



## The Effects of the Physical Environment on Children's Development

Insights for parents, teachers, and educators featuring research by Dr. Gary Evans, Departments of Human Development and Design and Environmental Analysis, Cornell University

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Cornell University environmental and developmental psychologist [Gary Evans](#) has conducted numerous research studies examining the effects of the physical environment on children's well being. Evans' large and diverse body of research reveals that the effects of the physical environment—noise level, overcrowding, and housing and neighborhood quality—are as significant for children's development as psychosocial characteristics such as relationships with parents and peers. Indeed, the physical environment profoundly influences developmental outcomes including academic achievement, cognitive, social and emotional development as well as parenting behavior.

### Noise

Children's reading abilities, cognitive development, physiological indicators, and motivational tasks are affected by exposure to noise. The most common noises that children are exposed to are transportation (e.g. cars, airplanes), music and other people. Evans' research reveals significant reading delays for children living near airports and exposed to airport noise. He and his colleagues found these delays in reading to occur at noise levels far below those required to produce hearing damage or loss.

Chronic and acute noise exposure also affects cognitive development, particularly long-term memory, especially if the task is complex. Short-term memory appears to be less affected, but this is dependent upon volume of noise. One way that



*"Evans' research reveals significant reading delays for children living near airports and exposed to airport noise."*

children adapt to chronic noise is by disregarding or ignoring auditory input. A consequence of this coping strategy is that children also tune out speech, which is a basic and required component of reading. As a result, not only are children's reading abilities affected, but also their abilities at tasks that require speech perception.

Noise levels also indirectly influence children's cognitive development via their effect on the adults and teachers who interact with children. Teachers in noisy schools are more fatigued, annoyed, and less patient than teachers in quieter



schools. Teachers in noisy schools also lose instruction time due to noise distractions and have a compromised teaching style.

Children exposed to chronic loud noise also experience a rise in blood pressure and stress hormones. And children as young as four are less motivated to perform on challenging language and pre-reading tasks under conditions of exposure to chronic noise.

*Technical Note: Data from studies on aircraft noise and reading include a cross sectional study with statistical controls for socioeconomic status (income) and a prospective, longitudinal study with the same children before and after the opening of a new airport. “Controlling for income” is a statistical procedure that allows a researcher to eliminate the effect of income on the results. Thus, we can conclude that it is the level of noise, not that low-income families may live closer to airports, which accounts for the findings. In other words, significant reading delays are found for children living near airports, regardless of income.*

### Crowding

Research demonstrates that crowding has an effect on interpersonal behaviors, mental health, motivation, cognitive development, and biological measures. Family size has not been found to be a critical factor in crowding. Rather, Evans identifies density, or number of people per room, as the crucial variable for measuring effects of crowding on children’s development.

Regarding child development, Evans has found that 10-12-year-old children are more likely to withdraw in overcrowded situations. Children may engage in withdrawal behavior as a means of coping with an overstimulating environment. Evans’ research also reveals that a highly concentrated number of children in an activity area results in more distractions and less constructive play among preschool-aged children.

Overcrowding also influences parenting behaviors. Parents in crowded homes are less responsive to young children. Evidence of parental unresponsiveness begins early—before a child is one year old, and occurs at all income levels. Overcrowding also strains parent-child relationships. Parents in overcrowded homes are more likely to engage in punitive parenting, which in turn, affects the level of children’s distress. Evans’ research shows that strained parent-child relationships negatively influence social, emotional, and biological measures (e.g. elevated blood pressure) in 10- to 12-year-old children.

Children’s mental health status may be affected by overcrowding. Elementary school-aged children who live in more crowded homes display higher levels of psychological distress and they also have higher levels of behavior difficulties in school. Evans has found that overcrowding produces psychological distress among 3rd and 4th grade students as reported by both the children and their teachers. These effects are intensified if children reside in large, multifamily structures. Effects were also intensified among a group of 8-to-10-year-olds if the family home was chaotic.

Chronic overcrowding influences children’s motivation to perform tasks. Independent of household income, children aged 6-12 show declines in motivational behavior and also demonstrate a level of learned helplessness—a belief that they have no control over their situation and therefore do not attempt to change it—although they have the power to do so. But there are gender differences: Evans found the link between overcrowding and learned helplessness among 10-to-12-year-olds to exist for girls, but not for boys.

