

is the same, however: making sense out of the previously unwanted variance in grouped data by relating it to independent measures of other kinds of individual difference. Once one grasps the point that there are almost always individuals who do not follow the group's mean trend, a fact that may be the result of hidden but nonrandom determinants, the door is open to many exciting new investigative vistas and the broadening of theory.

REFERENCES

- Barr, H. B., Langs, R. J., Holt, R. R., Goldberger, L., & Klein, G. S. (1972). *LSD: Personality and experience*. New York: Wiley.
- Cronbach, L. J. (1957). The two disciplines of scientific psychology. *American Psychologist*, 7, 173–196.
- Cronbach, L. J. (1975). Beyond the two disciplines of scientific psychology. *American Psychologist*, 30, 116–127.
- Frank, J. D. (1938). Level of aspiration test. In H. A. Murray et al., *Explorations in personality: A clinical and experimental study of fifty men of college age* (pp. 461–471). New York: Oxford University Press.
- Gardner, R. W., Holzman, P. S., Klein, G. S., Linton, H. B., & Spence, D. P. (1959). Cognitive control: A study of individual consistencies in cognitive behavior [Monograph]. *Psychological Issues*, 1(4).
- Holt, R. R. (1945). Effects of ego-involvement upon levels of aspiration. *Psychiatry*, 8, 299–317.
- Kosslyn, S. M., Cacioppo, J. T., Davidson, R. J., Hugdahl, K., Lovaglio, W. R., Spiegel, D., & Rose, R. (2002). Bridging psychology and biology: The analysis of individuals in groups. *American Psychologist*, 57, 341–351.
- Murray, H. A., et al. (1938). *Explorations in personality: A clinical and experimental study of fifty men of college age*. New York: Oxford University Press.
- Underwood, B. J. (1975). Individual differences as a crucible in theory construction. *American Psychologist*, 30, 128–134.
- differences research to illuminate the links between psychology and biology. We agree that the study of individual differences is vital for uncovering processes that have hitherto remained obscured by relying too heavily on group-level approaches, and we commend their multilevel, multidisciplinary approach to this important topic. However, we believe that Kosslyn et al. should have given more attention to one of the most promising avenues for pursuing their multilevel approach—comparative research. Although Kosslyn et al. did refer to animal studies, they did not sufficiently emphasize the potential contribution of animal research.
- Comparative research has contributed to many areas of biology and psychology in large part because of methodological advantages afforded by animal studies. Five important methodological advantages are particularly relevant to Kosslyn et al.'s (2002) approach. First, animal studies allow greater experimental control and facilitate more extensive experimental manipulations than is possible in studies of humans. Thus, animal studies can be used to test specific hypotheses that, with humans, must often rely on suboptimal designs. For example, Capitanio, Mendoza, and Baroncelli (1999) manipulated animals' social environments to examine the links between the stability of social environments and physical health. Second, observations of animals can be made in far greater detail and for more extensive periods than is possible with humans. For example, Virgin and Sapolsky (1997) drew on five years' worth of behavioral observation of baboons to illuminate the links between male social behavior and endocrine responses. Third, animal studies permit the use of a wide range of physiological interventions and the measurement of a wide range of physiological parameters, providing the type of data that are necessary to identify the biological mechanisms underlying psychological processes. For example, Zuckerman (1996) drew on animal studies involving measures of neurotransmitters, enzymes, and hormones to develop a psychobiological model for sensation seeking. Fourth, the short life span of many species allows researchers to conduct longitudinal studies in shorter periods than is possible with humans. For example, in a period of only four years, Fahlke et al. (2000) examined how rhesus macaques' rearing experiences and stress responses in infancy predicted alcohol consumption in young adulthood. Fifth, detailed quantitative and molecular genetic information is available for some animal species such as mice, and animal research permits transgenic, knockout, and cloning studies that can provide novel opportunities to further understand the genetic influences on psychology and biology (Flint, 2002). For example, Dulawa, Grandy, Low, Paulus, and Geyer (1999) used knockout mice to examine the links between the dopamine receptor (D4R) gene and novelty-seeking behavior.
- Kosslyn et al. (2002) provided several instructive examples of human research that demonstrate how individual differences can moderate the links between psychological events and the immune system. However, this is a topic that can greatly benefit from the advantages afforded by animal research. In fact, in a recent special issue of the journal *Brain, Behavior, and Immunity* (June 1999) devoted to the role of individual-difference factors in psychoneuroimmunology, three of the eight articles used animal studies, effectively exploiting several of the benefits of animal research.
- In one of these articles, Capitanio et al. (1999) provided an excellent illustration of the advantages afforded by animal research. Their research examined the personality and physiological correlates of rhesus macaques' behavioral, neuroendocrine, and immunological response to simian immunodeficiency virus (SIV) disease. This exemplary study incorporated many of the principles set forth in Kosslyn et al.'s (2002) article: an analysis of both group-level and individual-difference measures that evaluates the independent contributions of both psychological and biological variables in addition to the interaction between the two. Capitanio et al.'s findings showed that monkeys' sociability predicts both behavioral responses to social manipulations (stable vs. unstable conditions) and antibody response to SIV inoculation, which both in turn predict length of survival. Such a controlled and comprehensive study could not have been conducted with humans for practical as well as ethical reasons.
- As noted by Kosslyn et al. (2002), their multilevel research strategy rests on prior characterization of individual differences. Personality traits can be reliably assessed in animals (Gosling, 2001; Gosling & Vazire, 2002), opening the way for at least some multilevel comparative research. Thus, we argue that animal studies can add yet another level of analysis to the multilevel approach envisioned by Kosslyn et al.; the comparative perspective can and should play a central role in this research, providing unique insights into the links between psychology and biology that could not easily be obtained through research on humans alone.

