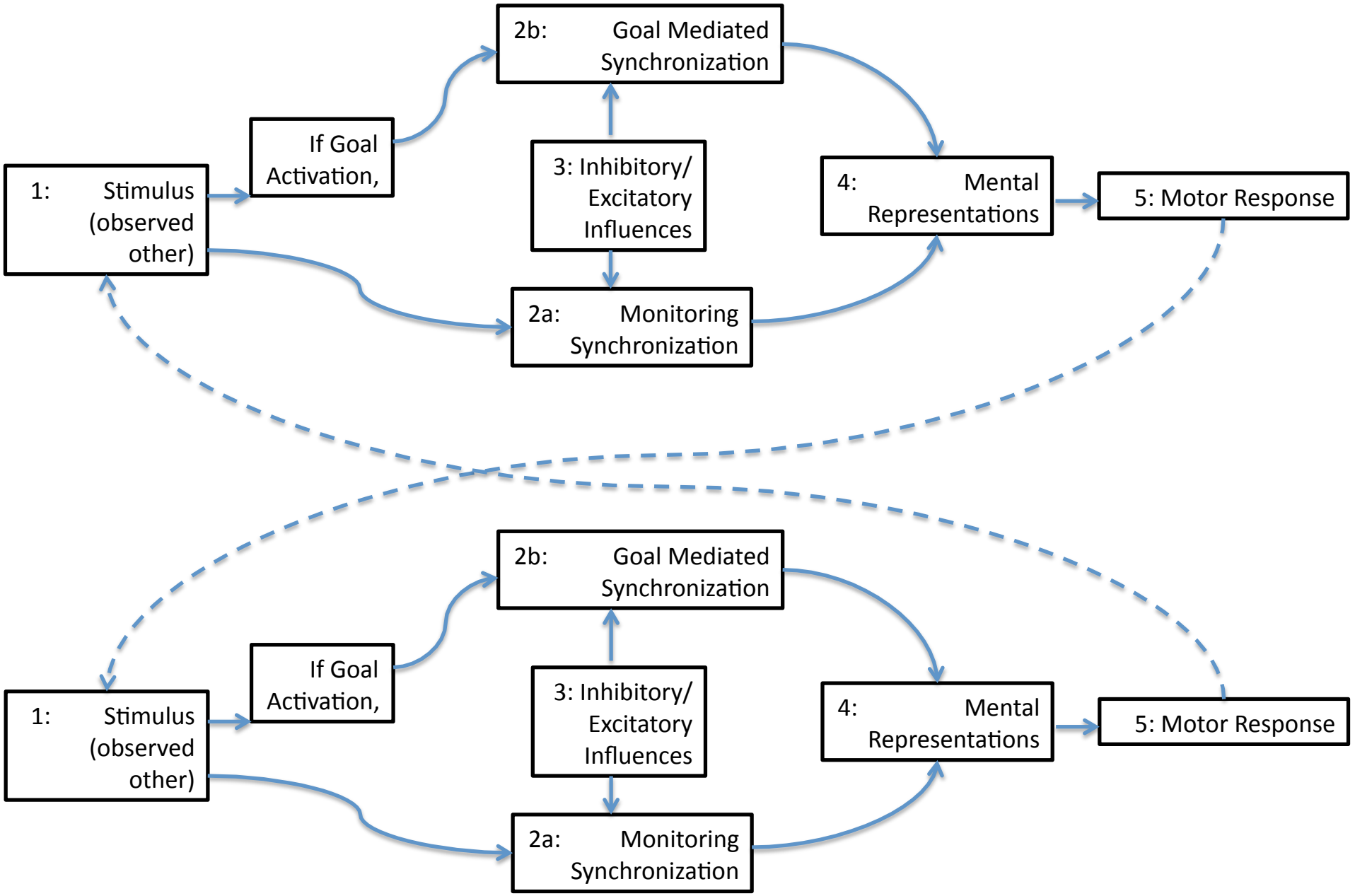

2b: Goal Mediated Synchronization
If Goal Activation,
3: Inhibitory/ Excitatory Influences
4: Mental Representations
5: Motor Response
1: Stimulus (observed other)
2a: Monitoring Synchronization
2b: Goal Mediated Synchronization
If Goal Activation,
3: Inhibitory/ Excitatory Influences
4: Mental Representations
5: Motor Response
1: Stimulus (observed other)
2a: Monitoring Synchronization

Co-regulation can lead to 3 forms of co-action:

Entrainment

Mimicry

Coordination

Imitation and the Correspondence Problem (Brass & Heyes 2005)

"When we observe another person moving we do not see the muscle activation underlying their movement but rather the external consequences of that action. So how does the observer's motor system 'know' which muscle activations will lead to the observed movement?"

