Big-team science does not guarantee generalizability

Sakshi Ghai

(Oxford Internet Institute, University of Oxford)

Patrick S. Forscher

(Busara Center for Behavioral Economics, Nairobi, Kenya)

Hu Chuan-Peng *

(School of Psychology, Nanjing Normal University, Nanjing, China)

* Corresponding author: Hu Chuan-Peng, hcp4715@gmail.com

A new era of global "big team science" studies has transformed human behavior research. These innovative studies rely on a large, distributed network of participants from different parts of the world and represent a substantial advancement over the average study in psychology that rarely goes beyond a single demographic population (e.g., North American undergraduates)[1]. Here we examine one such big team science project which claimed the "globalizability" of temporal discounting, the phenomenon in which the subjective value of deferred rewards is smaller than immediate rewards[2]. We argue that, although this study represents a substantial advance over the typical psychology study in its sampling approach, claims of global generalizability are overstated given the samples collected. Although the project recruited 171 researchers from 109 institutions, and 13,629 research participants speaking 40 languages across 61 countries, relying solely on the typical big team methodology created an illusion of generalizability, leading authors to overestimate the extent to which research findings can be applied globally. Across low-and-middle-income (LMICs) and high-income countries (HICs) included in Ruggeri et al.[2], we find samples were all similarly young, well-educated, urban, and digitally connected. This homogeneity belies the heterogeneity present within each country[3,4]. To avoid this illusion of generalizability, we argue that researchers should carefully consider three dimensions of diversity: sample, author and methodological diversity.

Sample diversity

To their credit, the impressive dataset compiled by Ruggeri et al. included not only 40% of the countries from the group of LMICs, but several underrepresented countries from high-income countries (e.g., in Eastern Europe). Although there was substantial variation in countries – a feature that is both laudable and atypical of psychology – the sample was homogenous in certain important aspects. For example, when we examined the population distributions in three countries – lower-middle income (Nigeria, N = 263), upper-middle-income (China, N = 398), and high-income (USA, N = 386) – the samples in Ruggeri and colleagues' dataset are highly unrepresentative of their home countries (Figure 1). Despite stark differences in the general populations across these countries, participants shared largely similar attributes, such as being highly educated, young, and digitally connected. The sample characteristics achieved by Ruggeri and colleagues likely stemmed from their own devised sampling methodology, the Demić-Većkalov method (i.e., using informal snowballing and online channels). While this method was sufficient to achieve diversity in participants' country of origin, their recruitment strategy relied heavily on a convenience sampling approach. Overreliance on online samples obscures important regional, cultural, and ethnic differences within global populations[56].

Additionally, we can infer that their sample of 61 countries lacked sufficient representation from rural participants, a theoretically relevant and important target group for determining the universality of temporal discounting. Figure 1 shows that certain provinces and regions within the countries of the USA, Nigeria, and China were overrepresented in the sample compared to their true population distribution.

Although rural populations can be hard to reach, it is particularly important to do so in countries with majority rural and peri-urban populations, such as parts of Asia and Africa (e.g., 65% of Indians live in rural areas)[7]. If samples lack representation from rural populations in these regions, this can significantly skew our understanding of psychological processes. It is therefore not accurate to assume that temporal discounting naturally generalizes to 76% of the world's population as Ruggeri et al. claim. The author's strong claim to cross-cultural generalizability is therefore not warranted.

Any claim of generalizability requires having samples that are representative of the full spectrum of variation in all theoretically relevant dimensions. Admittedly, this is setting a very high bar as it necessitates the identification of all theoretically significant dimensions, adequate

sampling of all levels within each dimension, and establishing a consistent pattern across all levels. We recognize that this is often not a realistic possibility given resource constraints, and we do not propose that every global study must extensively recruit rural populations or invest in nationally representative sampling. However, doing so is especially important when a project's inferential goal is broad generalization[8], and when the team has the resources necessary for large-scale data collection. When accessing hard-to-reach but highly prevalent populations is not an option, researchers need to draw more measured and calibrated conclusions[9].

