

## **Advancing the Field**

# **Designing Brain Healthy Environments for Intergenerational Programs**

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*Intergenerational relationships are at the center of programs designed to bring younger and older populations together for their mutual benefit. The physical spaces used for intergenerational interactions should be designed in such a way as to promote the development of positive relationships among people of different ages. Research in the neurosciences provides a basis for creating environments that are conducive to intergenerational interactions that stimulate cognitive interest and rewarding social engagement. This article will bring elements of environmental design together with brain research principles to outline appropriate applications for intergenerational programming, including arranging spaces and planning activities with a participant-centered approach. The goal is to provide a scientifically based rationale for organizing environments that are safe and welcoming for all age groups and also support multisensory experiences that stimulate positive human interaction.*

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Intergenerational relationships are at the center of programs designed to bring younger and older populations together for their mutual benefit. Some intergenerational programs are located at sites where different age groups are housed separately but they share common space. Other programs bring the generations together for specific purposes at specific times, and that space may be used by other groups at other times. In either case, the environment can influence how participants interact and also shape how they feel about the experience. Thus, the physical space used for intergenerational interactions should be designed in such a way as to promote the development of positive relationships among people of different ages.

Research in the neurosciences provides a basis for creating environments that are conducive to positive intergenerational interactions. Studies have indicated, for example, how to elicit positive emotions, how to stimulate the brain through positive social interaction to maintain optimum functionality, and how to reinforce memory (Carter, 1998; Wolfe, 2001). This article will bring elements of environmental design together with brain research principles to outline appropriate applications for intergenerational programming. The goal is to provide a scientifically based rationale for organizing environments that are safe and welcoming for all age groups and support multisensory experiences that stimulate positive human interaction.

Early in the 1990s, the Stride Rite Corporation built an intergenerational day care facility at their corporate headquarters in Cambridge, Massachusetts. Experts in elder care and child care (author) participated in designing the environment to ensure that it would foster beneficial intergenerational interactions among the preschool children and the frail elders who attended the program. Some key decisions turned out to be important elements in achieving this goal. First, the dining room was located near the central entry and reception area that separated the two wings where the programs were housed. This floor plan presented a large common area shared by both age groups where pleasing smells greeted visitors. Separating the programs into opposite wings permitted ready access while also protecting the integrity of each age group's own activities. Classrooms in the preschool were equipped with large windows on the corridor side so that the older adults could watch the children without disrupting their play. All areas of the center had chairs that could be adjusted for any table height or personal physique so that everyone could be at the same eye level.

At the time this center was constructed, information from the neurosciences was not yet widely disseminated or influencing the thinking of architects and day care providers, nor were there many intergenerational programs in existence that could offer a design template. Fortunately, by combining shared expertise, many of the decisions were consistent with what is recommended today. The elder care staff insisted on "accessibility," and the child care staff insisted on "developmentally appropriate practice,"

such as allowing choice and providing pleasurable multisensory experiences that could be enjoyed by both older and younger participants (Bredenkamp, 1987). An art room, which was put in the elder care wing on the far side of the dining room, provided one of the main opportunities for building relationships among older and younger participants. Over time, the staff recognized the value of engaging the elders and children in shared experiences with print-making, collage, and clay modeling. Current research now shows how those kinds of art activities activate various regions of the brain and how the setting was conducive to positive learning and social interaction.

### WHY APPLY BRAIN RESEARCH TO ENVIRONMENTAL DESIGN?

The past two decades have shown substantial growth of new findings in the developing field of neuroscience. Researchers are discovering daily how the brain processes, filters, and assimilates new information (Whalen & Phelps, 2009); how the brain attends to and recalls particular memories (Wolfe, 2001); and how “enriched” environments may stimulate dendrite growth, the building block of learning (Greenhough, Madden, & Fleischmann, 1972). Hundreds of articles in both scientific and educational journals are being published yearly, while conferences worldwide are documenting discoveries relating to how the brain’s electrical and biochemical reactions influence attention, memory recall, and emotions (Bergan & Coscia, 2001; LeDoux, 1996; Miller & Cummings, 2007).

