

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, moral-

ity, 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.

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

29 August 2006; accepted 2 November 2006
10.1126/science.1134475

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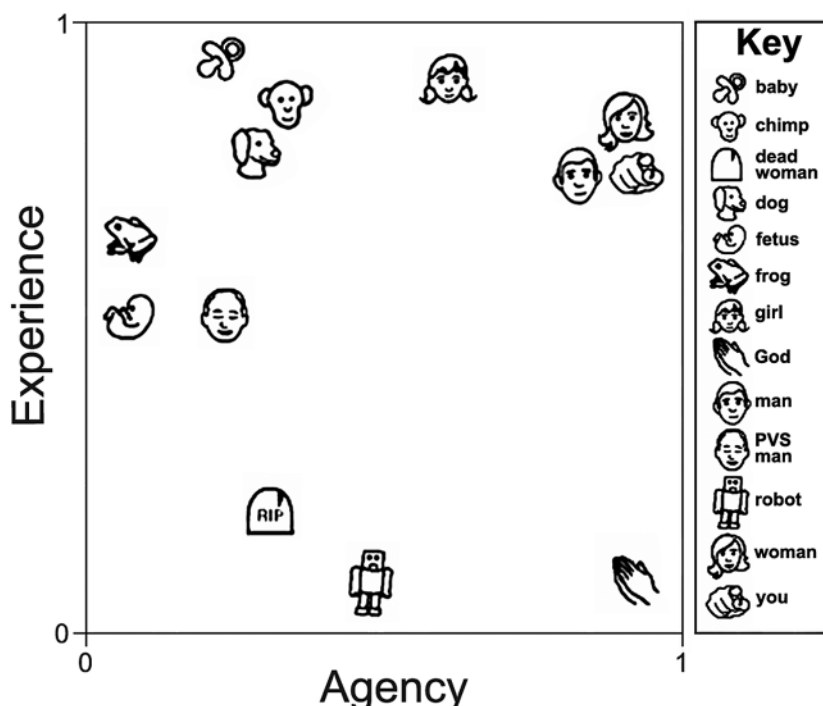


Fig. 1. Adjusted character factor scores on the dimensions of mind perception. PVS, persistent vegetative state.



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Published 2 February 2007, *Science* **315**, 619 (2007)
DOI: 10.1126/science.1134475

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Supporting On-line Material for

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Includes:

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Mind Survey

Respondents saw photos and vignettes on the characters in random order (Appendix A), and selected a survey from a set of descriptions of 18 mental capacities or 6 personal judgments (Appendix B). For the survey, images and descriptions of the two characters to be compared appeared with a five-point scale anchored by “Much more this one” below each image, “Slightly more this one” next, and “Both equally” between the images. Respondents also supplied demographic information and made 7-point Likert-type ratings on religious belief (“I consider myself to be strongly religious” and “I believe that God exists”) and afterlife belief (“I believe that people whose bodies are dead continue to live on spiritually”). On survey completion, respondents were shown how their rank ordering of the characters compared with the mean of others who had completed the same survey.

Respondents

Recruitment occurred through links to the Mind Survey from other research groups in social and moral psychology and sites offering comprehensive lists of web-based psychology studies. There were roughly 3,400 instances of surveys launched, but about 25% of these were not completed. Data from the remaining 2,399 completed surveys were analyzed. Respondents included 64% females and 36% males; 1% Native American, 5% Asian, 4% Black, 4% Hispanic, 78% White, 3% multi-racial, and 4% “other.” Respondents ranged in age from 12 to 75, with a mean of 30.44 years ($SD = 12.27$). The majority (70%) identified as Christian, with 5% Jewish, 1% Hindu, 1% Muslim, 3% “other,” and 19% no religion. Education groups included 23% with high

school diploma or less, 31% with some college, 19% with undergraduate degree, and 25% with some post-graduate work or a graduate degree. Political affiliation included 36% Democrat, 18% Independent, 20% Republican, and 26% none of these (many of whom were non-US respondents). Individuals could choose to complete more than one survey or the same survey more than once. Multivariate analyses of variance examining the influence of demographics on survey choice revealed no consistent group biases in survey selection.

Analytic Strategy

For each survey, each character appeared in 12 different comparisons, and mean relative ratings were computed for each character across all respondents to that survey. We merged data sets from the 18 mental capacity surveys to compute correlations between mental capacities across the characters, and submitted these to principal components factor analysis with varimax rotation (see Supplementary Table for factor loadings). We used the regression approach to estimate factor scores for each character; these appear in Figure 1. (For ease of interpretation, factor scores in Figure 1 were adjusted to be anchored at 0 and 1.)

Relationship between Dimensions of Mind and Personal Judgments

We computed scores for each character as described above on data from the 6 personal judgments (see Appendix B). Then, we computed correlations between these means and Experience and Agency factor scores across the 13 survey characters.

