The Limitations of Concepts in Developmental Psychology

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Many concepts in developmental psychology are inferred or confirmed from very particular experimental or naturalistic observations but investigators often generalize their validity to a broad domain of situations. This permissiveness is affecting progress. This paper provides examples of this error and criticizes the tendency to award essences to predicates representing psychological processes.

Developmental psychology, like other domains in the social sciences, is being restrained by its history. One limitation is a derivative of its philosophical parents, for the first psychologists tried to gather laboratory evidence that would prove the validity of the abstract concepts of consciousness, perception, morality, and memory. The second pull to the past comes from an awe for physics, because in psychology's early years biology had not yet attained its currently high status. Unfortunately, both philosophers and physicists like abstract concepts that invite a commitment to Platonic essences. Philosophers, for example, continue to write about *consciousness* or *morality* as if these words named unitary natural phenomena. Physicists describe an atom of oxygen as if its features were identical in all instantiations, even though the features in air are not identical to its features when part of a molecule of sulfuric acid. Psychology must free itself from both traditions and recognize, as biologists do, that the functions of every

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hypothetical structure vary with the agent and the context of measurement. The message in this brief essay is that each experimental procedure or method of analysis influences the conceptualization of the phenomena each produces.

Most scientists belong to one of two distinct groups. One cohort begins its empirical work by assuming the validity—some may prefer the word *reality*—of a particular concept, be it fear, intelligence, or depression, and try to find a procedure that will index the processes the concept implies. For example, neuroscientists and psychologists who are convinced that the term *fear* names a natural phenomenon use conditioned freezing, potentiated startle, increased salivary cortisol, or, in humans, self-reports of fear as valid reflections of the same state. The commitment to the unitary concept is so strong that advocates resist rejecting its utility, despite inconsistent evidence, and instead, look for new methods to reaffirm their faith in the idea.

The second group, more loyal to Mach and Bohr than to Einstein and Heisenberg, reject all concepts that assume Platonic essences. These scholars believe that all nature ever reveals are robust relations between observed phenomena and that we invent words, understood to be conventions, to explain the covariation. When these scientists acknowledge the reliable relation, in animals, between the presence of a tone that signals electric shock and the display of body immobility (freezing), they attempt to explain the reasons for the relation. Because freezing can be induced without conditioning, and is muted if the electric shock used in conditioning is very intense, they resist ascribing a unitary state of fear to any animal.

Scientific domains cycle over time in their friendliness to one or the other of these attitudes toward the relation between words and events. Because 19th-century scientists had become addicted to a priori concepts like *elan vital, will, vis nervosa,* and *the ether,* early 20th-century scholars, recognizing that the academy had filled with verbal rubbish, tried to cleanse the halls with the rules that became known as logical positivism. Percy Bridgman, Ludwig Wittgenstein, Rudolph Carnap, and Morris Schlitz led the house cleaning. But because the austerity of the positivistic rules shackled the creative intuitions that are necessary for theoretical advance, these imperatives lost their hold on the next generation, and by the 1960s, words naming essences once again began to accumulate in technical journals. It is time for another house cleaning.

Contemporary psychologists are addicted to assigning abstract psychological properties to animals and humans that fail to specify the agent and the context in which the properties are actualized. Obvious examples are concepts like *extrovert, fearful, intelligent,* or *securely attached,* for which the situations in which the trait is displayed are unspecified. Fewer biologists are guilty of this error because they understand that every life process is linked to a particular class of organism and actualized under *particular* conditions. Each person possesses representations of the events encountered most frequently in a particular context, whether forest, office, airport, stadium, television screen, or laboratory scanner. Men holding machine guns are discrepant in most settings but not on television screens. Because humans evaluate every event with respect to the situation in which it normally occurs, every event must be conceptualized as an "event in a context." The context, like a channel setting on a television set, primes the brain to expect a particular set of most probable experiences. This process can be observed in rats, for injecting cocaine into the brain has one consequence if the rat is in a familiar home cage and quite another if the animal is in an unfamiliar place. A 1-year-old is more likely to cry to an approaching stranger if in an unfamiliar room than at home (Kagan, 1984), and adults show greater cardiovascular reactivity to a stressor if they are with their favorite pet than if alone or with a spouse (Blascovich & Mendes, 2002).

