

Oishi and colleagues (Oishi et al. 2007; 2009a) likewise wondered why Americans typically define themselves in terms of personality traits, skills, and abilities rather than collective attributes (Markus & Kitayama 1991) and show conditional group identification (Cialdini et al. 1976). They demonstrated that high residential mobility might be partly responsible for such patterns of self-concepts and group identification (see Oishi, in press, for review). Uskul et al. (2008) speculated that the degree of economic interdependence might be in part responsible for analytic thinking dominant in the United States. They examined whether herders (who are economically independent) would show a greater degree of analytic tendency than farmers and fishermen (who are more dependent on others in their economic activities) in the same single region of Turkey. Indeed, they found that Turkish herders showed more analytic tendencies than did farmers and fishermen. Likewise, Yamagishi et al. (2008) hypothesized that preference for unique choice (Kim & Markus 1999) among Americans is due in part to open as opposed to closed social systems, and they demonstrated that this was indeed the case. Finally, one of the target article authors' own seminal research (see Henrich et al. 2005) has importantly shown that market integration and payoffs to cooperation in daily economic activities predicted cross-societal variations in behavioral responses in the Ultimatum Game.

A socio-ecological perspective may help us to understand not only cross-societal variation, but variation within WEIRD populations, too. For example, mean punishment expenditures from the Public Goods Game described in the target article's Figure 4 show high diversity within WEIRD samples: The United States and Australia are at one end and Germany and Denmark are at the other end. The socio-ecological perspective helps us to generate various hypotheses regarding this variation. For instance, the United States and Australia are nations high in residential mobility, whereas Germany and Denmark are nations low in residential mobility. Could these within-WEIRD variations be the result of societal differences in residential mobility (and temporariness of group membership)? If so, would there be a comparable within-nation variation in punishment behaviors between residentially mobile cities (e.g., Atlanta) and residentially stable cities (e.g., Philadelphia), a within-city variation between residentially mobile people and stable people, and even a within-person variation between the times when people are thinking about moving and the times they are thinking about staying? In the area of self-concept and conditional group identification, Oishi and colleagues have found such within-society variations as well as cross-society variations (see Oishi, in press, for review).

We are of course not claiming that all variation between human populations is due to socio-ecological factors. There is no doubt that biological and evolutionary forces also play an important role. However, a socio-ecological perspective does provide a concrete framework for searching for the causes of diversity and universality of mind and behavior.

In conclusion, we agree that psychological knowledge should not be solely based on WEIRD people. We also agree with Henrich et al. that it is important to include large and diverse samples in our science. We recommend two additional steps for researchers. First, ask the simple, yet important question of "Why are WEIRD people so weird?" Second, test whether any potential socio-ecological factors that might make WEIRD people weird account for societal, regional, and individual variations in a broad array of phenomena central to human psychology. These two additional steps are critical because they can convert the research on limited WEIRD samples from a major liability (as the authors suggest) to a major asset from which we can build and develop the type of psychological and behavioral sciences that the authors promote in their target article – the psychological and behavioral sciences that illuminate the *causes* of universality and diversity in mind and behavior. Instead of dismissing the research based on WEIRD people, we can start a

better science from it! We believe that a socio-ecological perspective is particularly helpful to this end.

Determinants of cognitive variability

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Abstract: Henrich et al. address how culture leads to cognitive variability and recommend that researchers be critical about the samples they investigate. However, there are other sources of variability, such as individual strategies in reasoning and the content and context on which processes operate. Because strategy and content drive variability, those factors are of primary interest, while culture is merely incidental.

Henrich et al.'s thought-provoking article discusses two major issues – how psychologists should pursue research, and how culture leads to cognitive variability. In what follows, we address these issues in turn, and argue that any cognitive theory ought to account for not only culture, but also other sources of cognitive variability.

