How do children view their world? What helps them connect with their environment and community? Or, perhaps more importantly, what gets in their way? These are questions that need to be addressed when working to make schools and neighborhoods safe and accessible for children. Discussions of Safe Routes to School programs usually focus on the physical activity and safety benefits for children. But safe and livable neighborhood streets, with adequate facilities for walking, bicycling and traffic calming, can also help children develop a positive and holistic view of their communities.

Safe and livable neighborhood streets help children develop positive and holistic views of their communities.

Photo: Dan Burden
This article examines how mapping exercises with schoolchildren can reveal the influence of travel conditions on perceptions of the neighborhood environment. This, in turn, can help communities identify, prioritize, and generate support for improvements that will make the routes leading to school safe and inviting for walkers and bicyclists. This research further demonstrates how exposure to heavy traffic negatively affects children’s perceptions of their environment, and how installing pedestrian and bicycle improvements can quickly improve those perceptions. This shift in perceptions may not only encourage more physical activity, but can also strengthen the connection between children and their communities. In sum, safe school-area streets for walking and bicycling improve a neighborhood’s livability from a child’s vantage point.

Children are highly dependent on cars (and their drivers) for mobility, and, at the same time, they are at the greatest risk from the threats posed by speeding traffic. “Look both ways and wait for the cars before you cross the street!” parents will instruct their children. If a road is busy with speeding traffic and has no sidewalks and/or bike lanes, parents will likely tell their kids to avoid it altogether. The underlying message is clear — cars rule our streets and, consequently, many of our neighborhoods — effectively isolating our children from the surrounding community and limiting the range of activities they can participate in along the way to growing up.

This limit on independent mobility decreases children’s opportunity to be physically fit and healthy. But it may also have an impact on aspects of their mental health by way of diminished ability to independently experience and learn about the world around them.
As auto-dependent development has become the norm, we have seen an alarming downward trend in children independently walking and biking to school. A recent poll found that while 71 percent of adults walked or bicycled to school when they were young, only 18 percent of their children do so. The movement to create Safe Routes to School has focused in large part on helping children get back on their feet and on their bicycles in order to get more healthy exercise as part of their daily routine. This is important: the portion of children who are overweight or obese has quadrupled in the last 25 years. But creating safe streets may also have a fundamental impact on children’s sense of well-being in their neighborhood and their connection to their community.

Cognitive mapping exercises dramatically illustrate how children (and adults) perceive their environment, and how doing something as simple as building a pathway can change those perceptions. This article focuses on a cognitive mapping exercise conducted in schools in Contra Costa County in the San Francisco Bay Area. This exercise demonstrated how high traffic affects children’s perceptions of their community and how making improvements can quickly change those perceptions and help children have a more positive view of their community.

COGNITIVE MAPPING

The practice of cognitive or image mapping originated in the field of psychology and was introduced to a broad audience of urban designers and planners by Kevin Lynch. Through his seminal work, *The Image of the City*, Lynch classified the physical, perceptible objects of an environment into five elements: Paths, Edges, Nodes, Districts, and Landmarks. Image mapping has been used by urban planners to help identify important destinations, preferred routes of travel, and barriers in a community.

My father, Donald Appleyard, a student then faculty colleague of Lynch’s, used mapping exercises to conduct a renowned study on the impacts of traffic on street and community livability. He did this by comparing three residential streets in San Francisco, similar in many respects, except for their traffic levels. Some of his major findings were that as traffic volumes increase, quality of life factors that lead to healthy and strong communities (e.g., social connections, size of home territory, neighborhood pride and property values) decrease. In adapting to these traffic impacts, residents would withdraw and retreat into the backs of their homes and away from the street and, consequently, their community. He also found that children and the elderly were particularly vulnerable to the negative affects of traffic exposure.

Figure 1 (following page) graphically represents the inverse relationship between social ties (shown by the lines across the streets) and vehicular traffic, which increases from top to bottom. In the top street, where there is light vehicular traffic, there are many social connections and an active street-life. Whereas in the bottom street, the reverse can be seen with heavy traffic and fewer social ties. In sum, this image shows how community ties can actually be knit together by a street that is livable and inviting.
Figure 1: This image shows how community ties can actually be knit together by a street that is livable and inviting — or torn apart when auto traffic noise, pollution, and threats dominate the street environment.

Source: Figure 3, page 21, Livable Streets, Donald Appleyard, University of California Press, 1981.
Figure 2: This illustration shows how a resident’s sense of their home territories shrinks as traffic grows heavier and faster.

Source: Figure 4, page 23, Livable Streets, Donald Appleyard, University of California Press, 1981.
or, alternatively, they can be torn apart when auto traffic noise, pollution and threats dominate the street environment.