Recently, educational researchers (Gallagher, 2005; Rushton & Larkin, 2001; Rushton & Juola-Rushton, 2008) have attempted to bridge the new and exciting discoveries of the neurosciences to the educational arena. As educators or intergenerational specialists begin to interpret findings that are reported in the neuroscience journals and transfer the knowledge to practices and policies, caution is necessary. In an article titled “Developmental Neuroscience: Implications for Early Childhood Intervention and Education,” Hannon (2003) states that “findings to date from developmental neuroscience appear, despite their high scientific interest, to have few immediate implications for practice or policy” (p. 58). Similarly, John Bruner (1998), President of the James S. McDonnell Foundation, questions the validity of this marriage, too, arguing that “brain science has little to offer education practice or policy” (p. 14). Keeping these claims in mind, it is our responsibility as educators and practitioners to remain knowledgeable about research stemming from the neurosciences and attempt to extrapolate principles that will lead to best practices. We need to be informed in order to provide children, youth, adult learners, and a growing aging population with the best possible environments to support their well-being and help them build positive relationships with people of different ages.

## HOW OUR BRAINS WORK

Having a basic understanding of the brain's functions leads to better understanding of how environmental design may support or hinder an individual's comfort level and mental engagement in any given situation. The brain has four regions or lobes, each designed to interpret, organize, and filter incoming stimuli from the environment. The brain naturally filters out approximately 99% of what our senses absorb in order to function normally (Wolfe, 2001). One important factor that distinguishes humans from other animals is the degree of development in our frontal lobe, particularly the prefrontal lobe. It is the prefrontal cortex that provides us with the gift of reasoning and understanding "who we are" in relationship to others. Young children's prefrontal lobe is the last part of their brains to fully develop (Wolfe, 2001). Our "higher thinking skills"—the ability to make value judgments and informed decisions and to be creative—continue to develop as we age (Cohen, 2005). An ongoing research study at the University of California, San Diego, by psychiatrists Dilip Jeste and Thomas Meeks is yielding indications that "wisdom" (e.g., self-understanding, compassion, morality, etc.) involves combining and balancing both old portions of the brain (the limbic system that governs emotional behavior) and the more recently evolved portion of the brain (the prefrontal cortex) (in LaFee, 2009).

Brain research has confirmed that "the mind grows stronger from use and from being challenged in the same way that muscles grow stronger from exercise" (Cohen, 2005, p. xv). We are born with many more neurons that we can use and, in time, many neurons begin to "prune" away as we age, particularly if those pathways remain inactive. At birth, we have over 100 billion neurons. Each neuron can make up to 10,000 synaptic connections, forming one of the most complex organs in the universe (Shoshani, Kupsky, & Marchant, 2006). During the first five years of development this number of connections, referred to as synaptogenesis, is necessary in order for the developing brain to unfold in a healthy manner. As we age and particularly if we are not engaged in stimulating or meaningful activities, the neurons in the cortex begin to disappear. Fortunately, brain plasticity can be improved through cognitive and social engagement and a new study in Boston by Ellen Winner and Gottfried Schlaug indicates that arts learning and music instruction may improve math skills, attention, and general intelligence (in Mauk, 2009).

As part of the frontal lobe and just before the parietal lobe, a band of cells sits approximately a half an inch wide running from ear to ear called the motor cortex, which governs all muscular movement in the body. Wriggling our toes or brushing our teeth requires the neurons in this thin strip to be activated. Directly behind the motor cortex is the parietal lobe, an important part of the brain that it interprets and integrates our spatial awareness of self and others. It regulates our pain levels, and so damage to this portion of the

brain interferes with our perception of touch and with the body's position in space. Parallel to each other and along the outside of the brain near the ears are the temporal lobes. These lobes are critical in the development and understanding of language and auditory memory. Of particular importance, the temporal lobes allow humans to communicate with one another. And, finally, at the back of the brain is the occipital lobe that relates to the receiving and processing of visual information. Although each lobe is distinct in its functions and each cell may have a specific purpose, neurons from different regions of the brain work together, allowing us to understand what it is we are viewing, smelling, touching, or hearing. Also, both halves of our brains have separate functions: the left tends toward more analytical complexities while the right hemisphere lends itself more to intuitive processing. They work together, communicating via the corpus collosum, which is a bundle of nerves measuring approximately a half an inch in diameter (slightly larger in women than men), to understand an experience.