First, Henrich et al. compare empirical data obtained from individual samples that fall under the umbrella description WEIRD (Western, Educated, Industrialised, Rich, and Democratic) with those obtained elsewhere, and draw the conclusion that "WEIRD subjects may often be the worst population from which to make generalizations" (sect. 7.1.2). For example, they report that people in many non-Western samples do not experience the Müller-Lyer illusion as strongly as do Americans, and query that "if visual perception can vary, what kind of psychological processes can we be sure will not vary?" (sect. 3.1, para. 5). However, while Henrich et al. caution against making sweeping generalizations from limited sets of data, they do not explain why they are permitted to make sweeping generalizations of relativism from their own data – the Müller-Lyer illusion is but one single phenomenon in visual perception, hardly representative of all visual perceptual processes. What would count as a representative sample of human psychology? The assertion that WEIRD participants are least representative of human psychology implies that there is a more representative sample, but Henrich et al. have failed to specify it. We believe that such a specification can only be arrived at empirically, and that it is impossible to specify a priori what a representative sample of human cognition should be.

Psychological research is theory-driven. Hence, in the absence of any evidence or theoretical rationale suggesting otherwise, WEIRD samples are a convenient proxy for conducting research, and they allow researchers to draw tentative conclusions about the matter of investigation. We acknowledge that certain specific psychological phenomena observed in WEIRD samples may not occur in other populations, and such discrepancies may help researchers make more accurate predictions in future experiments. Henrich et al.'s results underline the point that tentative conclusions are needed in order to support or contravene a theory.

Second, Henrich et al. have identified culture as a major source of cognitive variability, but we believe it is important to

examine other sources of variability, as well. Cognitive processes are by nature non-deterministic: Children do not employ a deterministic strategy to perform cognitive tasks (e.g., Siegler 1996), and patients with dementia, head injury, ADHD, and schizophrenia are even less consistent in their thinking (for a review, see MacDonald et al. 2006). Likewise, the same individual may perform a task differently at different times. In one of our studies (Bucciarelli & Johnson-Laird 1999), a group of participants had to draw deductions from syllogistic premises by using cut-out paper shapes representing syllogistic terms. Results showed that individuals' strategies differed from trial to trial in terms of which premises to interpret first, how to interpret the premises, and how to diligently search for counterexamples. As a result, it was impossible to predict individuals' cognitive operations based on their previous performance.

What other sorts of factors affect the way we think? Maturation and psychopathological factors are clear determinants, but the content on which a cognitive process operates may affect the process itself. Individuals think about different contents because they differ in their experiences, education, and beliefs. Culture may explain variability in these factors only to a certain extent, and hence psychologists ought to develop theories that explain how a cognitive process (a) can be modulated by content, and (b) develops and decays under normal and pathological conditions, respectively.

Consider the case of bicultural individuals. The behaviour of these individuals is guided by one internalized culture or the other at different moments (e.g., Ng & Lai 2009; Pouliasi & Verkuyten 2007), and they organize their cultural identities differently (Haritatos & Benet-Martínez 2002). When bicultural individuals' cultures contain inconsistent moral values, they will experience moral dilemmas such as the following described by a 19-year-old second-generation Indian American: "I enjoy my Indian culture, I feel that it is rich in tradition, morality, and beauty; confused because I have been in many situations where I feel being both cultures is not an option . . . I feel like you have to choose one or the other" (Haritatos & Benet-Martínez 2002). How might a theory explain this phenomenon? Mental models theory (e.g., Johnson-Laird 2006) allows for individuals to entertain inconsistent beliefs, because we tend to rely on separate sets of beliefs in separate contexts (Johnson-Laird et al. 2000). This is evident in moral reasoning, in which moral intuitions and conscious moral reasoning are based on beliefs that are neither complete nor consistent (Bucciarelli et al. 2008). Our conception of culture therefore differs from that in cross-cultural psychology, which considers culture as a network of discrete, specific constructs that guide cognition only when they come to the foreground in an individual's mind (Hong et al. 2000).