Author diversity

The diversity of authors is an important consideration for the future of equitable big team science scholarship[10]. Here we conducted an analysis of author country affiliation by global regions. Country affiliations are not a full representation of researcher diversity[11], but they do provide a glimpse into the inclusion of researchers based and working out of countries outside HICs. Our analysis finds that 13% of authors in Ruggeri et al. had institutional affiliations based in LMICs (Figure 2).

High participation of researchers located in these underrepresented regions is crucial to the success of big team science, especially as most work is funded and led by HICs. Since researchers tend to focus on recruitment strategies that they are familiar with, the absence of local researchers may exacerbate the issue of "unknown unknowns"[12]. To create mutually beneficial collaborations, involving local researchers beyond the role of translations and data collection, and ensuring participation in the conceptualization of the project is be vital[13]. This can help further advance sample diversity across all stages of research, including theory, methods, and data collection. Although big team science strategies have the potential to break away from existing power structures in academia, this potential will only be unlocked by including researchers working out of LMICs in influential leadership positions.

Methodological diversity

Ruggeri et al. first tested the variability of their hypothetical measures of temporal discounting in the US, Australia, and Canada and then subsequently translated their measure into several official languages of participating countries. However, there was no information provided on how they validated the stimuli to capture participants' understanding of temporal choices in different cultural contexts. Moreover, using official languages instead of local, regional

languages automatically excluded those who did not read and write in official languages, which are usually those with fewer educational resources.

Notably, a study found that their main effect disappeared after adapting their social discounting protocol (e.g., using rice as opposed to money as an alternate currency) to low-literate, resource-scarce settings in rural Bangladesh[4]. To strive for such diversity in methods, studies may sometimes require a complete rehaul of existing approaches, especially when testing variability in LMICs. For example, in the field of global health, the process of systematic transcultural translation is a lengthy one combining both qualitative (e.g., cognitive interviewing) and quantitative validation (e.g., psychometric assessments) across multiple contexts[14].

On balance, we believe that big team science studies hold enormous potential for increasing the representation of diverse cultures. Ruggeri et al.'s study dismantles various stereotypes about lower-income individuals being unstable decision-makers and presents a promising step forward for the future of replication research. However, researchers need to clearly present the limitations of their sample, especially when discussing policy implications of their work and practice greater epistemic humility[15]. To truly understand whether a phenomenon is insensitive to sociocultural and ecological variation, we must rethink our approach to cross-cultural research. This may require localising, rather than generalising, research findings. For example, researchers could provide detailed information about their samples in the abstract and discussion of their manuscripts indicating the specific (sub-)populations or demographic groups to which their findings apply – in the case of Ruggeri et al., a convenient, young, educated, urban sample from 61 countries. Inviting big team science studies to be more critical and self-reflective on their sample homogeneity can mitigate the risks of overgeneralization and realize their full potential.

Contributions

S.G, H.C-P and P.S.F. drafted the manuscript. S.G and H.C-P analyzed the data.

Corresponding Author: Hu Chuan-Peng

Competing interests

The authors declare no competing interests.

Data Availability

Data for reproducing the figures can be found at https://github.com/hcp4715/NHB_Globalization_Revisit.

Code Availability

Code to reproduce the analyses reported in this commentary can be found at https://github.com/hcp4715/NHB_Globalization_Revisit