The influence of the testing context is sometimes surprising. An examiner tells a 4-year-old that if she points to the location where a piece of candy is hidden, a stranger, and not she, will get the sweet. However, if she points to the other location, she will get the candy. If the examiner tells the child to use her finger to point, she is honest and informs the stranger of the candy's correct location. However, if she is given a rod as the indicator, she points to the other location and takes the candy for herself (Hala & Russell, 2001). This result affirms the significance of the *details* of the testing context on the evidence used for inference.

The reluctance to restrict a psychological property to a class of situations is obvious in essays on morality. Western psychologists and philosophers continue to debate whether fairness, justice, honesty, kindness, and restraint on harming another are a priori moral imperatives. Much of the disagreement melts away if we insist that the actions be conceptualized. It is easy to argue that killing another without provocation is morally wrong. However, administering a requested lethal dose of morphine to an elderly cancer patient in pain becomes ethically defensible once the context of a moral action is specified. The practice of conceptualization makes it is easier to sort behaviors and intentions into moral and amoral categories.

Because every class of experimental procedure is a special context, the meaning and validity of every conclusion must be evaluated in light of the method that produced the evidence. Each procedure produces information representing only a part of the whole that scientists wish to comprehend. Two measures designed to evaluate an infant's ability to recognize a novel event, for example, can be unrelated (Rose, Feldman, & Jankowski, 2003). Simultaneous recordings of psychological and biological measures often lead to different inferences. Most 10-year-olds shown pictures of children they had played with in preschool four to five years earlier, along with pictures of unfamiliar children, had poor recognition memory for the former playmates when they were asked to say whether they had ever seen the child in the photo. However, many children who did not recognize a former playmate produced a galvanic skin response to photos of children they had played with earlier but not to the strangers (Newcombe & Fox, 1994).

The method selected for data analysis influences inferences. When investigators use a heritability equation in a study of intelligence in twin pairs, they are forced to assume that genetic and environmental contributions are additive. When psychologists use analysis of covariance to control for social class influences on the relation between children's vocabulary and adult vocational choice, they are forced to assume that the magnitude of the effect of social class is similar at all levels of vocabulary knowledge. Both assumptions are subject to critique.

Developmental psychologists rely primarily on three different sources of evidence: questionnaires and interviews, behavioral observations (either naturalistic or in a laboratory), and biological measurements. Each procedure provides a specific class of evidence, and the constructs invented to explain the results are limited to the source of evidence. There are usually low correlations among self-report, behavioral, and biological indexes of the same construct, whether fear, attachment, or intelligence. Self-report data, which involve semantic representations, are the least constrained; behavioral observations and biology are more seriously restricted by the context of observation.

The current belief that a particular behavior or biological reaction maintains the same meaning across different incentives and contexts is retarding progress. Consider, again, the popular assumption that the duration of bodily immobility, or the magnitude of potentiated startle, in response to a conditioned stimulus that signals electric shock means that the animal is in a state of fear mediated by the amygdala. Although a rat with a lesioned amygdala shows minimal freezing, implying the absence of a state of fear, the same animal will defecate in the place where it was shocked. This fact implies that the animal is in a fear state (Antoniadis & McDonald, 2000). Thus, the meaning of body immobility depends on the specific context, and a "response in a context" should be the proper construct.

Too many psychological concepts are indifferent to the species, response, and particular situation in which the behavior occurs. As a result, words like *fear* and *aggression* are used to describe an animal state. Nelson and Chiavegatto (2001) assumed that a mouse biting an intruder belongs to the same psychological category as an adolescent who bullies a peer. However, an intention to harm another, which is absent in mice, is an essential feature of all human acts called aggressive.

The problem lies with the borrowing of predicates that are intended to apply to human behavior or states and attributing the same meaning to these words when they are applied to animals. This practice occurs because there is a smaller number of distinct verbs than nouns for living forms. The psychological meaning of *bit* in the sentence "The boy bit his brother," is not the same as its meaning in "The mouse bit the intruder." Unfortunately, English does not have a word other than *bit* to describe the animal's behavior. Thus, the behavioral biologist selects this word but assumes, incorrectly, that the act is aggressive in intent whether it occurs in humans or animals. Because the meaning of a predicate often varies with the agent—that is why ancient Romans used different words for the act of kissing when the actor was a mother, spouse, or lover—neurobiologists should be careful when they apply to animals predicates that are intended to describe human behavior. In general, biological measurements require a very different vocabulary than the one used for either self-reports or behavioral observations. A change in cortisol, heart rate, skin conductance, cerebral blood flow, or event-related potentials are a function of biological systems, not psychological structures. That is why it is important to combine varied sources of evidence.

