UC San Diego

Lecture 7.2 Musical Embodiment and Enactivism

MUS 20 Exploring the Musical Mind

Summer Session II 2025

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Enactivism

- *Enactivism* is a position in cognitive science that argues that cognition arises through a dynamic interaction between an acting organism and its environment.
- It claims that the environment of an organism is brought about, or enacted, by the active exercise of that organism's sensorimotor processes.
- The term 'enactivism' is close in meaning to 'enaction', defined as "the manner in which a subject of perception creatively matches its actions to the requirements of its situation".
- Enactivism emphasize the growing conviction that cognition is not the representation of a pre-given world by a pre-given mind but is rather the enactment of a world and a mind on the basis of a history of the variety of actions that a being in the world performs.
- Experience of the world is a result of mutual interaction between the sensorimotor capacities of the organism and its environment.

Enactivism

- *The key point, then, is that the species brings forth and specifies its own domain of problems ...this domain does not exist "out there" in an environment that acts as a landing pad for organisms that somehow drop or parachute into the world. Instead, living beings and their environments stand in relation to each other through* ***mutual specification or codetermination****. – The Embodied Mind: Cognitive Science and Human Experience (1992)*
- *Organisms do not passively receive information from their environments, which they then translate into internal representations. Natural cognitive systems...participate in the generation of meaning ...engaging in transformational and not merely informational interactions: they enact a world. – Horizons for the Enactive Mind: Values, Social Interaction, and Play (2014)*

Embodied and Situated Cognition

Embodied Mind, Situated Cognition, and Expressive Microtiming in African - American Music by Vijay Iyer

- The viewpoint known as embodied or situated cognition treats cognition as an activity that is structured by the body situated in its environment—that is, as embodied action.
- In this view, cognition depends upon experiences based in having a body with sensorimotor capacities; these capacities are embedded in an encompassing biological, psychological, and cultural context.
- Sensory processes (perception) and motor processes (action), having evolved together, are seen therefore as fundamentally inseparable, mutually informative, and structured so as to ground our conceptual systems.

Embodiment

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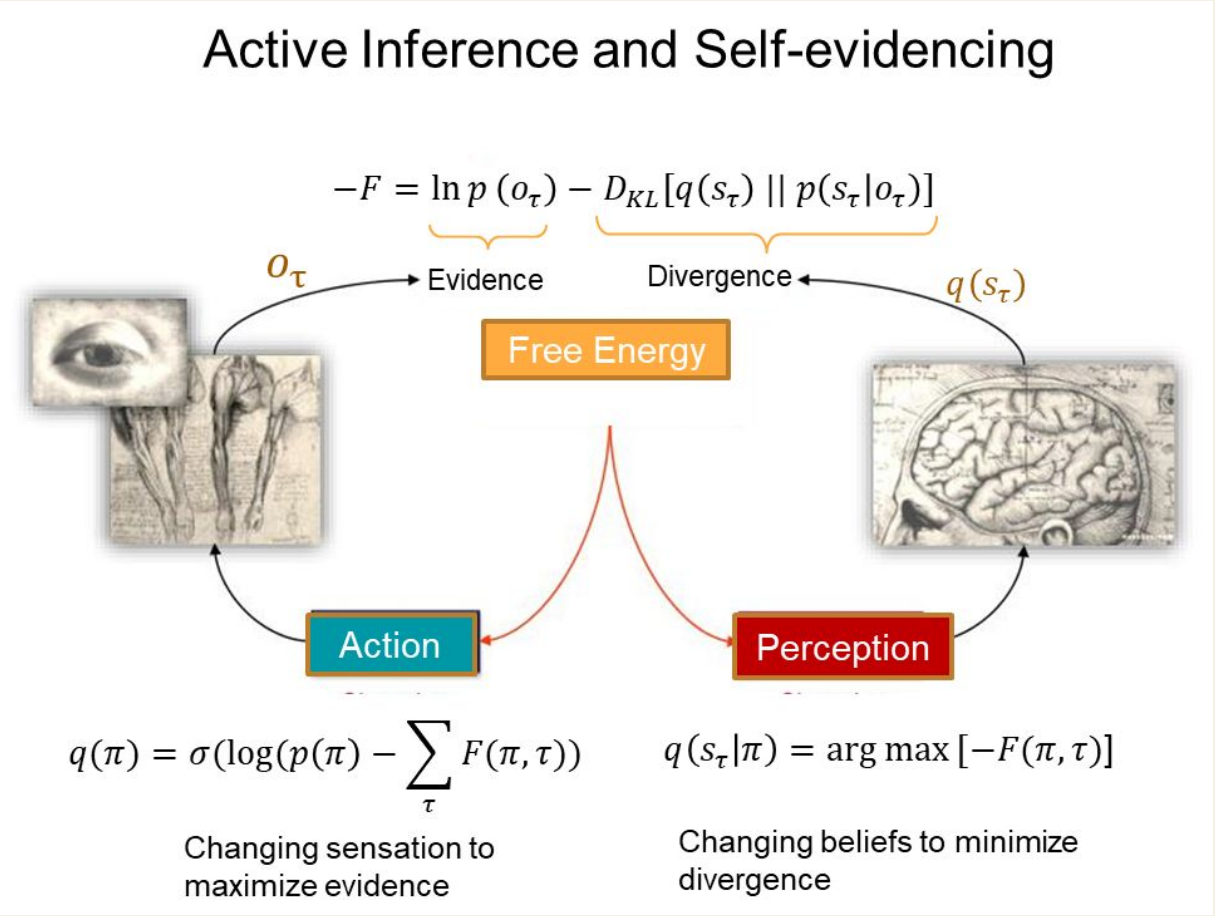
- Perception is understood as *perceptually guided action*.
- Cognitive structures emerge from the recurrent sensorimotor patterns that enable the perceiver to guide his or her actions in the local situation; the emergent, learned neural connections between the senses and the motor system form the basis for cognition.
- This view provides a sharp contrast from the standard information-processing viewpoint, in which cognition is seen as a problem of recovering details of the pre-given outer world.
- In the embodied viewpoint, the mind is no longer seen as passively reflective of the outside world, but rather as an active constructor of its own reality.