References

1. Forscher, P. S. et al. The Benefits, Barriers, and Risks of Big-Team Science. *Perspect Psychol Sci* **18**, 607–623 (2023).
2. Ruggeri, K. *et al.* The globalizability of temporal discounting. *Nat. Hum. Behav.* **6**, 1386–1397 (2022).
3. Ghai, S. It's time to reimagine sample diversity and retire the WEIRD dichotomy. *Nat. Hum. Behav.* **5**, 971–972 (2021).
4. Tiokhin, L., Hackman, J., Munira, S., Jesmin, K. & Hruschka, D. Generalizability is not optional: insights from a cross-cultural study of social discounting. *R. Soc. Open Sci.* **6**, 181386 (2019).
5. Yue, L., Zuo, X.-N. & Chuan-Peng, H. The 'weird' problem in a "non-WEIRD" context: A meta-research on the representativeness of human subjects in Chinese psychological research [Stage 1 registration]. (2021).
6. Schimmelpfennig, R. *et al.* The Moderating Role of Culture in the Generalizability of Psychological Phenomena. *Advances in Methods and Practices in Psychological Science* **7**, (2024).
7. United Nations, Department of Economic and Social Affairs, Population Division. *World Urbanization Prospects: The 2018 Revision*. (United Nations, New York, 2019).
8. Yarkoni, T. The generalizability crisis. *Behav. Brain Sci.* **45**, (2022).
9. Hoekstra, R. & Vazire, S. Aspiring to greater intellectual humility in science. *Nat. Hum. Behav.* **5**, 1602–1607 (2021).
10. Coles, N. A., DeBruine, L. M., Azevedo, F., Baumgartner, H. A. & Frank, M. C. 'Big team' science challenges us to reconsider authorship. *Nat. Hum. Behav.* **7**, 665–667 (2023).
11. Ghai, S., de-Wit, L. & Mak, Y. How we investigated the diversity of our undergraduate curriculum. *Nature* (2023) doi:10.1038/d41586-023-00614-z.
12. Adetula, A., Forscher, P. S., Basnight-Brown, D., Azouaghe, S. & IJzerman, H. Psychology should generalize from — not just to — Africa. *Nat. Rev. Psychol.* **1**, 370–371 (2022).

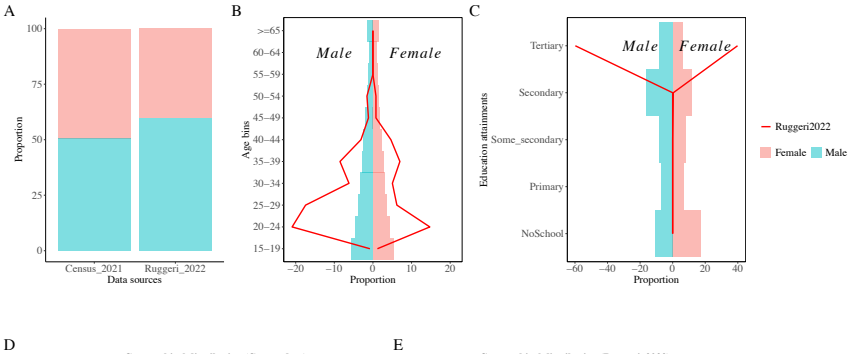
13. Mughogho, W., Adhiambo, J. & Forscher, P. S. African researchers must be full participants in behavioural science research. *Nat. Hum. Behav.* 1–3 (2023)
14. Carvajal-Velez, L. *et al.* Measurement of Mental Health Among Adolescents at the Population Level: A Multicountry Protocol for Adaptation and Validation of Mental Health Measures. *J. Adolesc. Health* **72**, S27–S33 (2023).
15. Clarke, B., Schiavone, S. & Vazire, S. What limitations are reported in short articles in social and personality psychology? *J Pers Soc Psychol* **125**, 874–901 (2023).

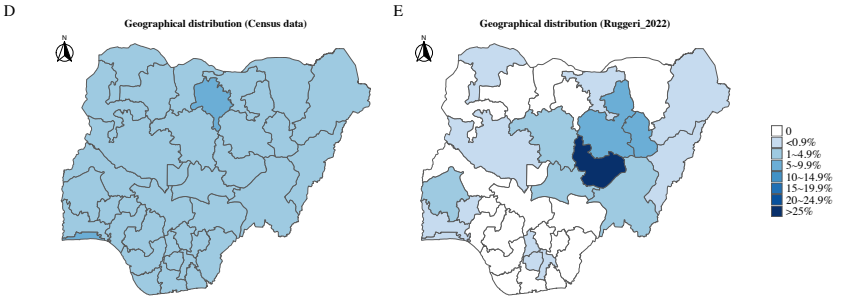
Figure captions

Figure 1: Results from comparing Nigerian, Chinese and USA samples in Ruggeri et al (2022) and Census data of each country. (A) Sex ratio; (B) Distribution of age; (C) Distribution of Education attainments; (D) Geographical distribution.

