Assisted Imitation: Beginning to Be an Intelligent Agent

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Abstract

My work delineates the interplay of perception and action that may illuminate how infants and automata might detect and learn new actions by observing and interacting with intelligent agents while engaging in *assisted imitation*

1. Introduction

Byrne (2003) has drawn attention to the fact that scholars use the term imitation in two ways: (1) *the transfer of skill problem* (how can the child acquire *novel, complex behavior* by observing?); (2) *the correspondence problem* (how can the child match *observed actions* with *self-executed actions?).*

Some propose solving the *correspondence problem* by building in the explanation, arguing that infants know that other are "like me" from birth (Meltzoff and Moore, 1999). However, knowing our bodies are alike may account for imitating behaviors present at birth, but not for learning new actions. Other scholars assert that infants learn new behaviors, based on the assumption that caregivers imitate infants and/or because infants imitate what they see others doing, without delineating the source of this ability or by proposing they simulate movements already in the repertoire (Barresi & Moore, 1996; Heyes, 2005; Hurley, 2005). Are these assumptions warranted? Apparently not. Highly significant results from our naturalistic research indicate that caregivers rarely imitate their infants and infants rarely imitate their caregivers spontaneously.

These results come from a longitudinal sample consisting of five English-speaking, Euro-American middle-class and six Spanish-speaking, Latino working-class families with an infant of 6 months who lived in a large urban center in the Western United States. They participated from the initial prelinguistic period until the infant said more than one-word at a time at about 21-26 months. We collected twenty-minute videos each month of naturalistic interaction at home, plus supporting documentation.

Instead of spontaneously imitating one another, caregivers invite infants to imitate. Such *assisted imitation* accounts for over 95% of the observed imitative behavior. These caregiver methods that may promote a transfer of skill illuminate how the infant learns new bodily abilities and how to detect new opportunities for action. The practices may literally put an infant in touch with both sides of the *correspondence problem* – the relation between first and third person perceiving and acting. This approach focuses on how caregivers bracket ongoing actions so that infants discover a range of *affordances* (opportunities for action) and *effectivities* (bodily abilities) which contribute to participating in a new activity (Zukow-Goldring, in press).

While tutoring a new skill, caregivers often embody infants or act in tandem with them as the *two go through the motions* of some activity together. As caregivers *embody* their infants, the infants have a chance to see and feel that their own movements are "like the other." That is, when caregiver and infant move as one, the infant may detect regularities or amodal invariants (propioceptively, kinesthetically, visually, tactilely, and so on) in the synchronous onset/offset, rhythm, and tempo of the action that specify a common sense/perception or *correspondence* between caregiver and infant movements. Such supervised learning narrows the search space and enhances the speed of engaging adeptly in a new activity. These caregiver practices may illuminate how automata might detect and learn new affordances for action by observing and interacting with other intelligent agents.

These naturalistic investigations suggest solutions to important questions in developmental robotics (Breazeal and Scassellati, 2002; Dautenhahn and Nehaniv, 2002): how robots know what to imitate, the import of perception-action coupling, determining what is new, and methods for error correction.

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