Individual Differences in Dimensions of Mind

We examined the role of individual-difference variables by partitioning respondents according to 9 variables: gender, age, strength of religious beliefs, attainment

of college education, political affiliation (Democrat or Republican), marital status, parental status, dog ownership, and strength of belief in a spiritual afterlife. Median splits were made for the 3 continuous variables (age, strength of religious beliefs, and belief in a spiritual afterlife) so that all variables had 2 levels. We then computed means for each character for each level of the individual-difference variable (e.g., men versus women). We used factor score coefficients from the omnibus factor analysis to estimate scores on Experience and Agency separately for each group, and then calculated the difference in factor scores between the two groups. We divided the difference scores by the standard error for the difference to produce z -statistics.. Of 234 z -statistics (13 characters \times 9 individual difference variables \times 2 factors), 23 were statistically significant. Respondents reporting stronger belief in a spiritual afterlife attributed less Agency to the girl, chimpanzee, dog, woman, man, infant, and self—and greater Agency to God. Afterlife beliefs also increased perceptions of Experience in the girl and infant. Respondents indicating stronger religious beliefs saw less Agency in “earthly” characters—chimpanzee, dog, girl, and woman (but not man)—and more Agency in God. And compared to Democrats, Republicans perceived the fetus and God higher in Agency; and the robot, girl, chimpanzee, and woman (but not man) lower in Agency.

Supplementary Table

Factor Loadings of Mental Capacities

Mental Capacity	Factor	
	Experience	Agency
Hunger	.97	.15
Fear	.93	.31
Pain	.89	.41
Pleasure	.85	.51
Rage	.78	.58
Desire	.76	.64
Personality	.72	.68
Consciousness	.71	.69
Pride	.71	.69
Embarrassment	.70	.65
Joy	.67	.60
Self-control	.18	.97
Morality	.35	.93
Memory	.33	.91
Emotion recognition	.54	.83
Planning	.55	.82
Communication	.66	.74
Thought	.68	.73

Appendix A: Character Descriptions and Images

Green frog. The Green Frog can be found throughout eastern North America. This classic "pond frog" is medium-sized and green or bronze in color. Daily life includes seeking out permanent ponds or slow streams with plenty of vegetation.

Charlie. Charlie is a 3-year-old Springer spaniel and a beloved member of the Graham family.

Toby. Toby is a two-year-old wild chimpanzee living at an outdoor laboratory in Uganda.

7 week fetus. At 7 weeks, a human fetus is almost half an inch long--roughly the size of a raspberry.

Nicholas Gannon. Nicholas is a five-month-old baby.

Samantha Hill. Samantha is a five-year-old girl who lives with her parents and older sister Jennifer.

Sharon Harvey. Sharon Harvey, 38, works at an advertising agency in Chicago.

Todd Billingsly. Todd Billingsly is a thirty-year-old accountant who lives in New York City.

You. When you see the mirror, please consider how you, yourself, would compare with the other choice presented.

Gerald Schiff. Gerald Schiff has been in a persistent vegetative state (PVS) for the past six months. Although he has severe brain damage--Gerald does not appear to communicate with others or make purposeful movements--his basic bodily functions (such as breathing, sleeping, and circulation) are preserved.

Delores Gleitman. Delores Gleitman recently passed away at the age of 65. As you complete the survey, please draw upon your own personal beliefs about people who have passed away.

God. Many people believe that God is the creator of the universe and the ultimate source of knowledge, power, and love. However, please draw upon your own personal beliefs about God.

Kismet. Kismet is part of a new class of “sociable” robots that can engage people in natural interaction. To do this, Kismet perceives a variety of natural social signals from sound and sight, and delivers his own signals back to the human partner through gaze direction, facial expression, body posture, and vocal babbles.

Appendix B: Survey Descriptions

Mental Capacities

Communication. This survey asks you to judge which character is more capable of conveying thoughts or feelings to others.

Consciousness. This survey asks you to judge which character is more capable of having experiences and being aware of things.

Desire. This survey asks you to judge which character is more capable of longing or hoping for things.

Embarrassment. This survey asks you to judge which character is more capable of experiencing embarrassment.

Emotion Recognition. This survey asks you to judge which character is more capable of understanding how others are feeling.

Fear. This survey asks you to judge which character is more capable of feeling afraid or fearful.

Hunger. This survey asks you to judge which character is more capable of feeling hungry.

Joy. This survey asks you to judge which character is more capable of experiencing joy.

Memory. This survey asks you to judge which character is more capable of remembering things.

Morality. This survey asks you to judge which character is more capable of telling right from wrong and trying to do the right thing.

Pain. This survey asks you to judge which character is more capable of experiencing physical or emotional pain.

Personality. This survey asks you to judge which character is more capable of having personality traits that make it unique from others.

Planning. This survey asks you to judge which character is more capable of making plans and working toward goal.

Pleasure. This survey asks you to judge which character is more capable of experiencing physical or emotional pleasure.

Pride. This survey asks you to judge which character is more capable of experiencing pride.

Rage. This survey asks you to judge which character is more capable of experiencing violent or uncontrolled anger.

Self control. This survey asks you to judge which character is more capable of exercising self-restraint over desires, emotions, or impulses.

Thought. This survey asks you to judge which character is more capable of thinking.

Personal Judgments

Destruction. This survey asks you to imagine an event that would destroy all traces of the characters' existence. If there were an event that would otherwise destroy all traces of both characters' existence, but you could choose to save one of them, which character would you choose to save?

Happiness. This survey asks you to imagine that you could somehow make one of

the characters happy. If you could somehow make one only of these characters happy, which one would you choose to make happy?

Harm. This survey asks you to imagine having to harm one of the characters. If you were forced to harm one of these characters, which one would it be more painful for you to harm?

Liking. This survey asks you to indicate which character you like more. Which character do you like more?

Punishment. This survey asks you to imagine having to punish one of the characters for causing a person's death. If both characters had caused a person's death, which one do you think would be more deserving of punishment?

Soul. This survey asks you to decide which character is more likely to have a soul. Which character do you think is more likely to have a soul?