Figure 2: Results from comparing author's institution affiliation. 87% of authors were affiliated with institutions based in the high-income countries (HICs) and 13% in the low-and-middle-income (LMICs). The highest percentage of affiliations were with institutions based in North-Western Europe at 37%, followed by North America at 22%, Southern Europe at 12%, and Eastern Europe at 11%. The remaining authors were affiliated with institutions in Asia (9%), Latin America (4%), Middle East and North Africa (2%), Africa (2%), and Oceania (1%).

Data of Nigeria





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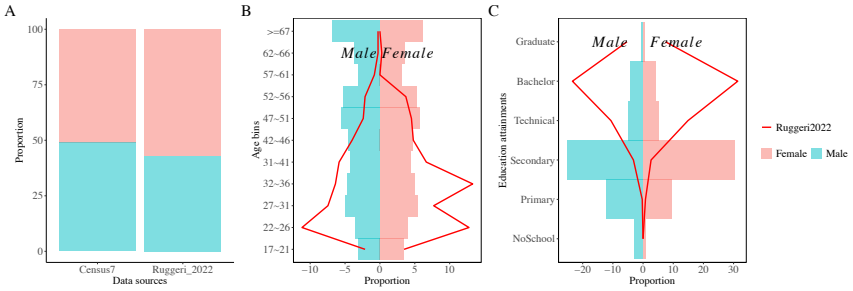

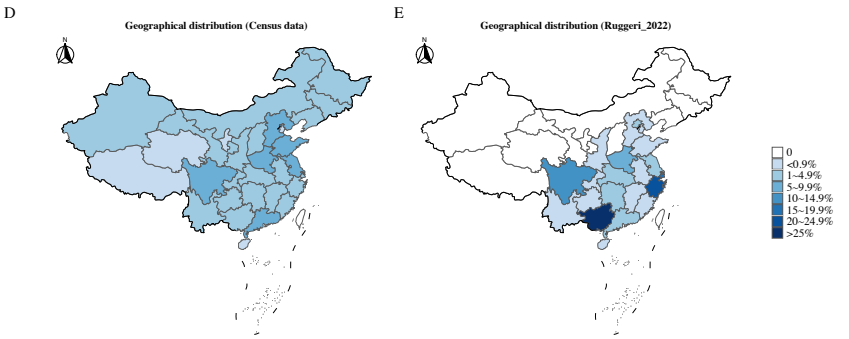

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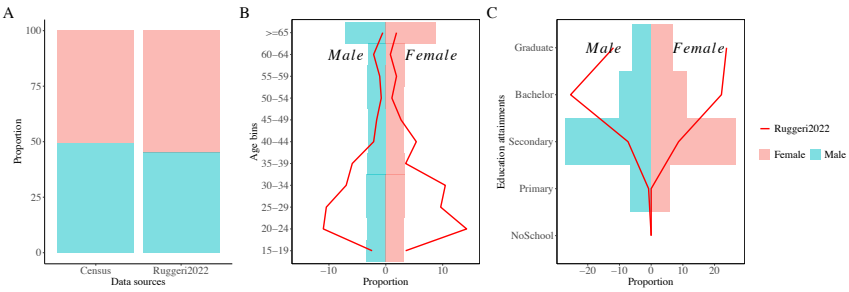

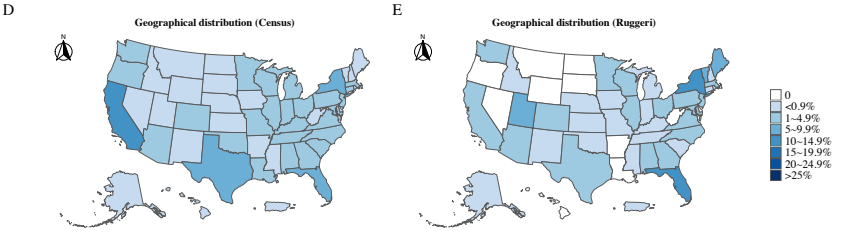

Author Institution Affiliation