Competing theories:

Generalist vs. Specialist

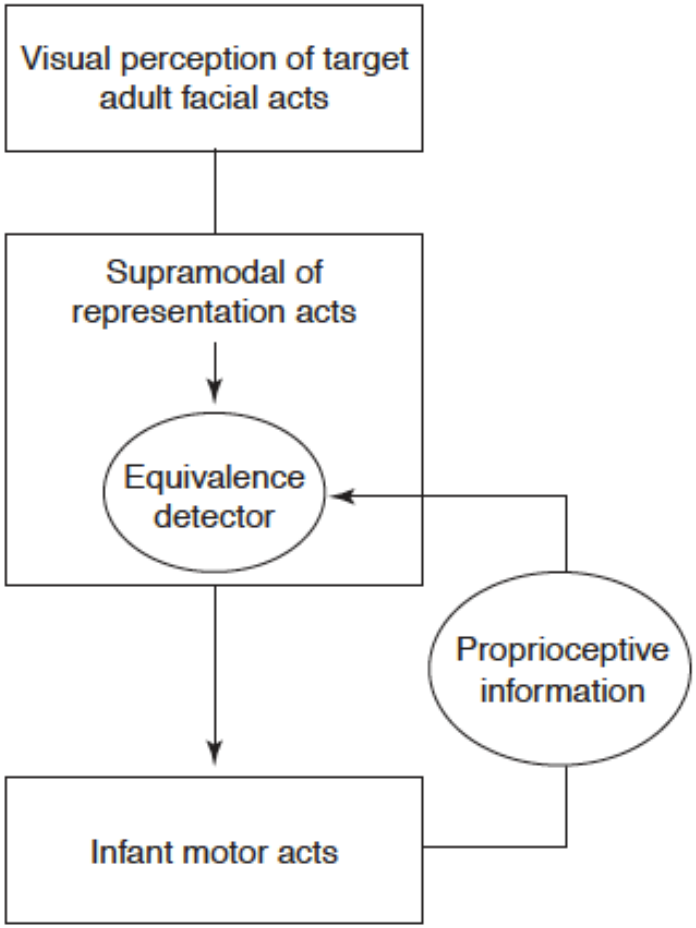
Generalist:
Imitation is accomplished through standard learning and motor control mechanisms.

Specialist:
Imitation is accomplished by a special-purpose mechanism.

SPOILER ALERT!!!!

Generalist Wins!!!

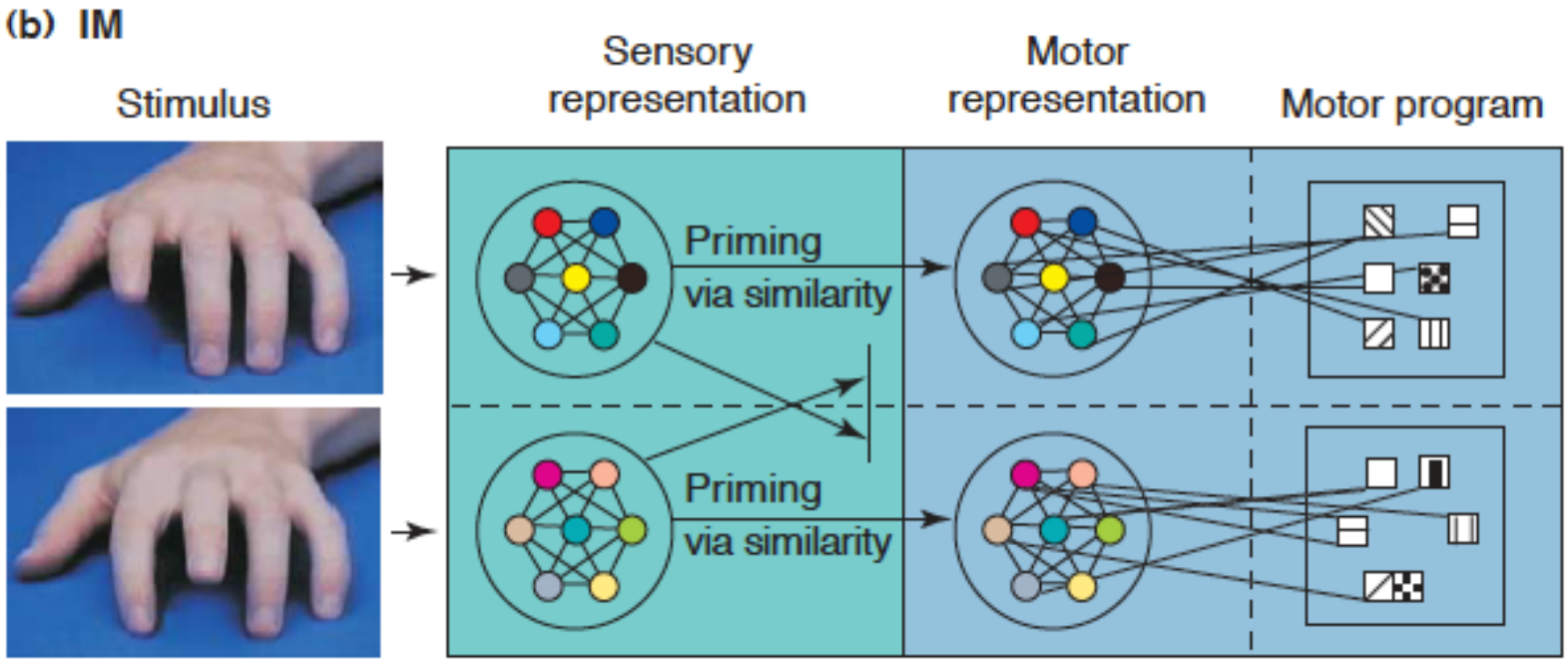
Specialist theory:
Active intermodal matching (AIM)