Cohen (2005) reminds us that new brain cells can form throughout life as a result of stimulation and that the brain's emotional circuitry becomes more balanced with age. Experience and learning continue to reshape the brain so that over time, the two hemispheres are used more equally (p. 4). The mature integration of thinking and feeling leads to greater wisdom (p. 95). Along with maturity and, perhaps, a decrease in short-term memory or the speed of reaction times comes an increase in the brain's overall potential for developing satisfying relationships. A recent study at the University of California, Irvine, by neurologist Dr. Claudia Kawas indicates that not only is it important to continue challenging our minds as we get older but also that a social component may be crucial to maintaining mental acuity (in Carey, 2009).

As we interact with the environment, sensory impulses enter the brain via our five senses and make their way to the thalamus. Once here, the thalamus redirects the incoming impulse to the appropriate part of the cortex. For example, all visual stimuli are sent to the occipital lobe that recognizes color, straight and curved lines, and so on. The same message is also sent to the amygdala (in close proximity to the thalamus) at the same time. It is the job of the amygdala to determine if any of those outside signals represent danger. For instance, if an object picked up by the eyes is dark and has curvy lines, the amygdala may interpret that as a snake. In this case, the amygdala immediately sends messages to the pituitary and adrenal glands, which then flood our bodies with various hormones and neurotransmitters. Once released into the body, our heart beats faster, sending oxygen to the major muscles groups (in case we need to run), our digestive track shuts down (diverting energy to the legs and arms), our eyes dilate (so we look more dangerous and can take in more sights), the hair on our necks stands up, and often our body begins to sweat. When the senses pick up a perceived threat, our brains initiate the body's fight-or-flight response. Examples of

perceived or real threats in the environment that would inhibit positive intergenerational interactions may include the following: (a) embarrassment by others (e.g., program participants or someone in a position of authority), (b) unrealistic deadlines to complete a task, (c) a confusing floor plan that creates a sense of dissonance in not knowing where one is, (d) tense voice tones or loud arguments (e.g., among colleagues, program participants, or, again, those in a position of authority), and (e) pressure to complete a task that is too difficult.

If the curvy object turns out to be just a stick, the prefrontal cortex will send a more rational explanation to dampen the amygdala's initial fear reaction and calm the body. Almost simultaneously, higher reasoning kicks in with the more careful appraisal of the perceived threat. Therefore, staff can help program participants reinterpret situations that may have triggered the "fight or flight" response. "That dark, curvy stick looks like a snake. Maybe we could paint it a bright color so it won't startle anybody." The amygdala can also be inhibited by nonemotional mental tasks (Carter, 1998). Boring activities may be calming, but they might also interfere with positive social engagement. Opportunities for choice, social interaction, and self-regulation activate parts of the brain such as the occipital lobe (visualization), thalamus (sensory stimulation), and prefrontal lobe (memory), resulting in positive feelings. In planning the environment for intergenerational exchanges, the physical space, program activities, and practitioners guiding the interactions can all be factors that contribute to setting the stage for mutually beneficial interactions.

## PLANNING ENVIRONMENTS

In school classrooms, learning environments that are organized to be compatible with principles derived from brain research may include the following elements:

1. *Spaces with comfortable "areas of discovery."* The goal is to set up a learning environment that strengthens synaptic connections between dendrites by providing opportunities to experiment, replay, and express ideas. The environment is particularly important in that we need to create welcoming and engaging spaces for learners of all ages so that they feel secure and safe. Stress, particularly long-term stress, opens the door to the release of cortisol (a hormone) into the body that disrupts the learning process, memory, and attention.
2. *Opportunities for the students to take responsibility for their own learning.* When children have choices, they are more likely to respond positively to their surroundings and have an internal motivation to learn. Neurologically, we know that when students feel good about themselves, higher levels of dopamine (a neurotransmitter) are being released between the dendrites.