Evans’ studies find several effects of overcrowding on both objective and subjective measures of children’s cognitive development. Elementary school children living in more crowded homes score lower on standardized reading tests and they see themselves as less scholastically competent than their classmates.

Parenting behaviors directly related to children’s cognitive and language development are also affected by density level. Evans found that parents in crowded homes speak less to their infants and use fewer complicated words during the period from infancy up to age two and a half. Research demonstrates that the quality and sophistication of speech as well as the quantity of words spoken by parents to their children are significant factors in the amount and types of words children produce.

Biological measures implicate the effects of overcrowding on children’s physiology. In one study, Evans found gender differences in measures of blood pressure among 10-12-year-old children with males in higher residential crowding situations demonstrating elevations in blood pressure, but not females. However, higher overnight levels of the stress hormones epinephrine and norepinephrine were found in both 8- to 10-year-old male and female children living in high-density apartments. This finding was especially relevant when chaos and disorder was present in the family.

## Housing and Quality of Neighborhood

Housing quality and the neighborhoods in which houses are situated have also been investigated in relation to children's socioemotional development. For example, families living in high-rise housing, as opposed to single-family residences, have fewer relationships with neighbors, resulting in less social support. Studies on housing and quality of neighborhood have also examined the role of chaos in children's environments finding an association between chaotic home environments and levels of psychological distress among middle school children.

Research has identified the physical characteristics of neighborhoods that significantly influence children's development. These characteristics include: residential instability, housing quality, noise, crowding, toxic exposure, quality of municipal services, retail services, recreational opportunities, including natural settings, street traffic, accessibility of transportation, and the physical quality of both educational and health facilities. Perhaps not surprisingly, Evans' research findings support the therapeutic effects of children's exposure to natural settings. Natural settings are preferred by children and allow them to exercise gross motor abilities as well as engage in social interactions. In addition, these settings also alleviate the adverse effects of children's exposure to chronic stress.

The research outlined above demonstrates both the direct and indirect effects of the physical environment on children's development. Direct effects include cognitive, social, emotional, and biological outcomes. Indirect effects include interactions with parents and teachers, which in turn, influence developmental outcomes such as learning and language development. Although in several studies Evans demonstrates these effects for children at all income levels, low-income children experience excessive exposure to noise, overcrowding, and unfavorable housing and neighborhood conditions. Exposure to these poor-quality physical conditions is linked to other psychological and social aspects of the environment, especially poverty. Using a building block analogy, low-income children have more blocks stacked one on top of the other than children of other income levels. Thus, children living in poverty experience multiple exposures, rather than a single exposure to risk.

## What You Can Do

- ❑ **Guard against additional, interior noise sources.** Individuals living in noisy environments often habituate, or become accustomed to the noise level. Aim to reduce the existing noise instead of adding other sources of noise.
- ❑ **Check the volume level on your child's music devices** (e.g., iPod, walkman; it is too loud if someone else can hear the music). If he listens to his favorite music too loudly, make proper volume adjustments. Also monitor the volume level on computers, televisions, and other electronic devices, keeping them as low as possible.
- ❑ **Engage your child.** Children ignore and tune out speech as a way of coping with environmental overstimulation. Take notice if your child is not paying attention or listening to your speech and if so, intervene. Take your child to a quiet outdoor nature spot or a quiet indoor location such as the local library. This is especially important during the preschool and early elementary school years (ages 3-6 years) when children are learning to read.
- ❑ **Tune in instead of tuning out.** Parents living under high noise exposure appear to withdraw, be less responsive, and talk less to their children. The natural tendency is to disengage from speaking and reading to children so as not to compete with the noise. These coping strategies negatively affect children's reading and cognitive abilities. Be alert to the occurrence of these behaviors and counter them by talking to your child, reading aloud to her, engaging her in discussions, and actively listening to what she has to say to you.
- ❑ **Modify your environment.** If your budget permits, consider purchasing extra noise attenuation devices for your child's room for use during homework activities and sleeping. Ear plugs are a low-cost alternative.
- ❑ **Consider your child's school environment.** If you have a choice, send your child to a quiet, less chaotic school. This is particularly desirable if your home environment is also noisy. Be active in your community. The noisiest environmental conditions occur in low income and ethnic minority communities. One way to counteract this is to be active and involved. Ask your representative why it is noisier in these communities.
- ❑ **Seek information.** If a major source of noise in your community is road traffic, check with your local planning department. Note that traffic volume is closely aligned with traffic noise levels. The busiest streets are usually the noisiest.

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