Additionally, Figure 2 shows how residents’ sense of their home territories shrinks as traffic grows heavier and faster. When heavy traffic forces residents to retreat into the backs of their homes and away from the street, the areas in front of homes — that could be vibrant places for children to play and neighbors to socialize — are left empty of street-life. As a result, few “watchful eyes” are left to enhance neighborhood safety.

Following on the legacy of my father’s work, I initiated a study to explore how traffic affects children’s perceptions of their environment, focusing specifically on the community environment between home and school. Early in the study, I worked with two colleagues, Vijay Jayachandran and Marcus Diederich, to conduct focused interviews and mapping exercises with nine- and ten-year-olds, having them draw free-form maps of their neighborhood between home and school.

One conclusion was immediately obvious: being part of traffic profoundly affects children’s perceptions. Many children primarily experience the world outside their homes from the backseat of a car. National surveys show that, on average, children spend more than an hour a day in a car, not including time in the school bus. Figure 3 shows a child’s windshield view of his world. As part of our study, this 10-year-old child, who was driven everywhere, was asked to draw a map of his neighborhood.

Figure 3: A map drawn by a 10-year-old child who was driven everywhere. The result is a series of disconnected paths that lead separately from home to school, friends, or the mall, with little detail or connection with the community.
between home and school, as if he were “to describe it to someone.” The result was a series of disconnected paths that led separately from home to school, friends, or the mall, with little detail or connection with the community within which he lived.

Another participant of the same study, a child who was also driven everywhere, was unable to make any connection with his community between home and school and he resorted to marking a line through the middle of the paper, drawing his school above and his home below the line.

These examples show how neighborhood design — by placing schools, parks, and playgrounds away from homes and providing inadequate sidewalks and bike lanes to access them — can affect children’s sense of place. As parents are forced to chauffeur their children throughout their childhood, children can become cognitively disconnected from their community.

Several studies have found that traffic and sprawling communities can impose further negative impacts on youth livability:

- **Heavy traffic reduces the independent mobility of children and youth.**
- **Opportunities and locations for spontaneous, non-structured play are severely restricted by traffic.**
- **Chronic traffic noise can stress children and raise their blood pressure, heart rates, and levels of stress hormones.**
- **In neighborhoods where traffic is a nuisance and a threat, children have a limited range of play activities and spend less time outside. Children who live in neighborhoods not dominated by traffic have a wider circle of friends, and so do their parents.**
The cognitive mapping exercise we conducted in Contra Costa County, California, is a dramatic illustration of these findings. In order to gauge the effect of traffic, we chose two residential neighborhoods with elementary schools, Parkmead (heavy-traffic-exposure) and Gregory Gardens (light-traffic-exposure). The communities were similar in most respects, except for their exposure to traffic volumes and speed. The light-traffic-exposure (Light TE) neighborhood, had about half the amount of traffic as the heavy-traffic-exposure (Heavy TE) neighborhood and the cars traveled at lower speeds (because of drainage swales that provided informal traffic calming). In addition, the Light TE neighborhood had good pedestrian facilities in key locations, and the traffic it did have was not as centrally located. (See Figures 4a and 4b)

Figures 4a and 4b: The light-traffic-exposure neighborhood, Gregory Gardens (a), had about half the amount of traffic as the heavy-traffic-exposure neighborhood, Parkmead (b), and the cars traveled at lower speeds.
MAPPING EXERCISE

Following the same protocol for each group, we provided 9- and 10-year-olds with blank pieces of paper and several plain, black pencils. We then read instructions asking them to “draw a map of their neighborhood, between home and school, as if they were describing it to someone” (Figure 5). We also asked them to identify and comment on areas that they liked, disliked, or felt were dangerous, and to indicate the location of their friends’ homes and places they like to play. We gave each group the same amount of time for each task. (For more information on this research, contact the author at <bappleyard@msn.com>.)

In order to highlight the children’s common themes, we created two composite maps, using a legend that reflected the elements drawn on the maps (Figure 6). The legend designates cool colors for positive elements (green for homes of friends and acquaintances, blue for places they like to play), and warm colors for negative elements (red circles for danger, orange circles for dislike, and red squares for automobiles). The more children who drew a particular element, such as a road, the thicker the line on the composite map.9

Figure 5 (above): We provided 9- and 10-year-olds with paper and pencils and asked them to “draw a map of their neighborhood, between home and school.”

Figure 6 (left): We created two composite maps, using a legend that reflected the elements drawn on the maps.
As was the case in the Heavy TE neighborhood, cognitive mapping exercises like this (Figure 7) provide a way for children to express their views of the world. Such exercises are invaluable for identifying and assessing the problems and opportunities experienced by children along the routes to school (e.g., important destinations, secret paths, preferred travel routes, and existing barriers). In turn, they can prove invaluable to helping community members, public staff and policymakers identify and articulate the most cost-effective solutions to making neighborhoods and school area streets more livable for the children.