Having choices and, thus, some control over the environment, allows participants to enjoy their activities more. Furthermore, choice activates attention by creating arousal. Emotions drive attention, which drives learning.

3. *Familiar objects, furniture, pictures, and other décor that help to bridge connections between the child's home life, the real world, and the classroom.* The brain seeks novelty and at the same time requires a predictable environment. Meaningful experiences that are repeated will strengthen neural pathways (learning will occur). A sense of security is based on familiarity. As mentioned, stress in the environment may release the hormone cortisol which, in time, may affect short and long-term memory.
4. *Formal and informal opportunities for dialogue.* Conversation leads to pondering new ideas, revising understandings, and increasing vocabulary. Stimulating the language centers of the brain leads to better communication as well as developing reading and writing skills. The more we strengthen the myelin sheaf that surrounds the neuron, the faster the connections between dendrites are made. When the various lobes are communicating, as well as the two separate brain halves, as demonstrated by the highlighted portion of a PET (positron-emission tomography) scan, we can see the interactive nature of the brain's functioning when we are in conversation, showing how dialogue creates the possibility of new connections being made.
5. *Opportunities for meaningful problem solving (stimulating the prefrontal lobe).* Open-ended hands-on materials such as art supplies, puzzles, blocks, dramatic play props, and writing implements, including computers, offer participants the means to be creative, to discover what happens when, and to express emotions. Mental stimulation is associated with neural plasticity (connections between neurons).

These five principles are also relevant in considering the design of intergenerational programs. However, when designing environments to promote intergenerational engagement, some added complexities arise. First, the focus extends beyond any one individual or age group that uses a particular setting. Hence, there is greater diversity in terms of the interests, needs, and capabilities of the people in the setting to take into account with regard to the program activities and regulatory policies that apply to the environmental design. Along with the elements of a brain-healthy educational environment, we will examine five design elements to consider from the perspective of supporting intergenerational engagement: autonomy, stimulation, interaction, shared identity, and flexibility.

## AUTONOMY AND PERSONAL CONTROL

When considering intergenerational engagement from within a caregiving framework, such as the initiatives that take place in assisted living or nursing

care facilities (e.g., with older adults who are frail or have chronic illnesses and need a lot of care), the underlying philosophy of care will influence the way in which intergenerational relationships are promoted and environments are designed. Health care professionals refer to “person-centered care,” an approach that would be similar to a “learner-centered” classroom for children in that these environments focus on providing welcoming, socially engaging, and emotionally satisfying experiences that are not directed by staff in a predetermined manner. Offering choice is an important part of such a philosophy of caregiving. Person-centered care does not mean that the residents can do whatever they want. It means that the caregiver assists them in making choices and fostering their sense of autonomy. A person-centered approach involves respecting everyone’s right to be involved in all decisions that affect his or her life so that the locus of control ultimately resides with the person receiving care. For example, a person may choose not to participate in activities that are available, and the person has access to different places in the environment and so controls proximity with others.

When it comes to environmental design and management, emphasis is placed on giving residents opportunities to personalize their private spaces (e.g., names in addition to numbers on their rooms, putting up personal mementos, etc.). They are empowered to change, manipulate, or restructure their environments according to their needs and preferences. From an intergenerational perspective, it is worth considering how the environment can reflect the contributions and personalities of the participants, their budding relationships, and their evolving shared interests. For example, a jointly planned and painted mural or a friendship garden might be accomplished with the assistance of the staff. In each of these examples, the jointly created environmental element has the symbolic value of togetherness with the social benefit of living, learning, and creating together while also respecting individual differences.

The examples noted previously fit into a broader framework for enhancing participant involvement in environmental design, management, and restoration efforts. When applied to work conducted with monogenerational groups, the focus is often on creating “youth-friendly” (Ward & Fyson, 1973) or “elder-friendly” (Harding, 2007) places. Participatory work with intergenerational groups requires the added dimension of exploring what people of different generations have in common in terms of how they experience and take action to improve the community settings they frequent. Having choices and opportunities to participate in decision making about the shared space adds to the potential for building positive relationships.

