

The title for this Special Section is **Bringing Developmental Science into the World**, edited by Roberta Michnick Golinkoff, Kathy Hirsh-Pasek, Rachel Grob, and Mark Schlesinger

“Oh, the Places You’ll Go” by Bringing Developmental Science Into the World!

Roberta M. Golinkoff
University of Delaware

Kathy Hirsh-Pasek
Temple University and The Brookings Institution

Rachel Grob
University of Wisconsin

Mark Schlesinger
Yale University

Urie Bronfenbrenner and Ernest Boyer argued for leaving the laboratory to conduct rigorous developmental research in the real world where children are found—in the places they go. Contributions to this special issue meet Bronfenbrenner and Boyer’s call while at the same time recognizing the continued importance of laboratory research. These articles range from a review of research on the arts to a language intervention in Senegal to large-scale dissemination and intervention projects designed to communicate the best developmental science to families, public agencies, and schools. Together these articles illustrate how we can study development in the world and enrich our work on the factors that promote development. Taking this path presents us with a set of additional hurdles to be addressed, such as how to communicate with the public and how to scale up our interventions in the face of diversity along many dimensions.

Oh, the places you’ll go! . . . You have brains in your head. You have feet in your shoes. You can steer yourself any direction you choose. You’re on your own. And you know what you know. And YOU are the one who’ll decide where to go . . .

—Dr. Seuss, *Oh, The Places You’ll Go!* (1990)

Philosopher Thomas Kuhn (1962) analyzed the developmental trajectory of science. In his framework, science progresses through paradigms or dominant ways of thinking about an area of inquiry. During “prescience,” no central paradigm is identifiable. Then, in what he called “normal

science,” a central paradigm is tacitly agreed upon by a group of scientists. Only when enough discordant evidence emerges, and the central paradigm no longer explains critical phenomena, does the science undergo what Kuhn called a “paradigm shift.” It is in this shift that “traditional” ways of analyzing problems rooted in the old paradigm give way to new ways of explaining and evaluating data. As our field entertains the move from the laboratory to the living room, we must grapple with new ways to study child development. We might well be on the precipice of a paradigm shift.

Yet the laboratory continues to be of great value to our collective enterprise. To take one example, the study of language development has made considerable progress because of laboratory studies that revealed early language comprehension as well as the processes children appear to invoke in learning their native tongue (e.g., Fernald, Zangl,

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Correspondence concerning this article should be addressed to Roberta M. Golinkoff, 206 Willard Hall, University of Delaware, Newark, DE 19716. Electronic mail may be sent to roberta@udel.edu.

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Portillo, & Marchman, 2008; Golinkoff, Ma, Song, & Hirsh-Pasek, 2013; Kemler Nelson et al., 1995). In the laboratory, where many methods rely on visual fixation time as the dependent variable (e.g., Hoff, 2012), the field has generated substantial knowledge about how infants and toddlers perceive the sounds of speech (e.g., Werker & Gervain, 2013), segment the language stream (e.g., Jusczyk, Houston, & Newsome, 1999), and make sense of the sentences that are directed to them (e.g., Bavin, 2009). These findings could not have come from studying children in situ; they require presenting children with stimuli in controlled circumstances and making inferences about their responses. Nonetheless, language development is fueled by the environment (the way in which children are addressed, the ambient noise, etc.) and the contexts (school, day care, and home) in which children are found.

Urie Bronfenbrenner first challenged our field to take context seriously and to study the world that children and families actually inhabit. He famously wrote, "Much of contemporary developmental psychology is the science of the strange behavior of children in strange situations with strange adults for the briefest possible periods of time" (Bronfenbrenner, 1977, p. 513). He encouraged us to at least broaden the ways in which we think about and study developmental psychology.