REFERENCES

- Capitanio, J. P., Mendoza, S. P., & Baroncelli, S. (1999). The relationship of personality dimensions in adult male rhesus macaques to progression of simian immunodeficiency virus disease. *Brain, Behavior, and Immunity*, 13(2), 138–154.

Correspondence concerning this comment should be addressed to Robert R. Holt, P.O. Box 1087, Truro, MA 02666. E-mail: bobholt@capecod.net

DOI: 10.1037/0003-066X.58.5.407

Bridging Psychology and Biology With Animal Research

Simine Vazire and Samuel D. Gosling
University of Texas at Austin

Kosslyn et al. (May 2002) advocated combining group-based research and individual-

- Dulawa, S. C., Grandy, D. K., Low, M. J., Paulus, M. P., & Geyer, M. A. (1999). Dopamine D4 receptor-knock-out mice exhibit reduced exploration of novel stimuli. *Journal of Neuroscience*, *19*, 9550–9556.
- Fahlke, C., Lorenz, J. G., Long, J., Champoux, M., Suomi, S. J., & Higley, J. D. (2000). Rearing experiences and stress-induced plasma cortisol as early risk factors for excessive alcohol consumption in nonhuman primates. *Alcoholism: Clinical and Experimental Research*, *24*, 644–650.
- Flint, J. (2002). Animal models of personality. In J. Benjamin, R. P. Ebstein, & R. H. Belmaker (Eds.), *Molecular genetics and the human personality* (pp. 63–90). Washington, DC: American Psychiatric Publishing.
- Gosling, S. D. (2001). From mice to men: What can we learn about personality from animal research? *Psychological Bulletin*, *127*, 45–86.
- Gosling, S. D., & Vazire, S. (2002). Are we barking up the right tree? Evaluating a comparative approach to personality. *Journal of Research in Personality*, *36*, 607–614.
- Kosslyn, S. M., Cacioppo, J. T., Davidson, R. J., Hugdahl, K., Lovallo, W. R., Spiegel, D., & Rose, R. (2002). Bridging psychology and biology: The analysis of individuals in groups. *American Psychologist*, *57*, 341–351.
- Virgin, C. E., Jr., & Sapolsky, R. M. (1997). Styles of male social behavior and endocrine correlates among low-ranking baboons. *American Journal of Primatology*, *42*, 25–39.
- Zuckerman, M. (1996). The psychobiological model for impulsive unsocialized sensation seeking: A comparative approach. *Neuropsychobiology*, *34*, 125–129.

Correspondence concerning this comment should be addressed to Simine Vazire, Department of Psychology, 108 E. Dean Keaton Street, University of Texas, Austin, TX 78712. E-mail: simine@mail.utexas.edu