## STIMULATION

Research from the neurosciences has demonstrated how important positive stimulation (novelty or challenge without stress) is to the brain’s functioning

throughout life. Some research addresses the pitfalls associated with being in situations where there is either too much stimulation (stimulus overload) or too little stimulation (stimulus deprivation). It turns out that in environmental design circles, stimulation is a major focus as well. There is much written about using colors, textures, materials, and quality of light to engage the senses of those within a planned environment (Fozard, Schieber, Gordon-Salant, & Weiffenbach, 1993; Purple Cherry, 2009).

In terms of designing intergenerational environments, however, we also need to consider how the intergenerational interaction itself functions as a set of stimuli that can be modified with design decisions. For instance, there are design strategies to protect people from what they might perceive as “too much” intergenerational engagement, a form of stimulus overload, such as building additional exits or “escape routes” into spaces used for congregate meetings. It is also useful to keep in mind that, even in shared site facilities, people have needs for privacy as well as interests in engaging with their same-aged peers. These needs and interests are reasons behind locating the Stride Rite child care and elder care programs in separate wings of their shared facility.

Another consideration is the décor. Participants may appreciate the opportunity to contribute to what is selected for display. For example, photographs of participants at different ages or of functional objects that have changed over time (such as egg beaters or typewriters) can provide not only visual stimulation but also shared cognitive interest. Another good conversation prompt would be to display artwork created by the participants, as was done at the Stride Rite Intergenerational Care Center. Colors, textures, and space can be used to create an atmosphere of comfortable familiarity yet provide visual images that elicit conversation.

The environmental design includes other sensory elements such as noise and smells that can also be used to generate positive emotions and social engagement. Soft background music indoors, for example, provides a soothing atmosphere that doesn't interfere with conversation but offers gentle stimulation to the brain. Familiar songs can elicit memories or shared appreciation of cultural experiences. Outdoor concerts would entail louder volume and additional sensory input such as breezes and chirping birds that would factor into planning and organizing the environment for intergenerational interaction. Comfortable seating and a good view of other people would enhance the potential for subsequent socializing.

## FORMAL AND INFORMAL INTERACTION

Furniture can be arranged to invite either formal or informal interaction among participants of different ages. Seating should accommodate a variety of sizes and abilities so that the intergenerational exchange is stress free. Traffic patterns

should allow easy accessibility for all participants no matter where they want to interact within the allocated space for the intergenerational program.

Conversation is facilitated by participating in a common task or problem-solving activity among small groups or pairs. Art materials are especially appealing when the task does not involve competition or deadlines for completion. Large spaces and large groups tend to be less conducive to informal conversation, although they are more appropriate for listening to presentations or watching performances. Drama and dance usually require larger open spaces and soft surfaces to baffle reverberating noise or prevent physical injuries if someone falls. Large group events can be followed by opportunities to discuss the performance in a more intimate space that supports conversation or by the option of hands-on learning experiences whereby mixed age groupings can practice their own artistic skills.

### FOSTERING A SHARED SENSE OF PLACE IDENTITY

There are various theories about how people attribute great meaning and significance to places connected with emotional experiences. Two concepts emerging from the literatures of environmental psychology and community psychology are “place attachment” and “place identity.” Manzo and Perkins (2006) note that the term “place identity” was first coined by Harold Proshansky in 1978 and “consists of those dimensions of the self that develop in relation to the physical environment by means of a pattern of beliefs, preferences, feelings, values, and goals. It is a dynamic phenomenon that grows and transforms through lived experience” (p. 337). Place attachment refers more generally to the affective bonds that often form between people and the places with which they are most familiar (Altman & Low, 1992). Whereas much has been written about how the bonds that people develop with familiar places provide a sense of stability, care, and concern for the setting (Rivlin, 1987), we can also look at how living in the same community and having a shared sense of community can serve to strengthen the bonds between people. Joint tasks related to studying, improving, or creating the environment can contribute to increased intergenerational understanding; in other words, participants learn about how people of other generations experience and feel about the local community. Intergenerational activities that provide participants with shared experiences using their local environment can promote greater intergenerational understanding and acceptance. For example, some might be focused on learning more about the local environment, such as through community tours, surveys, or scavenger hunts, while others may engage diverse age groups in a joint service initiative aimed at greening the environment by creating a community garden. Intergenerational dialogue about the shared environment might include discussing their notions of “personal space,” where they have a sense of belonging,