SUPRAMODAL ORGAN RELATIONS
I HAZ THEM

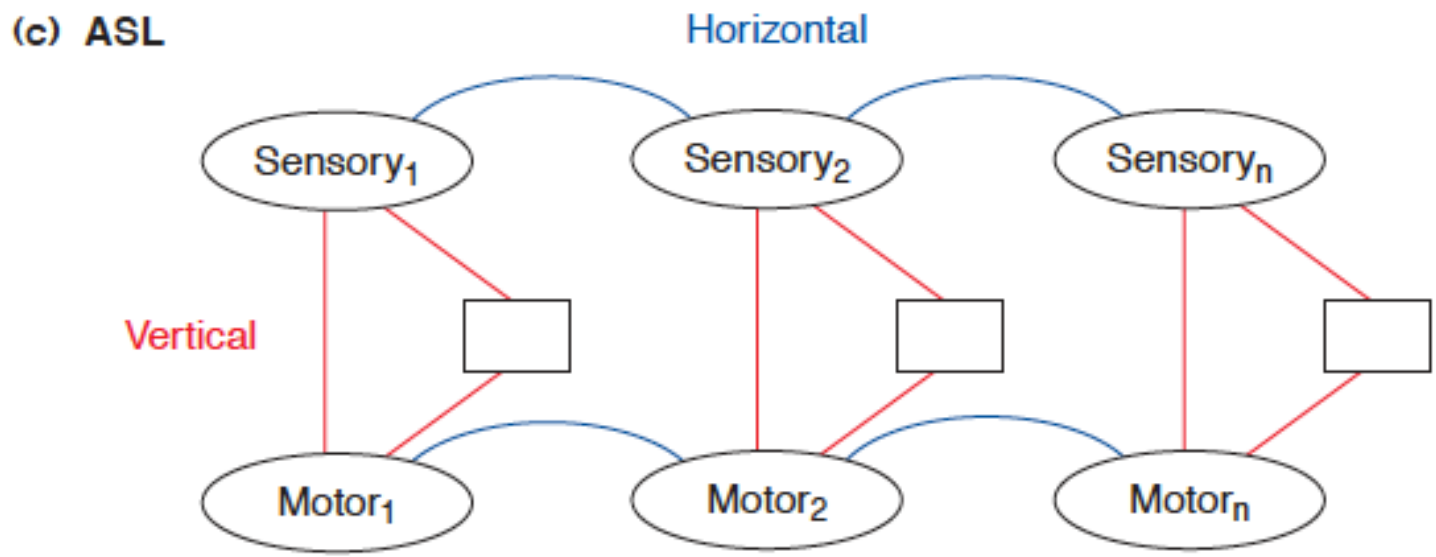
Generalist Theory #1:

Ideomotor Theory



Generalist Theory #2:

Associative Sequence learning

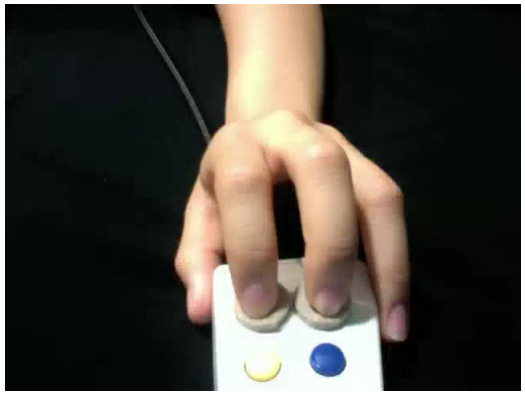


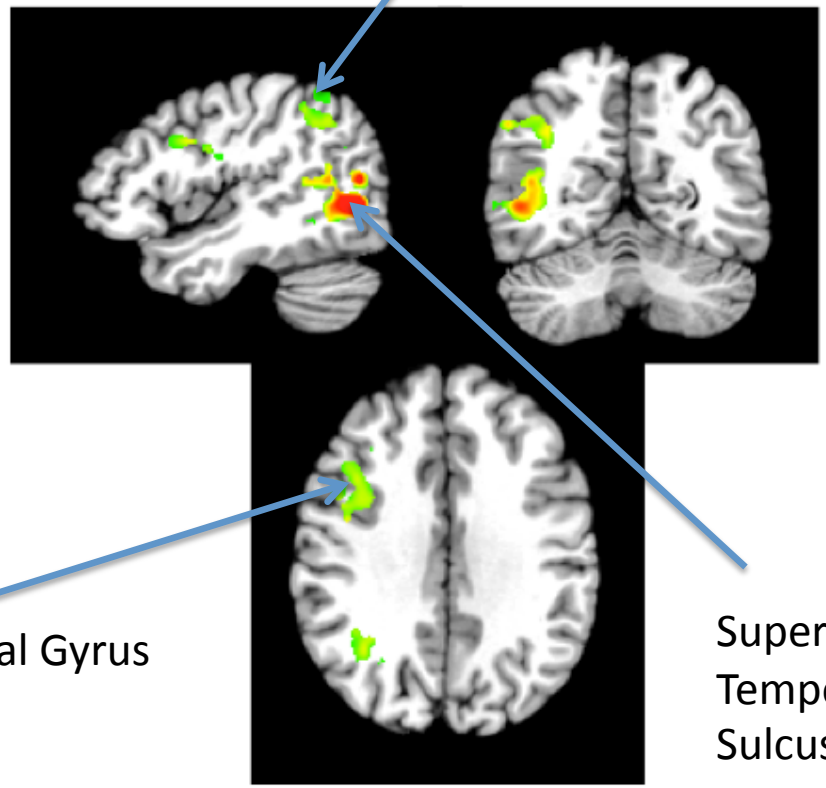
Evidence for motor activation by movement observation

Movement execution is faster when accompanied by observation of a congruent movement, as opposed to an incongruent movement.

Interference effects

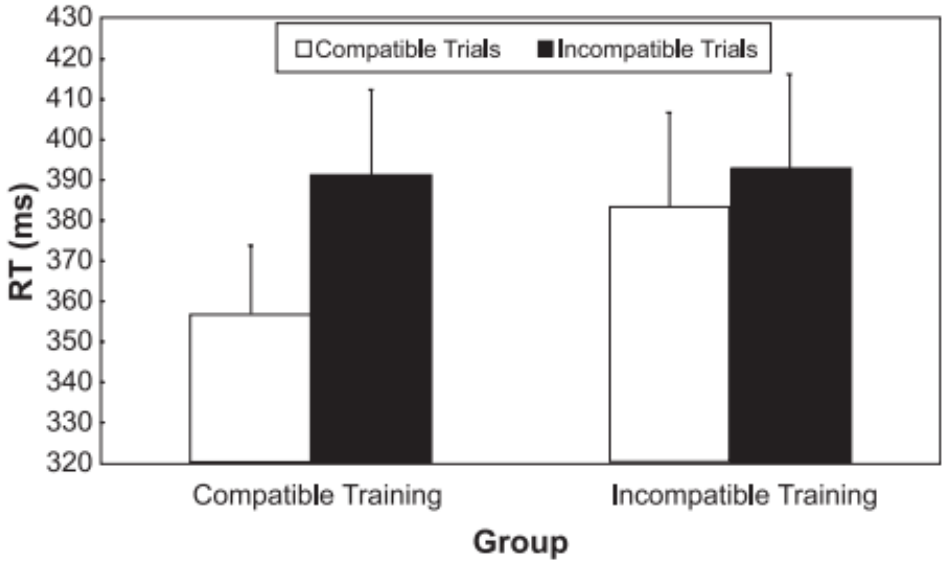
Special imitation mechanisms?