How do cross-cultural differences in thinking emerge in a society? Henrich et al. explain the development of these differences by appealing to content (data perceived, norms, and connotations) and context (individuals' contemporary environment, the environment during development, and the immediate experimental environment). We emphasize that an analysis of reasoning strategies can explain variability within the same individual. Therefore, if content, context, and strategy drive cultural differences, then those factors are of primary interest, whereas cultural differences are merely incidental. Cognitive theories should distinguish between the universal processes they propose and the specific contents on which they operate. For instance, our own theory of moral reasoning (Bucciarelli et al. 2008) posits that moral reasoning is simply normal deontic reasoning (Bucciarelli & Johnson-Laird 2005) applied to moral contents and contexts. Moral contents and contexts may differ across cultures, but the theory of deontic reasoning we propose is, and ought to be, domain-general. Such a dissociation between general computational operations and the contents they operate on allows researchers to construct theories that are sensitive not just to cultural differences, but to age-related, social, personality, and strategic differences, as well.

Responsible behavioral science generalizations and applications require much more than non-WEIRD samples

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Abstract: There are many methodological considerations – some intricately associated with the use of WEIRD samples – that adversely affect external validity as much as, or even more than, unrepresentative sampling does. Among suspect applications, especially worrisome is the incorporation of WEIRD-based findings regarding moral reasoning and retribution into normative expectations, such as might be held by international criminal tribunals in “cognitively distant” war-torn areas.

The article by Henrich et al. is a valuable contribution that goes beyond prior critiques of the deplorable lack of representativeness of a large proportion of participant samples that have been used in the behavioral sciences. The cogency of argumentation, and both the breadth and the detail of the empirical documentation that is provided, are impressive. Therefore, my commentary will not challenge the main thesis proposed by Henrich et al. Instead, its purpose is to supplement and increase the scope of their article's argument.

An important, although perhaps self-evident, observation is that the authors' thesis concerning WEIRD samples would be even more useful (perhaps considerably more so) had they at least mentioned and briefly outlined some other factors – often closely, and sometimes unavoidably, associated with the research designs using WEIRD samples – which may even more detrimentally affect the generalizability (external validity) of the results than does the lack of WEIRD samples' representativeness.

An abbreviated list of such factors will have to suffice here: unrepresentative sets of independent variables; artificiality of research settings; a limited number of tasks (often a single task) through which the independent variables are presented; and relying on a single data-collection method (such as questionnaires, surveys, or rating scales) – and therefore obtaining a single dependent measure (or an uninformatively correlated set of measures) that is often qualitatively different from the one to which generalization is sought in the “real world.” The mentioned factors are highly relevant for a more complete understanding of the issues in some of the areas discussed in the target article, especially fairness and cooperation, punishment of “excessive” cooperators, personal choice, “fundamental attribution error,” and moral reasoning.

Moreover, one must worry about the (statistical) interaction of the effect of WEIRD samples' uniqueness (extremity, non-modal character) with the effects of these additional factors (e.g., the frequently highly artificial tasks), such that the overall result (especially when interactions are of a multiplicative form) would be even more misleading with regard to some real-world criterion and domain of desired application than is the case on the basis of WEIRD samples' “differentness” alone. On the other hand, if, for example, a greater variety of tasks were used, the presently observed differences between WEIRD and various non-WEIRD samples might in some cases disappear. One simply cannot predict what would happen without doing the research.

The above family of methodological observations has its root in the pioneering work of Campbell and colleagues (e.g., Campbell & Stanley 1963; Webb et al. 1966). Among the subsequent empirical demonstrations of some of the underlying principles were the studies by Ebbesen and Konečni: for example, of decisions under risk (in automobile driving; e.g., Ebbesen et al. 1977; Konečni et al. 1976) and of key decisions by judges, prosecutors, and other participants in the criminal justice system (Konečni & Ebbesen 1982b). An important aspect of this work has been the mustering