as well as their preferences for personalizing shared spaces. Joint decision making and ownership of the environment will translate into greater mutual acceptance of one another's right to belong in the community. As was noted by a youth action program in New York city, "Experience has shown us that spaces created by this kind of highly participatory community design process suffer much less vandalism than those carried out by designers behind closed doors" (Hart, 1992, p. 13).

## FLEXIBILITY AND THE CREATION OF RESPONSIVE SPACES

Not only does the environment act on us but also we act on the environment. People actively assess, explore, derive meaning from, and modify their environments. There is a dynamic, changing quality to the way people relate to their environment. Altman (1976) states, "Territories shift, functions alter, group composition changes" (p. 35). He also notes that there is a dynamic, changing quality to the way people relate to one another: "Social systems adapt, cope and struggle" (p. 35). Accordingly, in designing environments that house intergenerational activities, there should be a fair amount of "flexibility" in order to accommodate a wide range of exchanges, including those that are not predetermined or even predicted.

An article that Simon Nicholson wrote in 1971 contrasts different types of play environments for children. In what he termed the "theory of loose parts," Nicholson makes the point that adventure playgrounds that provide children with a wide selection of "loose parts"—, for example, tires, wood, tools, paint, plants, etc.—are very effective in expanding the range of inventive play opportunities available to children, beyond what is typically found in playgrounds with permanent structures that have planned purposes. It seems appropriate to extrapolate this concept to intergenerational environmental design, where age-diverse user groups bring with them a broad spectrum of interests, capabilities (physical and cognitive), and conceptions for how they would like to use the space they share. Nicholson (1971) states that "in any environment, both the degree of inventiveness and the possibility of discovery are directly proportional to the number and kind of variables in it" (p. 30). Having "loose parts" to play with can also stimulate intergenerational connections through play (Davis, Larkin, & Graves, 2002) as the participants jointly decide how to use the materials in the setting.

There are other flexible design principles, such as designing rooms with movable walls, that similarly provide users of a setting with more control over how that setting will be used. The ability to change the character of a space, even with small modifications, engages adults and children in a positive way. According to Cohen (2005), older adults are more able to combine old ideas in new ways, and their creativity can inspire younger partners to think

outside of the box as they work together on organizing their space. As noted by Haider and Kaplan (2004), “The ability to change the character of a space, even to a limited degree, engages adults and children in a positive way. This interaction with the environment is instrumental in developing cognitive skills and encourages creative play and imaginative thinking. Identifying design strategies for open space that adapt to the changing needs of a community and its residents is a prerequisite for intergenerational appeal” (p. 174).

Table 1 presents a summary of the related connections between research in the neurosciences and indications for intergenerational environmental design:

### SUMMARY POINTS FOR DEVELOPING INTERGENERATIONAL ENVIRONMENTS

At first glance, the connection between the varying fields of neuroscience, early childhood education, and the well-being of older adults might not be immediately clear. Yet, the learning environment that young children experience during their formative years can either support or hinder their intellectual, emotional, and physical growth. Literature from the neurosciences helps to support educators in justifying why certain educational practices may strengthen synaptic connections and, thereby, foster learning, memory, and attention. Similarly, environmental design can also foster opportunities for people to connect with others and learn about new people. Our brains are designed to interact, connect, and communicate with others, and the older we get, the more critical it becomes to stay socially engaged in order to maintain a satisfying quality of life. Designing facilities in which younger and older participants are able to interact has powerful implications for both.