This *Child Development* special section showcases a range of projects that answer Bronfenbrenner's call by bringing our science out of the laboratory. Sometimes the research profiles development in non-Western countries with populations other than the Nacirema (American spelled backward, per Miner, 1956). It also takes us beyond samples of convenience—those White middle class children who travel in SUVs. Remarkably, our literature, and hence our science, is still largely defined through WEIRD populations: Western, Educated, Industrialized, Rich, and Democratic (Henrich, Heine, & Norenzayan, 2010a, 2010b; Neilsen, Haun, Kartner, & Legare, 2017). As Neilsen et al. wrote, "Failure to confront the possibility that culturally specific findings are being misattributed as universal traits has broad implications for the construction of scientifically defensible theories . . . and dissemination" (p. 31).

Scholarship that studies *all* of the world's children is sorely needed. A remarkable number of children in the world, for example, suffer from war, disease, and displacement (McKirby, 2016; UNICEF, 2015). Within the United States, despite being considered one of the world's richest countries, fully 21% of children live in economic deprivation

(National Center for Children in Poverty, 2017), creating a variety of detrimental effects for child development while also adulterating the impact of interventions (Lipina & Colombo, 2009; Yoshikawa, Aber, & Beardslee, 2012). It is thus imperative that our field embrace a broader view of childhood. In this issue, we work with colleagues to ask how we might accomplish this.

Ernest Boyer (1990) also deeply influenced the way in which we might view our science. In his Carnegie Foundation report "Scholarship Reconsidered," he asked that academia support and reward (a) a "scholarship of engagement" that focuses on how knowledge can be responsibly applied to consequential problems, and (b) a "scholarship of integration" that focuses on research at the boundaries where fields converge and connections across disciplines are possible. Boyer wrote,

Such a view of scholarly service—one that both applies and contributes to human knowledge—is particularly needed in a world in which huge, almost intractable problems call for the skills and insights only the academy can provide . . . Scholarship has to prove its worth not on its own terms but by service to the nation and the world. (p. 23)

Here too, it is prudent to ask what we can study in context and ask how our work can inform practice.

Together, Bronfenbrenner and Boyer ask us to confront the difficult reality that not all important phenomena children experience can be mirrored in a laboratory. Nor can some of this work be bound by the strictures of randomly controlled experiments. How then do we reconcile our desire for relevance and external validity with the need for strong and reliable science? Shonkoff (J. Shonkoff, personal communication, February 7, 2016) offers guidance as we struggle to meet these two seemingly contrasting needs. He suggests if we are to impact outcomes using the best science, we must change the way we think about our core questions from "does this work" to how might this input or environment differentially impact children across contexts, across conditions, and across varied "doses" or exposures. Greenberg and Abenavoli (2016) make a similar point. They have argued that "universal interventions" that affect large numbers of children and families in educational and developmental science demand "new models . . . as well as drawing from public health, medicine, and prevention science to consider the distinctive conditions that universal interventions afford to

understand the nature of population change” (p. 21).

The goal of increasing an understanding of developmental outcomes and processes while also impacting children’s and families’ lives is a lofty one. It requires that we step out of our comfort zones—both theoretically and empirically. Such studies are (to say the least) challenging, time consuming, and may yield small effects that seem to only work under some circumstances. But unless we embrace the complexity of real-world environments, and seek to better understand children’s lives where they happen, our research will be peripheral to the pressing problems children face.

Indeed, as the articles in this special section illustrate, such studies do not have to sacrifice rigor. In his classic book, *Pasteur’s Quadrant*, political scientist Daniel Stokes (1997), argues that rigor and relevance easily live side by side. Stokes put forward a model of the relationship between basic and applied research that fell into three quadrants. One quadrant contained “basic research,” where the quest is for fundamental understanding with no consideration of use—as in the work of Neils Bohr or Marie Curie. Another quadrant contains “applied research,” designed to solve problems such as inventing the light bulb (Thomas Edison), or Hedy Lamarr’s invention of “spread spectrum” technology to thwart the Nazis. The third quadrant contains the present set of articles: use-inspired basic research. This is “Pasteur’s Quadrant,” as Louis Pasteur was driven to solve problems such as anthrax and rabies for which he created vaccinations, as well as to understand the causes of disease (germ theory). Here, the *quest for fundamental understanding* and *consideration of use* dovetail. Here, too, is where Bronfenbrenner’s work belongs, and other giants of our field such as Robert Fantz (1963), who contributed to the discovery of pattern perception in infants and the measurement of infant visual acuity. These three categories of research not only coexist but also influence each other continually.