Free Energy Principle

The Free Energy Principle: A Unified Brain Theory? by Karl Friston

1. Optimizing representation
2. Optimizing action

Situatedness

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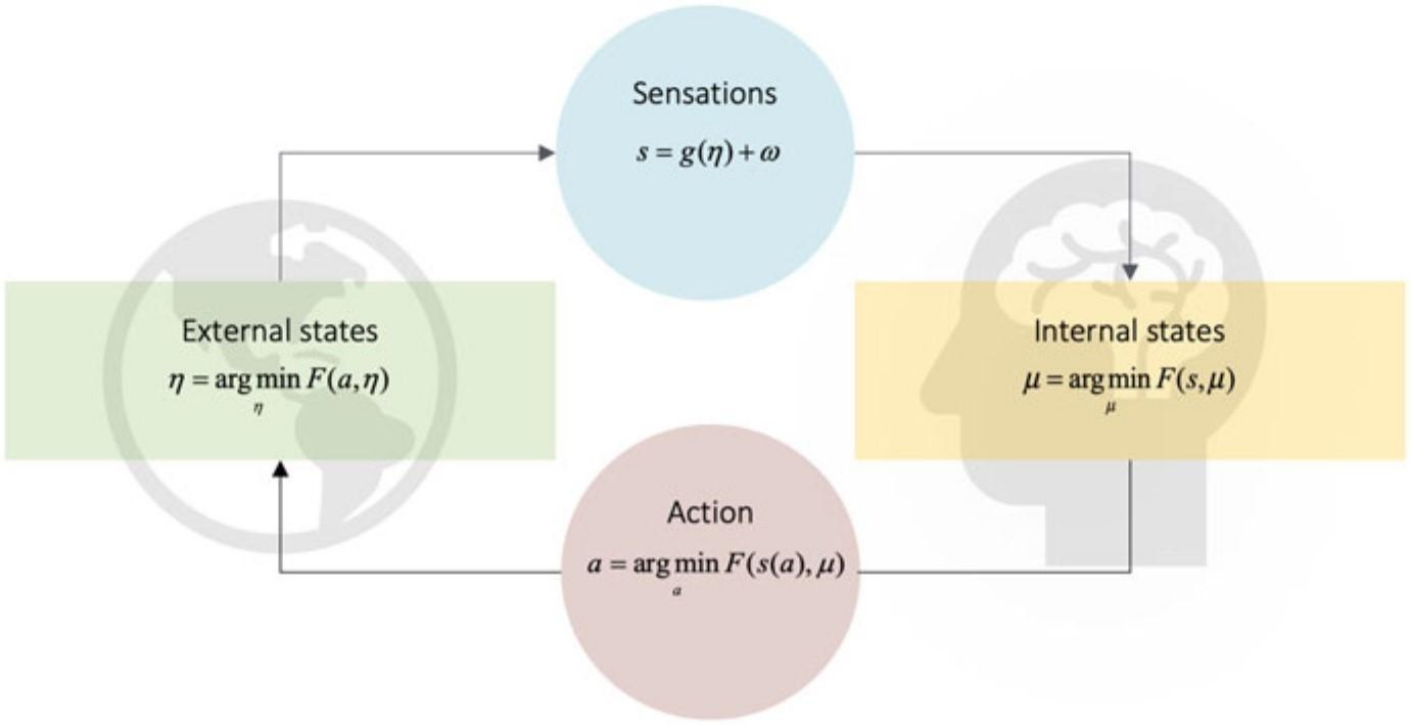
- The body and its environment not only provide constraints but also enable cognition.
- Cognition is seen in part as a social phenomenon, distributed over mind, body, activity and cultural context. We rely upon various attributes of our physical, social, and cultural environment to support or augment our mental capacities.
- The mind may be viewed as symbiotically embedded not only within its body but also in that body's environment, and structured by its surroundings.

