My Biggest Research Mistake

Adventures and Misadventures in Psychological Research

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Mistaking the Lab for Real Life

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I have always prided myself on being "ecologically minded." I endorse the ecological approach of James Gibson (1979) and my graduate advisors, Eleanor Gibson (1988) and Ulric Neisser (1976), and I share their belief that the key to unlocking the mysteries of perception and action lies in the functional relations between animals and their natural environments. In *The Ecological Approach to Visual Perception*, James Gibson (1979, p. 3) wrote, "It is not true that the laboratory can never be like life. The laboratory must be like life!" Gibson didn't mean that researchers should only conduct naturalistic studies or try to simulate all the details of reality in the laboratory. He meant that controlled laboratory experiments must contain the critical characteristics—the "essential invariants"—of real-world perception and action (p. 305). Thus, ecological validity is central to ecological psychology: Experimental findings must generalize to the real-world phenomena we wish to explain.

In studies of infant locomotor development (my field), ecological validity is seldom a concern. Instead, for nearly a century, most researchers (including me) have encouraged barefoot, nearly naked infants to step on treadmills or take continuous, forward steps along straight paths over uniform ground (reviewed in Adolph & Robinson, 2013, 2015). Certainly no researcher believes that babies only generate alternating leg movements or only walk barefoot and naked along continuous, forward, straight paths. Rather, the practical limitations of recording technologies and researchers' desire to experimentally control biomechanical factors led to reliance on treadmill stepping and the "straight-path" test. Moreover, the long tradition of using these not-very-ecologically valid paradigms generated a wealth of robust, detailed data about developmental improvements in infants' gait (step length, timing between legs, joint angles, etc.). So what's the harm?

Eleanor Gibson's focus on the relations between perception and action led her to adopt a very different paradigm, in which infants navigate obstacles in their path. In Gibson's studies, and presumably in the real world, the ground is not uniform, and infants do not take continuous, forward, alternating steps. Babies stop. They detour. They engage in exploratory activities. They find alternative methods of locomotion or ask their caregivers for help. Infants detect "affordances" (or lack of them) for locomotion.

Gibson's most famous task is the "visual cliff"—a glass-covered, illusory drop-off. Gibson's followers expanded on her work with variations of the visual cliff and a wild assortment of other obstacles (reviewed in Adolph & Kretch, 2012). For example, I've tested infants at the edge of real drop-offs, gaps in the surface of support, uphill/ downhill and high/low friction slopes, narrow ledges and bridges, foam pits, and so on. In some cases, we altered infants' bodies with lead-weighted shoulder-packs, Teflon-soled shoes, or platform shoes. Sometimes caregivers told infants to go and sometimes to stop (reviewed in Adolph & Robinson, 2013, 2015).

Outside the laboratory, of course, no infant walks down steep slopes wearing Teflon-soled shoes, and no caregiver encourages infants to do so. Like Eleanor Gibson, I intentionally designed my tasks to be novel. In my view, locomotor development—indeed all of motor development—requires learning to perceive changing body-environment relations and to select and modify actions accordingly. Infants must learn to move while coping with novel changes in their bodies and the environment. Following James Gibson's mandate to make the lab like life, my tasks were designed to capture the novelty and variability of real-world locomotor development. So what's the problem?

My mistake was that I confused tests of infants' abilities (what they can do in structured lab tasks) with their real-world experiences (what they actually do outside the lab). I did not start by describing infants' real-world locomotor development. Instead, I simply assumed that the essential ingredients of natural locomotor experience are novelty and variability. After 20+ years of testing infants walking along straight paths, navigating novel obstacles, and coping with experimental changes to their bodies, I finally thought to ask: What are the real-life experiences that support learning to locomote? How, where, and why do mobile infants walk to places of their own choosing? We finally began to describe infants' spontaneous locomotion during free play at home and in laboratory playrooms.

Counter to common sense and a century of laboratory research, during real-world locomotion, infants do not primarily walk to destinations. Although infants walk to caregivers, toys, and snacks when tested in the straight-path test and on raised walkways with an obstacle blocking their path, such goals are not the typical impetus for real-world locomotion. Head-mounted eye tracking shows that destinations viewed while stationary rarely instigate locomotion, and bouts of locomotion rarely terminate at a destination (Cole, Robinson, & Adolph, 2016; Hoch, Rachwani, & Adolph, 2017; Karasik, Adolph, Tamis-LeMonda, & Zuckerman, 2012). Instead, infants stop walking in the middle of the floor or take steps in place. They walk twice as much with no one to play with than while playing with their caregivers, and they walk just as much in an empty room as in a toy-filled room (Hoch, O'Grady, & Adolph, in press). Apparently, movement is its own reward. Although my tasks with drop-offs, slopes, and so on provide a perfectly good test of infants' perception of affordances, they do not capture the essential characteristics of how infants learn to locomote during natural activity.

A second surprise was more fortuitous, given my many years of work in this field. Gait during free play validates the straight-path test. Using large instrumented floor, we replicated the developmental progression in infants' gait (speed, step length, etc.) during free play with all the starts and stops, omnidirectional steps, and curved paths that are eliminated in the straight-path test. This means that researchers needn't coerce infants to walk in unnatural ways. Moreover, discontinuous, omnidirectional, curved paths characterize infants' first steps and continue unabated over the next nine months (Lee, Cole, Golenia, & Adolph, 2018). But these essential characteristics of real-world walking are absent in the traditional straight-path task and correspondingly absent from theories of locomotor development.

A final surprise concerns the quantity and variety of natural locomotion. In a cluttered environment while playing with caregivers, toddlers average 2,400 steps and travel the distance of eight football fields per hour, traipsing en route over most available surfaces (Adolph et al., 2012). In short, infants acquire immense amounts of time-distributed, variable practice with locomotion—exactly the sort of training regimen that leads to functional, flexible behavior. Happily for me, the description of infants' natural locomotor development, however tardy, is consistent with my hypothesis that infants' real-world experiences support learning to perceive and exploit changing body-environment relations, and this hypothesis can now be tested in ecologically valid experiments.

What is the take-home message from my mistake? Researchers in any field must remind themselves that participants' abilities in structured lab tasks do not necessarily reflect participants' actual behaviors outside the lab. And the best way to ensure ecological validity in structured lab tasks is to start with a rich description of real-world behavior.

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CRITICAL THINKING QUESTIONS

1. How do tradition, practical constraints, and reductionist thinking contribute to laboratory studies that lack ecological validity?
2. How might the lack of ecological validity lead to erroneous theories?
3. What can you, as a researcher, do to ensure that the phenomena in your laboratory studies reflect the real-world phenomena you wish to explain?

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