The 10 use-inspired basic research articles in this special section were inspired by both basic and applied research. They ask important questions about child development in a wide variety of settings. Among them are, how can we impact family life and encourage parents to engage in evidence-based practices—even in the face of cultural proscriptions to the contrary—in Senegal (Weber, Fernald, & Diop, 2017)? How can we use our scientific tools to engage in prevention and intervention with families to protect children from toxic stress (Roben, Dozier, Caron, & Bernard, 2017;

Shindler, Fisher, & Shonkoff, 2017)? How can we help schools improve their practices (Reynolds, Hayakawa, Ou, Mondy, Englund, Candee & Smerillo, 2017; Farran, Meador, Christopher, Nesbitt, & Billbrey, 2017) and find ways to encourage nonrelated adults to champion children’s development (Dubois & Keller, 2017)? Why is there little research on the impact of the arts on children (Goldstein, Lerner, & Winner, 2017) given its pervasiveness and the pleasure it affords? Finally, why are there so few studies on how families engage in interaction (Callanan, Castenda, Luce, & Martin, 2017; Grob, Schlesinger, Golinkoff, Hirsh-Pasek, & Pace, 2017)?

Persisting Challenges for the Field

These articles are proof of concept that we can have a use-inspired basic science to yield information about development in situ.

Communicating Our Science

Moving toward a science that is use inspired, brings up another hurdle. How do we communicate our science with integrity to a broader audience, to the audience that interacts with children? How do we encourage uptake of our findings and yet capture its nuances? For example, Galinsky and colleagues speak to the importance of “support(ing) adults to be their children’s change agent,” often in the context of two-generation interventions. This calls for being attentive to how parents view childhood and its implications for their children’s future lives (Galinsky et al., 2017). It also calls for us to be clear about the target audience for any particular intervention (Schindler et al., 2017; Roben et al., 2017; Farran et al., 2017; Reynolds et al., 2017).

A case in point is provided by the Weber et al. article. They brought what is known from western science about the importance of talking to infants to a Wolof-speaking population in Africa, whose cultural beliefs discourage this practice. Their positive impact suggests that sound developmental practices can have traction even in a rural African village.

Studying the Factors That Promote Child Development in the World

There is still much to be learned about how common everyday activities, such as children’s participation in the arts, enhance development. Children often spend time drawing and painting, or even

scratching scenes on the earth. The lucky ones might get music or dance lessons, but many children are not afforded the opportunity to engage in the arts. Goldstein et al. (2017) argue that in both formal and informal settings, the arts can have a profound impact on children's development. In fact, they conclude that, "Any activity as universal and engaging as the arts is likely to have important cognitive and social and emotional functions. Developmental scientists cannot afford to ignore such central real world behavior."

Nor can we any longer downplay the fact that much learning takes place in informal settings like homes and science museums (Callanan, Castenda, Luce, & Martin, 2017). Understanding how to design learning settings for children and families can have great payoff. As Meltzoff, Kuhl, Movellan, and Sejnowski (2009) argue,

The emerging field of informal learning is based on the idea that informal settings are venues for a significant amount of childhood learning. Children spend nearly 80% of their waking hours outside of school. They learn at home; in community centers; in clubs; through the Internet; at museums, zoos, and aquariums; and through digital media and gaming. (p. 288)

Each of these venues is ripe for study by developmental science and each includes social, cognitive, and affective components that beg to be understood. Research on the effects of digital media on children, for example, is rapidly expanding (e.g., Hirsh-Pasek, Zosh, et al., 2015).

