

## Science &amp; Society

## Translating cognitive science in the public square

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**Public space interventions offer one example of how to translate cognitive science into the public square. Here, we detail several successful projects and the six principles of learning that underlie them that support caregiver-child engagement, interaction, and the use of content area-specific language. Policy and community implications are also discussed.**

## Translating cognitive science in the public square

We are at a tipping point. For cognitive science to support broader societal change, a paradigm shift in the way that we think about research and communities is required. This paradigm shift requires acknowledging that even though a wealth of research has shown that neighborhood, family, and cultural contexts all play a critical role in supporting healthy brain development [1], much of the work has been laboratory based rather than being centered on children's and families' lived experiences. While laboratory research is indeed necessary, children do not interact with caregivers and peers in highly controlled environments; instead, cultural traditions and local knowledge influence behavior, learning, and development. When cognitive science moves from including community members in field studies to codesigning with community members, scientific knowledge and

interventions will be more culturally sensitive, equitable, and representative.

Research outside of psychology and the other social sciences offers some roadmaps for this kind of inquiry. For instance, adding green spaces to an environment can reduce aggressive behavior [2], and putting exercise equipment in public parks increases activity levels [3]. Rather than taking an intensive approach with a small group, these projects target a large swath of the population with a small dose of enrichment [4]. Perhaps public spaces can be designed with a light touch that enables a kind of 'mental' exercise for caregivers and children. By creating codesigned installations that 'bake in' the science of learning, physical spaces might empower people to behave in ways that support the kinds of caregiver-child interactions known to foster language, mathematics, and spatial learning [5]. Here, we outline how centering communities and using evidence-based principles to transform public spaces offer a new direction for cognitive science *in situ*.

## Six pillars for designing public spaces for change

Creating public spaces that offer cognitive enrichment requires several deviations from the typical research process. First, scientists need to work in collaborative teams of community members, architects, politicians, and urban planners. Second, rather than highlighting what is not known in the research, scientists must look at the accumulated evidence over time to offer evidence-based frameworks that can guide designs, such as by relying on six principles of learning for which there is consensus in the literature. Designs should inspire active (rather than passive), engaged (not distracted), meaningful (connects to what is known and what holds personal meaning), socially interactive, iterative (rather than repetitive), and joyful experiences [6,7], which are known to predict learning outcomes. Third, designs must

be informed by community input with respect to their placement, form, and uses. For example, consider a design building on the converging evidence that playing with puzzles helps children build science, technology, engineering, and mathematics (STEM) knowledge [8]. Community design input would allow members of the neighborhood to suggest what could be in a puzzle, where it might be placed, and even the design of the puzzle, be it on a wall, near a bench, or on the ground in front of a bus shelter.

## Playful Learning Landscapes (PLLs)

One initiative focused on this type of community-centered work is PLLs, a collaboration among researchers, the Playful Learning Landscapes Action Network, and The Brookings Institution. It targets everyday spaces rather than destinations such as playgrounds to promote playful learning and development [5]. It targets places where families wait as hubs for potential academic and social enrichment. Results from these projects have been widely published, offering overwhelming support for the hypothesis that public space and placemaking can enhance the behaviors known to foster literacy and STEM development and can shift the way we conduct research in community contexts.

Urban Thinkscape, an inaugural installation, transformed a bus stop in an under-resourced neighborhood into a beautiful hub for playful learning that encouraged caregiver-child conversation and interaction [9] (see Figure 1). Local community leaders worked side by side with architects, scientists, and nonprofit organizations to render blueprints that preserved the science while adapting to community desires regarding the location and design imprint of the spaces. Four installations fostered varied academic and social interactions. Stories and wooden decking with embedded story icons offered ways for children to be active and engaged in



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Figure 1. Urban Thinkscape. Image credit: Sahar Coston-Hardy Photography.

story telling – language skills associated with later literacy. Hidden Figures, a metal sculpture with hidden images, supported spatial discussions as children noted the shapes and configurations that appeared in the shadows below. Jumping Feet, an executive function-fostering hopscotch game, challenged children to hop on one foot where they saw two and on two feet where they saw one. Finally, Puzzle Bench offered four puzzles themed around community interest in Dr. Martin Luther King, Jr., who had launched the Freedom March from that very location. With community members as data collectors, observational research demonstrated that caregivers and children interacted more in the space after the installation than before. Caregivers and children also had more conversations about STEM and literacy topics, such as using spatial terms while aligning the pieces on the Puzzle Bench. There were also more interactions at the site than at a neighboring control playground [9].

