

## Reply to van Hoorn: Converging lines of evidence

We agree with the comments by van Hoorn (1) on our critique (2): testing causal hypotheses about human behavior is a challenge (1, 3). Making progress requires specifying alternative hypotheses and then testing these hypotheses using diverse and converging lines of evidence. We have defended the hypothesis that social norms, which culturally coevolved with the institutions of large-scale societies including markets, influence economic decision-making. This hypothesis emerged from a larger set that we developed both at the outset of our project and as we went along. Our interdisciplinary team's initial list of hypotheses included the idea that experimental games might spark an innate reciprocity module that would yield little variation across populations. We also considered the hypothesis that group-level differences might result from individual differences in wealth or income. Nevertheless, what emerged in the data in our first project was (i) substantial variation among 15 populations, (ii) a strong correlation with market integration, and (iii) little relation to individual-level economic or demographic variables. Not satisfied with our first effort, we sampled 10 new populations, replicated these findings with improved protocols (developed based on critiques of the Phase I), and then extended them to two additional experimental games. Along the way, we have explored alternative hypotheses using measures of genetic relatedness, social network position, anonymity manipulations, and framing tools. To our knowledge, no other existing hypotheses can better account for the observed patterns of variation.

Several independent lines of evidence converge to support our hypothesis. First, contrary to other accounts, our approach requires that people can readily acquire social behavior or motivations toward anonymous others through cultural learning. This finding is well-established experimentally for children. Experimental work shows that observing a model behaving altruistically in a novel situation leads children to behave more altruistically in the same context. This effect endures weeks later, remains when the child is alone, and is spontaneously enforced by subjects on novices (reviewed in ref. 4). Consistent with this finding, evidence indicates that the prosociality measured in economic games develops slowly over the first three decades of life, not hitting the adult plateau until the mid-20s (4).

Our approach also predicts that norms should be context-specific, and thus, how context matters will often vary among communities with the local norms. Several studies find that context (or framing) not only matters but matters in different ways in different places (3). Our analyses and use of framing techniques confirm this finding in diverse societies (5). Moreover, work using priming tools has already begun to confirm and explore the link between markets (priming markets) and prosocial economic choices (6).

Finally, studies of migration underline the importance of nongenetic inheritance by showing that the average behavior or

beliefs in the home country (place of emigration) predict the behavior or beliefs of the migrants' children and grandchildren. Economically important effects have emerged for generalized trust, fertility, loafing, labor participation, and son preferences. Such evidence challenges hypotheses limited to cost-benefit calculations, evoked modules, or environmentally cued ontogenetic processes. Alternatively, perhaps culture matters.

**Joseph Henrich<sup>a,1</sup>, Robert Boyd<sup>b</sup>, Richard McElreath<sup>c</sup>, Michael Gurven<sup>d</sup>, Peter J. Richerson<sup>e</sup>, Jean Ensminger<sup>f</sup>, Michael Alvard<sup>g</sup>, Abigail Barr<sup>h</sup>, H. Clark Barrett<sup>b</sup>, Alexander Bolyanatz<sup>i</sup>, Colin F. Camerer<sup>j</sup>, Juan-Camilo Cardenas<sup>k</sup>, Ernst Fehr<sup>l</sup>, Herbert M. Gintis<sup>l</sup>, Francisco Gil-White<sup>m</sup>, Edwin Laban Gwako<sup>n</sup>, Natalie Henrich<sup>o</sup>, Kim Hill<sup>p</sup>, Carolyn Lesorogol<sup>q</sup>, John Q. Patton<sup>r</sup>, Frank W. Marlowe<sup>s</sup>, David P. Tracer<sup>t</sup>, and John Ziker<sup>u</sup>**

<sup>a</sup>Departments of Psychology and Economics, University of British Columbia, Vancouver, BC, Canada V6T 1Z4; <sup>b</sup>Department of Anthropology, University of California, Los Angeles, CA 90095; <sup>c</sup>Department of Anthropology, University of California, Davis, CA 95616-8522; <sup>d</sup>Department of Anthropology, University of California, Santa Barbara, CA 93106; <sup>e</sup>Department of Environmental Science and Policy, University of California, Davis, CA 95616-8522; <sup>f</sup>Division of the Humanities and Social Sciences, California Institute of Technology, Pasadena, CA 91125; <sup>g</sup>Department of Anthropology, Texas A&M University, College Station, TX 77843-4352; <sup>h</sup>School of Economics, University of Nottingham, Nottingham NG7 2DR, United Kingdom; <sup>i</sup>Department of Anthropology, College of DuPage, Glen Ellyn, IL 60137; <sup>j</sup>Facultad de Economía, Universidad de Los Andes, K1 No. 18A-70, Bogotá, Colombia; <sup>k</sup>Department of Economics, University of Zurich, CH-8006 Zurich, Switzerland; <sup>l</sup>Santa Fe Institute and Central European University, Northampton, MA 01060; <sup>m</sup>Univeridad del Medio Ambiente, Valle de Bravo, Instituto Tecnológico Autónomo de México, México 01080; <sup>n</sup>Department of Sociology and Anthropology, Guilford College, Greensboro, NC 27410; <sup>o</sup>Centre for Health Evaluation and Outcome Sciences, Providence Health Care, Vancouver, BC, Canada V6Z 1Y6; <sup>p</sup>School of Human Evolution and Social Change, Arizona State University, AR 873403; <sup>q</sup>George Warren Brown School of Social Work, Washington University, St. Louis, MO 63130; <sup>r</sup>Department of Anthropology, California State University, Fullerton, CA 92831; <sup>s</sup>Department of Anthropology, Cambridge University, Cambridge CB2 3DZ, United Kingdom; <sup>t</sup>Department of Anthropology, University of Colorado, Denver, CO 80217-3364; and <sup>u</sup>Department of Anthropology, Boise State University, Boise, ID 83725-1950

1. van Hoorn A (2012) Cross-cultural experiments are more useful when explanans and explanandum are separated. *Proc Natl Acad Sci USA* 109:E1329.
2. Henrich J, et al. (2012) Culture does account for variation in game behavior. *Proc Natl Acad Sci USA* 109:E32-E33.
3. Fehr E, Hoff K (2011) Introduction: Tastes, castes and culture: The influence of society on preferences. *Econ J* 121:F396-F412.
4. Henrich N, Henrich J (2007) *Why Humans Cooperate: A Cultural and Evolutionary Explanation* (Oxford University Press, Oxford).
5. Lesorogol CK (2007) Bringing norms in—the role of context in experimental dictator games. *Curr Anthropol* 48:920-926.
6. Al-Ubaydli O, Houser D, Nye J, Paganelli MP, Pan X (2011) *The Causal Effect of Market Participation on Trust: An Experimental Investigation Using Randomized Control* (George Mason University, Fairfax, VA).

Author contributions: J.H., R.B., R.M., M.G., J.E., and J.-C.C. designed research; J.H., R.M., M.G., J.E., M.A., A. Barr, H.C.B., A. Bolyanatz, J.-C.C., F.G.-W., E.L.G., N.H., K.H., C.L., J.Q.P., F.W.M., D.P.T., and J.Z. performed research; J.H., R.B., R.M., J.E., and A. Barr analyzed data; and J.H., R.B., R.M., M.G., P.J.R., J.E., A. Barr, C.F.C., E.F., and H.M.G. wrote the paper.

The authors declare no conflict of interest.

<sup>1</sup>To whom correspondence should be addressed. E-mail: henrich@psych.ubc.ca.