The Challenge of Bringing Interventions to Scale and Assessing Their Effectiveness

Interventions designed to enhance child development often struggle when scaled up, as some of the articles here indicate. The articles reveal two quite distinctive sets of challenges related to scaling up. The first involves the intervention's resiliency in the face of turbulent real-world conditions, including high turnover among staff (Farran et al., 2017), transitory relationships with participants (Dubois et al., 2017), and changing circumstances in the settings in which the expansion is taking place (Reynolds et al., 2017). The second emerges from inevitable heterogeneity: variation in children's needs (Roben et al., 2017); parent, teacher, and community expectations (Weber et al., 2017; Grob et al., 2017); resource availability (Reynolds et al., 2017; Farran et al., 2017); and the prevalence and form of

external constraints on implementation (Schindler et al., 2017).

Every intervention designed to enhance child development embodies elements of multiple principles, strategies, and theories of change (Galinsky et al., 2017; Farran et al., 2017). When taken out into the world, however, participants are often exposed to only a portion of the elements that were possible (Dubois et al., 2017; Grob et al., 2017) and sometimes particular aspects of the program are foreclosed or altered (Reynolds et al., 2017; Farran et al., 2017). As a number of the articles illustrate, these considerations require careful and creative measures of "exposure" to the program—conventional notions of dose-response that measure only participants' time in the program are often too limited to appropriately assess a program's impact, because that impact depends in large part on *how* they encounter the intervention.

Articles in this issue also illustrate a distinction that in the clinical sciences is labeled the difference between "efficacy" (the performance of an intervention in controlled, experimental conditions) and "effectiveness" (the performance of that same intervention when broadly adopted in the field; Gartlehner, Hansen, Nissman, Lohr, & Carey, 2006). It is a nearly universal truth that as interventions move from the laboratory into the field, their effectiveness degrades. But there is a second broad pattern, equally evident in the clinical literature, which is addressed less specifically in these articles. During this same transition, variability of the program's performance also typically increases. This is a corollary to Schindler et al.'s observation that programs are best assessed not by how well they work but for whom they work and under what conditions.

The distinction between efficacy and effectiveness has particular import for understanding competing conceptions of program fidelity. Roben et al. (2017) report their attempts to bring their successful intervention into the world with fidelity. Unlike many interventions that lose fidelity and effectiveness when exported into the community, the Roben team has presented a model of how to create effect sizes comparable to what is seen in the laboratory in the world through the use of microfidelity computations.

Conclusions

Although child development research conducted in the laboratory will always be part of the rich matrix

that contributes to our science, the articles in this volume take readers on a journey that elucidates what we can learn if we extend our science to the messiness of the real world. The authors have struggled to bring external validity and relevance to the study of children and thus to paint a portrait of our science that will be richer and more explanatory in the end. These articles force us to think of our science in a new way—as one in which rigor and practice are aligned, as one in which scale up is critical, and as one in which new methodologies will need to be employed.

No doubt, this section is but a beginning and readers will be left with as many questions as solutions. Perhaps, however, it takes a small but decided step toward realizing the vision Bronfenbrenner and Boyer describe. We thus dedicate this special section of *Child Development* to Urie Bronfenbrenner, Ernest Boyer, and to those contemporary scientists who are willing to embrace the challenges and the messiness of the real world. “Oh, the places you’ll go” when you move beyond the laboratory to study child development!

