

Towards an Interactional Model of Children's Relationships with Personified Adaptive Systems

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Abstract

Personified adaptive systems (e.g., humanoid robots and embodied conversational agents) are those technologies which adapt to changes in their environment and utilize social features in order to communicate information. What is the nature of the relationships that children will develop with these systems, and how can designers account for these relationships? Traditional interaction models emphasize 'use' as the primary relational character thereby de-emphasizing the breadth of children's interaction experiences. A new model is needed, one that is grounded on a rich conceptualization of interaction and that integrates 'use' into a coherent and comprehensive characterization of child-system relationships. This paper is an attempt to move towards such an interactional model. The moral domain of children's experience is discussed as an example of how the model can elucidate design implications.

Introduction

A particular genre of technology is quickly becoming commonplace in children's lives and may have significant implications for children's social and moral development (Kahn, Freier, Friedman, Severson, & Feldman, 2004). Broadly characterized as personified adaptive systems, these technologies adapt to their environment and utilize social features in order to communicate information or provide services. Children are now experiencing these technologies as artificial tutors, robotic pets, therapeutic playmates, and video game characters. Such technologies are often designed to mimic human appearance and behavior under the assumption that such mimicry will result in improved human-computer interactions (Cassell, 2000). This assumption, however, may disregard the unforeseen complications of people's social responses to computing (Reeves & Nass, 1996).

The human-computer interaction field often assumes that 'use' is the essential character of the relationship between the individual and the system. Meyers, Grudin, Shneiderman, and many others in the ACM Workshop on Strategic Directions for Computing Systems defined HCI as "the study of how people design, implement, and use interactive computer systems" (Meyers et al., 1996, p. 794). Regardless of whether the 'use' paradigm is sufficient for HCI in general, it is clear that in interacting with personified adaptive systems children's experiences will extend beyond 'use' to include emotional, social, or moral experiences. Thus, this interactional model aims to better account for children's interactions with personified adaptive systems and, in so doing, provide insight into the implications for design.

Interactional Model

The development of this model is strongly informed by the Value Sensitive Design approach (Friedman, Kahn, & Borning, in press), which holds that neither the technology nor the social context determine how technologies implicate human values. Rather, value implications arise through the dialectic between the individual in interaction with the technology, the technology's design, and the social context of interaction.

Furthermore, drawing on the Piagetian constructivist tradition, broadly conceived, the interactional model is guided by the understanding that children construct knowledge through actions taken in the world (Piaget, 1983; Turiel, 1983) and that these knowledge-building actions are influenced by the social, cultural, and artifactual features of children's environments.

Thus, the interactional model aims to account for (1) the specific affordances of the artifact which promote the engagement of certain concepts in children, (2) children's already constructed (and changing) concepts of the artifact and their relationship to the artifact, (3) the social context which scaffolds this constructive process and designs the artifact, and (4) children's externalized behaviors in interaction with the artifact and the social context. Discussion is limited to the first two factors: the affordances of the artifact and children's concepts.

Affordances of Personified Adaptive Systems

'Affordance' is a term traditionally used to denote the features of an artifact which promote certain types of use interactions (Gibson, 1977). The term is used in this paper to denote those features of a personified adaptive system that promote specific types of social-cognitive relationships, including those of a moral nature. Affordances of a personified adaptive system which are likely to influence such relationships include the artifact's form, persona, sociality, and adaptability. Form includes robots, virtual agents, virtual environments, and digitally-augmented artifacts. Persona includes voice or other audio, physical gesturing, gazing, facial expressions, and affect. Sociality includes the ability to communicate with humans, reason and problem solve either cooperatively or competitively, and recognize and abide by rules, norms, and conventions. Adaptability is the system's ability to account for and respond to changes in its environment and the constituents within that environment.

Children's Concepts

As proposed by Turiel (1986) and others working with social-cognitive domain theory from developmental psychology, children's cognitive concepts are grouped into domains reflecting types of basic interactions in the world. These can include non-social, personal, social-conventional, and moral concepts. Non-social concepts include logico-mathematical and physical property concepts. Personal concepts include knowledge of personal preferences, interests, and internal mental states. Social-conventional concepts include knowledge regulated by social norms, rules, or authorities. Judgments of this sort are culturally-specific and can change in accordance with changes in the social context. Moral concepts, on the other hand, have generalizable features that stand independent of the social context. The moral domain includes issues of justice, welfare, and rights.

The point here is that in interacting with personified adaptive systems, children bring to the interaction an already structured (and restructuring) system of thought which guides behavior and influences the character of the child-system relationship. Concept domains are activated and coordinated by children in their interactions with the technology, and the nature of such engagement and coordination has implications for child-system interaction design.

The Moral Quality of Child-System Relationships

As an example of how the interactional model can provide insight into how design influences children's relationships to personified adaptive systems, consider the moral domain. The moral quality of the relationship that children develop with personified adaptive systems is likely to have two prevailing (and not always exclusive) characters: social heteronomy or moral autonomy (Piaget, 1965/1932).

Piaget describes heteronomy as a system of thought that relies heavily upon the consideration of conventions, rules, and authority for the guidance of appropriate behavior. Thus, systems that simply follow 'user' commands promote heteronomy by design. MIT's Leonardo (Breazeal et al., 2004), for example, promotes a socially heteronomous relationship insofar as it is designed to learn and act in response to the didactic teaching of its human counterpart.

Alternatively, Piaget describes autonomy as a system of thought that relies upon mutual respect intellectually favoring "inner consistency and reciprocal control" (p. 107) in the face of prevailing social conventions, rules, or regulations. Moral autonomy "replaces the norms of authority by... the norm of reciprocity in sympathy." For example, CMU's Valerie (Gockley, Forlizzi, & Simmons, 2006) uses persona and sociality affordances to engender emotional empathy from people with whom it interacts (e.g., it gets "testy") promoting a minimal form of reciprocity.

While it remains an open question as to whether a technology can ever engender authentic attributions of

respect or moral standing (Kahn et al., 2004), researchers are observing shifts in children's social and moral concepts as a result of interaction with increasingly sophisticated personified technologies (e.g., Kahn, Friedman, Perez-Granados, & Freier, in press; Turkle, 2005). Thus it appears that more than just 'use' interactions are occurring. A new model is needed that accounts for the breadth of children's relationships with personified adaptive systems. The model introduced here aims toward satisfying this need.

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