Dimensions of Mind Perception
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Dimensions of Mind Perception

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What kinds of things have minds? Answers to this question often hinge on perceptions. Turing (*1*) held that a computer has a mind if a perceiver can't tell that it is not human, and Dennett (*2*) has proposed that every mind is defined as such in the eye of the beholder. But to date, it has generally been assumed that mind perception occurs on one dimension—things simply have more or less mind—and the dimensions of mind perception have remained unexamined. Studies testing whether chimpanzees perceive minds (*3*) and whether children or people with autism have this ability (*4*) use a variety of indicators but have not explored whether minds are perceived along one or more dimensions. We studied the structure of mind perception through 2399 completed surveys on the Mind Survey Web site (*5*).

Each survey called for 78 pairwise comparisons on five-point scales of 13 characters for one of 18 mental capacities (e.g., capacity to feel pain) or for one of six personal judgments (e.g., "which character do you like more?"). The characters included seven living human forms (7-week-old fetus, 5-month-old infant, 5-year-old girl, adult woman, adult man, man in a persistent vegetative state, and the respondent him- or herself), three nonhuman animals (frog, family dog, and wild chimpanzee), a dead woman, God, and a sociable robot (Kismet). So, for example, one such comparison involved rating whether a girl of 5 is more or less likely to be able to feel pain than is a chimpanzee. The survey samples were largely independent; 2040 unique respondents contributed data. Participants with many backgrounds responded but averaged 30 years of age and were modally female, white, unmarried, Christian, Democrat, and with some college education (*6*).

Mind perception dimensions were identified by computing character means for each mental capacity survey and submitting the correlations between capacities across characters to principal components factor analysis (varimax rotation). The rotated solution accounted for all 18 capacities (extraction communalities ranged from 0.82 to 0.99), explained 97% of rating variance, and yielded two factors with eigenvalues over 1.0. A factor we termed Experience (eigenvalue = 15.85) accounted for 88% of the variance and included 11 capacities (from highest loading): hunger, fear, pain, pleasure, rage, desire, personality, consciousness, pride, embarrassment, and joy. A second factor, Agency (eigenvalue = 1.46), accounted for 8% of the variance and included seven capacities: self-control, morality, memory, emotion recognition, planning, communication, and thought. Characters' factor scores on these dimensions (Fig. 1) reveal interesting features; for example, God was perceived as having much Agency but little Experience.

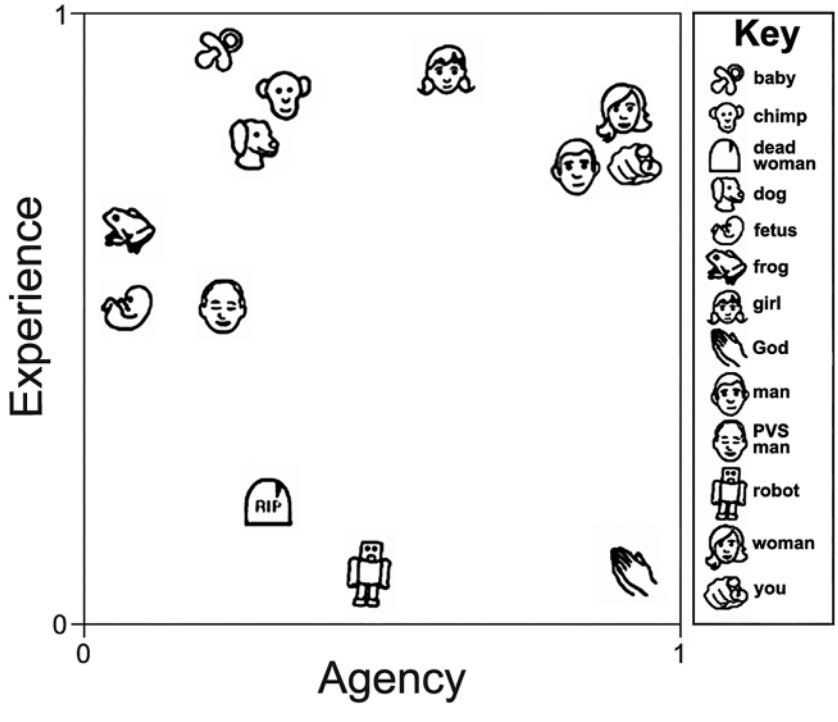

Fig. 1. Adjusted character factor scores on the dimensions of mind perception. PVS, persistent vegetative state.

Personal judgments of the characters were related to the mind perception dimensions. Some judgments were related to both Experience and Agency and suggest that, with the progression from no mind (bottom left) to adult human mind (top right), characters become more highly valued. Thus, both dimensions correlated with liking for a character, wanting to save it from destruction, wanting to make it happy, and perceiving it as having a soul (r ranging from 0.38 to 0.72). Such integrated use of the dimensions in valuing minds can account for the traditional conceptualization of mind as perceptible along a single dimension.

However, the remaining judgments showed differing correlations with the two dimensions. Deserving punishment for wrongdoing ("If both characters had caused a person's death, which one do you think would be more deserving of punishment?") correlated more with Agency ($r = 0.82$) than Experience ($r = 0.22$, $z = 2.86$, $P < 0.05$), whereas desire to avoid harming ("If you were forced to harm one of these characters, which one would it be more painful for you to harm?") correlated more with Experience ($r = 0.85$) than Agency ($r = 0.26$, $z = 2.10$, $P < 0.05$). The dimensions thus relate to Aristotle's classical distinction between moral agents (whose actions can be morally right or wrong) and moral patients (who can have moral right or wrong done to them). Agency is linked to moral agency and hence to responsibility, whereas Experience is linked to moral patiency and hence to rights and privileges. Thus, our findings reveal not one dimension of mind perception, but two, and show that these dimensions capture different aspects of morality.

References and Notes

1. A. Turing, *Mind* **59**, 433 (1950).
2. D. Dennett, *Kinds of Minds* (Basic, New York, 1996).
3. D. Premack, G. Woodruff, *Behav. Brain Sci.* **1**, 515 (1978).
4. S. Baron-Cohen, *Mindblindness* (MIT Press, Cambridge, MA, 1995).
5. Mind Surveys, http://mind.wjh.harvard.edu/.
6. Materials and methods are available as supporting material on *Science* Online.
7. We acknowledge J. Bradshaw, J. Hromjak, K. Kassam, P. Piff, and B. Simpson and funding from National Institute of Mental Health grants MH-49127 and MH-71053 and from a Social Sciences and Humanities Research Council Fellowship.

Supporting Online Material

www.sciencemag.org/cgi/content/full/315/5812/619/DC1
Materials and Methods
Table S1

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