References

- Bavin, E. (Ed.). (2009). *The Cambridge handbook of child language*. Cambridge, UK: Cambridge University Press.
- Boyer, E. (1990). *Scholarship reconsidered: Priorities of the professorate*. Princeton, NJ: Carnegie Foundation for the Advancement of Teaching.
- Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *American Psychologist*, *32*, 513–531. <https://doi.org/10.1037/0003-066X.32.7.513>
- Callanan, M. A., Castañeda, C. L., Luce, M. R., & Martin, J. L. (2017). Family science talk in museums: Predicting children’s engagement from variations in talk and activity. *Child Development*, *88*, 1492–1504. <https://doi.org/10.1111/cdev.12886>
- DuBois, D. L., & Keller, T. E. (2017). Investigation of the integration of supports for youth thriving into a community-based mentoring program. *Child Development*, *88*, 1480–1491. <https://doi.org/10.1111/cdev.12887>
- Fantz, R. (1963). Pattern vision in newborn infants. *Science*, *140*, 296–297.
- Farran, D. C., Meador, D. N., Christopher, C. H., Nesbitt, K. T., & Bilbrey, L. E. (2017). Data-driven improvement in pre kindergarten classrooms: Report from a partnership in an urban district. *Child Development*, *88*, 1466–1479. <https://doi.org/10.1111/cdev.12906>
- Fernald, A., Zangl, R., Portillo, A. L., & Marchman, V. A. (2008). Looking while listening: Using eye movements to monitor spoken language comprehension by infants and young children. In I. Sekerina, E. M. Fernández, & H. Clahsen (Eds.), *Developmental psycholinguistics: Online methods in children’s language processing* (pp. 97–135). Amsterdam, The Netherlands: J. Benjamins.
- Galinsky, E., Bezos, J., McClelland, M., Carlson, S. M., & Zelazo, P. D. (2017). Civic science for public use: Mind in the making and vroom. *Child Development*, *88*, 1409–1418. <https://doi.org/10.1111/cdev.12892>
- Gartlehner, G., Hansen, R. A., Nissman, D., Lohr, K. N., & Carey, T. S. (2006). *Criteria for distinguishing effectiveness from efficacy trials in systematic reviews*. Tech. Rep. 12. Washington, DC: Agency for Healthcare Research and Quality.
- Goldstein, T. R., Lerner, M. D., & Winner, E. (2017). The arts as a venue for developmental science: Realizing a latent opportunity. *Child Development*, *88*, 1505–1512. <https://doi.org/10.1111/cdev.12884>
- Golinkoff, R. M., Ma, W., Song, L., & Hirsh-Pasek, K. (2013). Twenty-five years using the intermodal preferential looking paradigm to study language acquisition: What have we learned? *Perspectives on Psychological Science*, *8*, 316–339. <https://doi.org/10.1177/1745691613484936>
- Greenberg, M. T., & Abenavoli, R. (2016). Universal interventions: Fully exploring their impacts and potential to produce population-level impacts. *Journal of Research on Educational Effectiveness*. <https://doi.org/10.1080/19345747.2016.1246632>
- Grob, R., Schlesinger, M., Pace, A., Golinkoff, R. M., & Hirsh-Pasek, K. (2017). Playing with ideas: Evaluating the impact of the ultimate block party, a collective experiential intervention to enrich perceptions of play. *Child Development*, *88*, 1419–1434. <https://doi.org/10.1111/cdev.12897>
- Henrich, J., Heine, S. J., & Norenzayan, A. (2010a). Most people are not WEIRD. *Nature*, *466*, 29. <https://doi.org/10.1038/466029a>
- Henrich, J., Heine, S. J., & Norenzayan, A. (2010b). The weirdest people in the world? *Behavioral and Brain Sciences*, *33*, 61–135. <https://doi.org/10.1017/S0140525X0999152X>
- Hirsh-Pasek, K., Zosh, J., Golinkoff, R. M., Gray, J., Robb, M., & Kaufman, J. (2015). Putting education in educational apps: Lesson for the science of learning. *Psychological Science in the Public Interest*, *16*(1), 3–34.
- Hoff, E. (Ed.). (2012). *Research methods in child language: A practical guide*. Hoboken, NY: Wiley-Blackwell.
- Jusczyk, P. W., Houston, D. M., & Newsome, M. (1999). The beginnings of word segmentation in English-learning infants. *Cognitive Psychology*, *39*, 159–207. <https://doi.org/10.1006/cogp.1999.0716>
- Kemler Nelson, D., Jusczyk, P. W., Mandel, D. R., Myers, J., Turk, A. E., & Gerken, L. (1995). The headturn preference procedure for testing auditory perception. *Infant Behavior & Development*, *18*, 111–116. [https://doi.org/10.1016/0163-6383\(95\)90012-8](https://doi.org/10.1016/0163-6383(95)90012-8)
- Kuhn, T. S. (1962). *The structure of scientific revolutions* (1st ed.). Chicago, IL: University of Chicago Press.

