LETTER

REPLY TO ADOLF AND FRIED: Conditional equivalence and imperatives for person-level science

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We thank Adolf and Fried (1) for their insightful commentary on our paper (2). We agree, in principle, that group-to-individual generalizability lies along a continuum. Some intraindividual and interindividual statistical estimates may be ergodic, sharing equivalent values across all statistical moments. Under these conditions, inferences from cross-sectional data could be applied to individuals. On the other end of this continuum, intra- and interindividual estimates are orthogonal, rendering them unrelated and nontransferable.

Adolf and Fried (1) argue that under nonergodic conditions, conditional equivalence may still be achieved if the sources of nonergodicity can be identified, facilitating conditional inferences across levels of analysis. We agree that the notion of conditional equivalence requires further investigation and join Adolf and Fried in calling for research that directly interrogates the agreement between group and individual data structures. Viewing ergodicity as a binary criterion, however, encourages researchers to evaluate group models and the extent to which they represent the individuals that comprise them. Therefore, we maintain that ergodicity is necessary to claim that a group model fully explains individual processes.

Practically, we are concerned that group models and research designs are often easier to power, perform, and incentivize (e.g., fund). Given the fact that mental, physiological, and behavioral processes manifest within people over time, it is prudent to assume that group models do not explain individual-level processes until it has been demonstrated. The burden of proof should thus fall on the group model to describe individuals. Each individual system may be quantitatively or qualitatively unique (2, 3).

Randomization is a well-established method for conditioning on unobserved heterogeneity, but the estimated differences between conditions are only true for the average participant in each condition. Thus, experimental effects are only true for constituent individuals to the degree that each individual is archetypal of the average. In other words, experiments and treatments informed by groups will necessarily omit or obscure individuals unless full ergodicity is observed or the individual deviance from the average is known.

Fundamentally, who is this average person in an ontological sense? Neuroscientists describe statistically "average brains" with features that have never been observed in a single person (4, 5). Sources of variance in data can be statistically separated into group, individual, and interaction effects (6, 7), but these are not mechanistic models (8). The "average" is a mathematically coherent idea but discounts the imperative to find principled ways of thinking about individuals (9, 10). Group-level models are important and answer unique questions, but they are statistical models whose transferability to individuals must be validated.

Finally, Adolf and Fried (1) note that we did not address temporal instability in our paper. The very presence of temporal dynamics, resulting from natural processes, only encourages us to think more precisely about processes as they unfold within individuals over time. Such dynamical processes must be measured and modeled at the appropriate scales to better describe reality, predict the future, and craft generalizable models. Future research should endeavor to uncover the processes that produce temporal variation in measurements and the latencies in time-dependent relationships among constructs.

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