Action-Perception Loop



Cultural Niche Construction

Paper: [Thinking through other minds: A variational approach to cognition and culture]

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Embodied Music Perception

Musical Correlates to Bodily Motions

Body Motion	Musical Correlate	Approximate Frequency Range (Hz)
Breathing, moderate arm gesture, body sway	Musical phrase	0.1–1
Heartbeat, sucking, chewing, walking, sexual intercourse, head nod	Musical pulse (*tactus*)	1–3
Speech/lingual motion, hand gesture, digital motion	Smallest musically salient subdivisions of musical pulse; fast notated rhythms	3–10
Phoneme, rapid flam between fingers or limbs	Grace notes, deviations, asynchronies, microtiming	10–60

Most wind-instrument phrase lengths are naturally constrained by lung capacity.

Tactus-heavy urban dance music often makes sonic references to foot-stomping and to sexually suggestive slapping of skin.

Time Scales of Music Perception

- Auditory Stream formation (Perceptual fusion):
  - Truax mentions the threshold of approximately 50 milliseconds per event, or 20 per second
  - Stockhausen mentions 1/16 second threshold (62 milliseconds)
- Texture (echoic memory 0.5 up to 2 sec.)
- Gesture
  - 1) breathing, moderate arm gesture, body sway "phrase" 0.1 - 1 Hz
  - 2) heartbeat, sucking/chewing, locomotion, "tactus" 1 - 3 Hz
  - 3) speech/lingual motion, hand gesture, digital motion "tatum" 3 -10 Hz
- Rhythm (tactus range 300-800 milliseconds)
- Short term memory (5 to 9 items stored, uses categorization)
- Long term memory (episodic, semantic, procedural)

Ecological Perception

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- All too often, theorists and psychologists have treated musical motion in terms of abstract, time-varying auditory images, while ignoring the motions exerted by the performer.
- Handel's three levels of event awareness:
  - The raw psychophysical perception of tones
  - The perception of abstract qualities of the tones apart from their source
  - The apprehension of environmental objects that give rise to the sound event.
- We connect the perception of musical motion at the ecological level to human motion. Musical perception involves an understanding of bodily motion— that is, a kind of *empathetic embodied cognition*.

Embodied Correlates to Abstract Musical Perception

Abstract Music Perception	Ecological Music Perception
Sounds	Sound sources
Perception	Recognition
Abstraction	Embodiment
Music	Sonic trace of organized human activity
Rhythm	Human motion
Tempo	Speed of human motion
Meter	Regularity of human motion; an *invariant* of the musical environment
Expressive timing	Deviations from invariance
Polyrhythm	Coordinated contrasting human motions
Timbre	Specific instrument/voice/sound source
Loudness	Degree of effort, exertion; number of individuals in unison
Melody	Sustained vocalization, vocal cord use, lung exertion, control
Harmony	Polyphony, interacting sound sources
Form, recurrence, organization	Events, situational/environmental factors
Unison	Synchronized action
Compositional time, musical time	Real time
Piece of music/composition/score	Performance/event