- Lipina, S. J., & Colombo, J. A. (2009). *Poverty and brain development during childhood: An approach from cognitive psychology and neuroscience*. Washington, DC: American Psychological Association. <https://doi.org/10.1037/11879-000>
- McKirdy, E. (2016). *Nearly 50 million children are refugees or migrants, says UNICEF*. Retrieved from <http://www.cnn.com/2016/09/07/world/unicef-report-on-child-refugees-and-migrants/>
- Meltzoff, A., Kuhl, P., Movellan, J., & Sejnowski, T. (2009). Foundations for a new science of learning. *Science*, *325*, 284–288. <https://doi.org/10.1126/science.1175626>
- Miner, H. M. (1956). Body ritual among the Nacirema. *American Anthropologist*, *58*, 503–507. <https://doi.org/10.1525/aa.1956.58.3.02a00080>
- National Center for Children in Poverty. (2017). *Child poverty*. Retrieved from <http://www.nccp.org/topics/child-poverty.html>
- Neilsen, M., Haun, D., Kartner, J., & Legare, C. H. (2017). The persistent sampling bias in developmental psychology: A call to action. *Journal of Experimental Child Psychology*, *162*, 31–38. <https://doi.org/10.1016/j.jecp.2017.04.017>
- Reynolds, A. J., Hayakawa, M., Ou, S., Mondri, C. F., Englund, M. M., Candee, A. J., & Smerillo, N. E. (2017). Scaling and Sustaining an Effective Early Childhood Intervention through School-Family-University Collaboration. *Child Development*, *88*, 1453–1465. <https://doi.org/10.1111/cdev.12901>
- Roben, C. K. P., Dozier, M., Caron, E., & Bernard, K. (2017). Moving an Evidence-Based Parenting Program Into the Community. *Child Development*, *88*, 1447–1452. <https://doi.org/10.1111/cdev.12898>
- Schindler, H., Fisher, P. A., & Shonkoff, J. (2017). From innovation to impact at scale: Lessons learned from a cluster of research-community partnerships. *Child Development*, *88*, 1435–1446. <https://doi.org/10.1111/cdev.12904>
- Seuss, D. (1990). *Oh, the places you'll go*. New York, NY: Random House.
- Sherman, L. E., Greenfield, P. M., Hernandez, L. M., & Dapretto, M. (2017). Peer influence via instagram: Effects on brain and behavior in adolescence and young adulthood. *Child Development*. Advance online publication. <https://doi.org/10.1111/cdev.12838>
- Stokes, D. (1997). *Pasteur's quadrant: Basic science and technological innovation*. Washington, DC: Brookings Institution Press.
- UNICEF. (2015). *Millennium development goals: Reduce child mortality*. Retrieved from <https://www.unicef.org/mdg/childmortality.html>
- Weber, A., Fernald, A., & Diop, Y. (2017). When cultural norms discourage talking to babies: Effectiveness of a parenting program in rural Senegal. *Child Development*, *88*, <https://doi.org/10.1111/cdev.12882>
- Werker, J. F., & Gervain, J. (2013). Speech perception: A foundation for language acquisition. In P. Zelazo (Ed.), *The Oxford handbook of developmental psychology* (pp. 909–925). Oxford, UK: Oxford University Press.
- Yoshikawa, H., Aber, J. L., & Beardslee, W. R. (2012). The effects of poverty on the mental, emotional, and behavioral health of children and youth: Implications for prevention. *American Psychologist*, *67*, 272–284. <https://doi.org/10.1037/a0028015>