Natural phenomena consist of events that do not require a special technology in order to be observed but the layers of disguised processes require special methods that are presumed to represent the conditions necessary, but not sufficient, for display of the public events. It is almost always the case that the easily observed layer can be the product of different underlying processes. Therefore, the observed phenomena are ambiguous in theoretical significance and inferences based on them are necessarily uncertain.

Headaches provide an example. The report of chronic headache could be the result of different etiological conditions; for example, constriction of the blood vessels of the head, a tumor, or an infection.

Therefore, the physician needs additional information from other procedures, including analyses of urine and blood as well as X-rays to diagnose the cause more accurately.

A behavior, test performance, or verbal report, like a headache, represents a superficial, easily observed phenomenon that can be produced by different conditions. An infant's display of increased behavioral orientation to an event could be due to the surprise caused by a violation of an expectation, a change in motion or contour density, or a history of prior affective experiences with the event (Montague & Walker-Andrews, 2001). A report of fear of snakes, public speaking, or strangers given on a questionnaire could be given by individuals who experience physiological arousal when they encounter the feared target, as well as by those who do not have any biological reaction. The self-report of fear has different meanings for these two groups. An IQ score of 75 could be attained by a 6-year-old child who had been isolated from stimulation since infancy, a child with Down or Asperger's Syndrome, or one with compromised hearing. One-year-olds who remained playing calmly when their mother left them alone in the laboratory room and did not approach her when she returned might have a parent who is neglecting or might possess a temperamental bias that mutes states of distress to unexpected events. Unless investigators eliminate all of the factors that could mediate a particular behavior or self-report, except the one of interest (which rarely happens), the inference drawn from the evidence is vulnerable to critique.

One constructive solution is to quantify several relevant measures rather than one. For example, Sorenson and colleagues (unpublished) discovered that college students showed equivalent, potentiated magnitudes of startle to acoustic probes presented when they were looking at aversive pictures or solving arithmetic problems. But the pictures, and not the cognitive problems, also elicited cardiac deceleration and corrugator muscle activity. The arithmetic problems elicted heart-rate acceleration and no corrugator activity. Thus, the two conditions produced different states, but that inference required the simultaneous measurement of more than one variable. Both adult humans and rats produce a P300 in the event-related potential to a discrepant tone presented in an odd-ball paradigm. But the rats and humans were not in the same psychological state, for only the humans showed a minimal P300 in the parietal area when they did not have to make a response to the discrepant target. The rats showed a large P300 whether or not they were required to make an instrumental response (Sambeth et al., 2003). The suggestion to code multiple variables is essentially similar to arguments for multiple methods in personality assessment. A single behavior, verbal report, or biological reaction can be the product of distinctly different conditions and quantification of multiple measurements is more likely to separate the varied causes.

Chemists gained major insights when they added information from the spectra produced by a heated element. Neuroscientists attained a deeper understanding of brain anatomy when they exploited electron microscopes. It is now time for developmental psychologists to enjoy a period of progress. But to attain that goal, they should add behavioral, cognitive, and physiological data to the semantic self-reports or observations of single behavioral variables that now dominate the methodologies used in many studies of human development.

The indifference to context is stronger in Western than in Asian cultures. One reason for this difference may be that the primary social entity in European American society is the individual. Each person must attain salvation, wealth, status, or happiness on their own, and praise for success or blame for failure is placed on the person rather than on others. By contrast, the imperative for Asian youth is to seek harmony with, and become part of, a group, first family and, later, peers and community. Each person's pride or shame rests on the success or failure of the groups of which the self is a member and not only on the self's talent and perseverance.

The next cohort of developmental psychologists must append a description of the class of agent and situation of observation to every predicate for a psychological process. The meaning and theoretical utility of constructs like "the concept of number" will differ if the subject is an infant discriminating two dots from six dots or an adult dividing 162 by 13. Similarly, the meaning of *secure attachment* will depend on whether the investigator records the infant's behavior to the mother's return in the Strange Situation or an adult's recall of her childhood relations with her mother. We need full sentences and more varied sources of evidence!

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