Another project, Play-and-Learn Spaces, invited families to codesign active and engaged libraries throughout a major

city in the northeastern USA [10] (see Figure 2). One corner of the library became a rock-climbing wall for children to create words by climbing up letters. Seating was transformed into large,

movable puzzle pieces and a stage, complete with magnetic words and letters (supporting iteration), that invited children to act out meaningful stories. The results were again compelling. Caregivers and children used more literacy-related and spatial talk at the Play-and-Learn spaces versus at non-Play-and-Learn libraries, such as discussing how to use the magnetic letters to spell a child's weekly school spelling words. They also displayed more positive affect and physical activity and less use of smartphones and tablets [10].

Finally, in Santa Ana, California, PLL is partnering with the local community to build structures in historically under-resourced environments throughout the city. The team is also designing signage for grocery stores to promote caregiver-child interactions [11]. To develop signage reflective of the local community's values and culture, caregivers participated in design sessions in which they shared stories about experiences grocery shopping with their children. Researchers



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Figure 2. Library Play-and-Learn Space. Image credit: Halkin Mason.



extracted themes from the stories and aligned them with learning goals that support the six pillars [12]. Several caregivers told stories about immigrating to the USA and having trouble ordering the correct amount of food at the delicatessen due to issues converting kilograms to pounds. As a result, the team created signs featuring a conversion chart that shows pounds and kilograms. These signs also invited children to count, discuss measurement, and practice converting quantities in ways that speak to their lived experiences.

### Into the policy arena

PLL projects generate significant behavior changes across studies and demonstrate the ways in which communities can work with scientists to enhance public spaces in ways that foster academic and social development. This kind of work allows us not only to address key questions in cognitive science but also to push policy toward more equitable, culturally relevant, and accessible enrichment for all children.

PLL is not alone in creating play space equity. Organizations such as the Bernard van Leer Foundation and KABOOM! are creating large-scale deployment of these types of interventions to provide governments and policymakers with the information needed to make informed decisions about maximizing the potential of spaces for improving the lives of families who live in today's cities. The Bernard van Leer Foundation's Urban95 Challenge initiative (<https://bernardvanleer.org/urban95-challenge/>), for example, asks how cities could become better adapted for children at a height of 95 cm (average for a 3-year-old). They focused on public spaces and asked applicants to work at citywide scale to effect change. Through its Play Everywhere program (<https://kaboom.org/play-everywhere>), KABOOM! also provides support for projects such as Urban Thinkscape and has created a broad network of projects that bring play

and learning into public spaces in innovative ways.

Finally, the nonprofit organization MathTalk (<https://math-talk.com/digital-products/>) codesigns installations focused on encouraging caregivers and children to talk about math concepts with community members from the Port neighborhood in Cambridge, Massachusetts. Six temporary installations were installed throughout the neighborhood on the sidewalk, including a Gigantic Number Line, which encouraged use of the count sequence as well as measurement, and Sidewalk Math, where children could hop, jump, and skip to learn more about counting and patterns, exemplifying the six pillars. Interview and observational data allow community members to document the effectiveness of these activities.

### Concluding remarks

By their creation in concert with local communities and by addressing the six pillars, public spaces can be conduits for large-scale change in neighborhoods. Doing this research, however, requires that we scan the literature for places of knowledge consensus and pushes us to move from the laboratory into communities where people live, work, and learn. PLL is one model for developing equitable, accessible, and evidence-based enhancements while answering basic questions about how children learn and develop in context. These types of enhancements not only support the science of learning but also provide governments and policymakers with the information needed to make informed decisions about maximizing the potential of spaces to improve the lives of families and to improve cities.

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### Declaration of interests

No interests are declared.

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