If robots make choices, are they alive?: Children's judgements of the animacy of intelligent artifacts

Milena K. Nigam (mkoziol@andrew.cmu.edu)
David Klahr (klahr@cmu.edu)
Department of Psychology; Carnegie Mellon University
Pittsburgh, PA 15213 USA

Introduction

Much of the research on children's developing concepts about the natural world has focused on how they distinguish between living and non-living entities (Carey, 1985). In addition to the well-established cue of autonomous movement, Richards and Siegler (1986) found that six- and seven-year-olds also include mental states as attributes of living things. However, there are different types of mental states (e.g., thoughts and emotions), and in today's technological environment, where even preschoolers have experience with "intelligent" artifacts such as computers and robots, children's understanding of the complex relationship between mental states and animacy judgments remains to be explored (Turkle, 1984).

We considered three types of mental states: (a) cognition (thinking), (b) emotion (having feelings) and (c) volition (having desires/goals). We expected that children's attributions of volition and emotion would be associated with animacy judgments, whereas attributed cognition, on its own, would *not* be associated with positive animacy judgments of computers and robots. (Note that we are making no claims about the causal direction of any such associations. This issue will be explored in future research.)

Method

We tested children in three age groups spanning the period in which adult-like judgments of animacy emerge (Carey, 1985): 14 preschoolers and kindergartners, 14 second graders, and 11 fourth graders. Children were shown color photographs of three classes of entities: (a) natural kinds (person, monkey), (b) intelligent artifacts (robot, computer), and (c) simple artifacts (doll, TV, hammer). For each entity, children were asked whether it was silly or OK to say a particular statement about that entity. (E.g., "Is it silly or OK to say: 'A robot can think.'?") (Cf. Keil, 1979.) Children were asked to make judgments concerning (a) the entity's animacy status (alive or not alive) and (b) its mental state capabilities. The presentation of mental states and animacy status was counterbalanced across entities.

Results and Discussion

Robot was the only entity where we found a substantial variation in animacy responses. We dropped fourth graders from this analysis because they all said that a robot was not alive. The distribution of mental state attributions related to robot animacy judgments is presented in Table 1.

Table 1
Covariation Matrix for Animacy and Mental State Attributions

	Cognition		**Emotion**		**Volition**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Alive	.26	.04	.30	0	.26	.04
Not Alive	.18	.53	.28	.42	.11	.60

To test which mental state attributes were most predictive of positive animacy judgments, we ran a stepwise logistic regression. It revealed that volition was the strongest predictor variable (odds ratio 1.8 [95% CI 1.2 to 2.9] p = .004) for robot animacy judgments. (This analysis yields the odds of saying that robot is alive given a judgment that it is volitional.) Note that nearly 30% of responses attributed emotion to a nonliving robot, and nearly 20% of responses attributed cognition to a nonliving robot. However, only 10% of responses attributed volition to a nonliving robot. Thus, this study reveals the emergence of children's early understanding of the nature of complex intelligent artifacts and its relation to the concept of animacy.

Acknowledgements

This research was supported in part by a graduate research fellowship from NSF to the first author and by a grant from NICHD (HD 25211) to the second author.

References

Carey, S. (1985). *Conceptual change in childhood.* Cambridge, MA: MIT Press.

Keil, F.C. (1979). *Semantic and conceptual development: An ontological perspective.* Cambridge, MA: Harvard University Press.

Richards, D., & Siegler, R. (1986). Children's understanding of the attributes of life. *Journal of Experimental Child Psychology, 42*, 1-22.

Turkle, S. (1984). *The second shelf: Computers and the Human Spirit*. New York: Simon and Schuster.