Role of Learning in Imitation

Heyes et al 2005



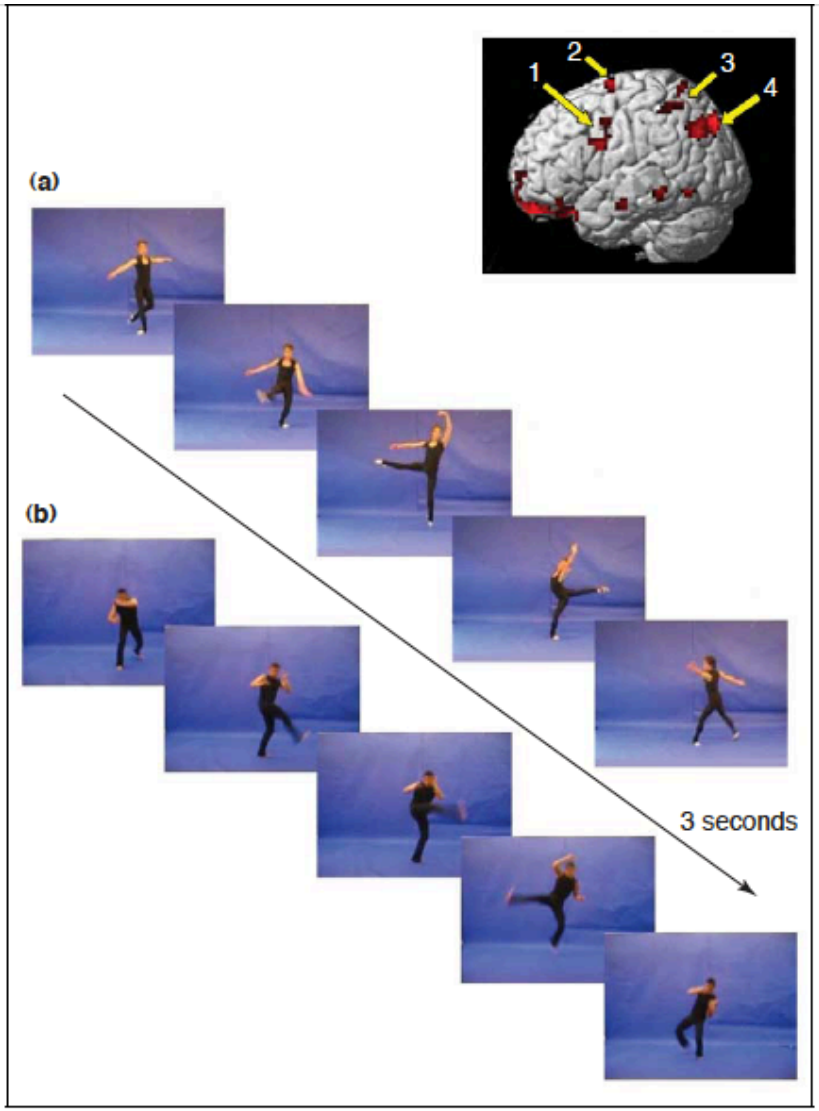


Figure 3. Neural activation during movement observation depends on expertise. Examples of **(a)** classical ballet movement, and **(b)** capoeira movement shown by Calvo-Merino and colleagues [38] to capoeira dancers, classical ballet dancers, and non-dancer controls in their study of the effects of expertise on motor activation by movement observation. The capoeira experts showed stronger activation in the premotor, parietal and posterior STS regions when observing capoeira movements than when observing ballet movements, and the ballet experts showed stronger activation in the same areas when observing ballet movements than when observing capoeira movements. The activation map on the right side of the graph shows this interaction in the ventral premotor cortex (1), dorsal premotor cortex (2), the intraparietal sulcus (3) and the posterior superior temporal sulcus (4) of the left hemisphere.

Evidence suggests that the answer to the correspondence problem is automatic activation of existing motor representations