Ideally, both children and adults of all ages ought to be able to feel safe in their surroundings, to find opportunities to explore new relationships, and, simultaneously, be free to experiment with novel situations. Therefore, creating spaces for positive interactions that elicit memorable experiences for both age groups is critical to their well-being. It is also vitally important that people of all ages be able to have a sense of privacy, to relax and be themselves. Environments for intergenerational exchanges must protect against social isolation while also allowing participants to choose how much or how long they are socially engaged. Learning and memory are strongly connected to emotions and, thus, the environment needs to be interesting and enjoyable as well as safe. Our brains are stimulated by discovering something new. The more we can provide meaningful experiences and opportunities for social interaction, the more we can challenge the brain to continue growing rather than slowly pruning away

**TABLE 1** Matrix for Intergenerational Environmental Design

Design concept	Brain research principle	Environmental application
Autonomy and personal control	High levels of stress or perceived threat inhibit learning (Caine & Caine, 1997). Each brain is unique and changes as a result of experience (Wolfe, 2001).	Accessibility is key to setting the stage for positive interactions. Allow choices for interaction and privacy to accommodate a range of interests, capabilities, and styles. Environment reflects a person-centered care philosophy. Provide participant choices in deciding how they will use their environment.
Quality of stimulation	An enriched environment increases cell weight, branching of dendrites, and synaptic responses (Diamond, 1998). Learning and memory are strongly connected to emotions, and, thus, the learning environment needs to be both stimulating and safe (Rushton & Juola-Rushton, 2008). The mental mechanisms that process music are deeply entwined with the brain's other functions, including emotion, memory, and perception (Mauk, 2009).	Hands-on experiences with the arts stimulate cognitive functioning. Dramatization and visual arts are positive modes of expression. Conversation is mentally and socially engaging. Sensory stimulation can be managed through space design as well as through the activities. Soothing background music/noise will enhance a sense of positive well-being.
Opportunities for structured and informal interaction	The brain is designed to perceive and generate patterns. "Wisdom" involves balancing emotions and reasoning, combining different parts of the brain (Lefee, 2009). Social engagement may be crucial to mental acuity. Creativity connects various parts of the brain (Cohen, 2005).	Rhyme and rhythm are memory aids. Familiar, real-life settings put people at ease. Repetition builds trust and long-term memory. Create opportunities for shared problem solving. Provide opportunities for informal conversation and discussion about shared experiences.
Fostering a shared sense of place identity	The brain's emotional center is tied into its ability to learn. Emotions, learning, and memory are closely linked as different parts of the brain are activated in the learning process (Rushton & Larkin, 2001). Positive emotions drive attention, which, in turn, drives both learning and memory (Wolfe & Brand, 1998).	Design spaces to reflect a sense of shared community, such as displaying participants' art work. Shared decision making allows participants to solve problems with mutual satisfaction. Provide opportunities for participants to discuss how they will use common spaces.
Flexibility and the creation of responsible spaces	Each region of the brain consists of a highly sophisticated neurological network of cells, dendrites, and nerves, which interconnect one portion of the brain to another.	Include materials that can be used in many different ways, according to how participants' interests evolve. Avoid stationary structures that predetermine usage.

unused connections. Neurosciences have helped environmental designers to better understand how stress and unwelcome levels of cortisol can alter our moods and desire to learn. The arts (painting, music, drama, and other opportunities for creative expression) offer an appropriate vehicle for stimulating conversation, problem-solving, and emotional expression as suggested by what we are discovering in the neurosciences. Empowering all ages to take responsibility for their own decisions about how to share spaces increases a sense of autonomy, which is an essential component of life satisfaction (Graves & Larkin, 2006).

The following summary points offer some guidelines for designing intergenerational program environments:

- Convey a sense of welcome for all who enter and use the setting.
- Organize spaces to counter social isolation but not violate people's need for privacy.
- Avoid stereotypical cues that convey negative inferences about people of a certain age group.
- Empower participants in making decisions about the uses of space (e.g., adapt shared governance that encourages participants to provide input that is valued by staff).
- Incorporate the arts (music, drama, visual arts, etc.) and opportunities for inventive play as a means of mental stimulation and social engagement.

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