![Figure 7: Cognitive mapping exercises like this help identify and assess problems and opportunities that children experience along the routes to school.](image)

This graphic comparison of the children’s collective cognitive experience makes it easy to see the inverse correlation between their exposure to traffic and the quality of their neighborhood experience.

In the Heavy TE neighborhood, the children frequently expressed feelings of dislike and danger and were unable to represent any detail of the surrounding environment. Newell Avenue, the main road in front of the school, is a tree-lined street and yet few of the trees were drawn; instead, red (danger, cars) and orange (dislike) dominated. Participants from the Light TE neighborhood, on the other hand, showed a much richer sense of their environment, drawing more of the streets, houses, trees, and other objects, and including fewer signs of danger, or dislike and fewer cars. The children also drew many more places in the street where they liked to play and areas that they just simply liked: they noted playing in 43 percent more locations in their streets relative to the children in the heavy-traffic-exposure neighborhood.

In sum, as exposure to auto traffic volumes and speed decreases, a child’s sense of threat goes down, and his/her ability to establish a richer connection and appreciation for the community rises. A child from the light-traffic-exposure neighborhood offered the testimonial on the following page (Figure 8).
CREATING SAFE ROUTES TO SCHOOL

While the cognitive mapping study helped identify, prioritize, and gather support and funding for needed improvements, it also presented an opportunity to see whether making the street safer for children could change their perception of their neighborhood. Within a year after the initial study, two walkways and a new stop sign were installed along the busiest corridors leading to the school in the heavy-traffic-exposure neighborhood (Figure 9). Waiting almost a year for the benefits to be realized, I conducted a follow-up study to examine how these facilities affected the livability and the quality of life of this community’s schoolchildren.

Figure 8: A child from the light-traffic-exposure neighborhood offered this testimonial.

Figure 9: Within a year after the initial study, two walkways and a new stop sign were installed along the busiest corridors leading to the heavy-traffic-exposure neighborhood’s school.
Before the improvements

Before the improvements were made in the heavy-traffic-exposure neighborhood, many children drew expressions of dislike and danger associated with automobiles and were unable to represent any detail of the surrounding environment—possibly feeling overwhelmed by the threats posed by the automobiles. After the improvements alleviated the exposure to these threats, there were indeed fewer expressions of danger and dislike, indicating a greater sense of comfort and well-being. Furthermore the students expressed a much richer recall of the characteristics of neighborhood around the busy street. (See Figures 10a and 10b.)

The pattern is also clear from the maps made by individual children who participated in both the before and after studies. In Figures 11(a) and (b) on the following page, a child showed a very high association with the threat of traffic before the improvements. (See the note in the lower right, “the cars never stop and there is too much traffic.”)

Furthermore, the busy, dangerous street between home and school is relegated to the bottom right corner of the map. Contrast this with the image drawn by the same child after the improvements. (To orient, note that in the second map the “n” shaped loop of the child’s home street is much smaller and farther to the left). First, the heavy traffic/high speed street is now much more significant portion of the child’s neighborhood image, as is the school. Furthermore, one of the most significant elements that stands out is the new pathway that is clearly represented across the lower portion of the map, highlighted by the green.

Figures 10a and 10b: Before improvements (a), there were many expressions of danger and dislike. After improvements (b), there were fewer such expressions, indicating a greater sense of comfort and well-being.
rectangle. While much of this child’s heightened cognitive sense of the neighborhood can be explained by the maturity and experience developed in the period between the studies, the clear identification of the pathway marks its role as a major contributor to enriching the quality of this child’s neighborhood experience.

Another child also expressed a positive overall image of his neighborhood after the improvement and again distinctly identified the new pathway (green rectangle) and stop sign (green hexagon) on the map (Figure 12).

While both children recognized that this street still presents a danger (“very bisey” and “not like because of all the cars”), their ability to manage and overcome the threat and domination of cars on these neighborhood street emerges due to the improvements to the pedestrian and biking environment.

Figure 12 (below): Another child distinctly represents the new pathway (green rectangle) and stop sign (green hexagon).
A comparison of the collective image maps of the children from the before group and the after group reveals how improvements to the pedestrian and bicycling environments help children develop a richer sense of their neighborhood, as well as lessen the sense of threat posed by automobiles.

These findings are especially important in light of the Safe Routes to School movement, which is bringing new resources into communities to improve the walking and bicycling environment for children. California and Texas have instituted statewide programs, and Congress has tentatively included a new Safe Routes to School program in the new federal transportation bill.

A before-and-after study of improvements made under the Safe Routes to school program in California found strong evidence of immediate success in five of nine schools studied. The study found more children walked to school, while automobile speeds were lower and more drivers yielded to pedestrians. The study found that projects that closed sidewalk gaps were especially successful.10 While the study did not measure children’s sense of well-being, it seems reasonable to assume that this improved as well.

CONCLUSION

This research seeks to address the question, “How does auto-dependency, and auto-domination of our streets and neighborhoods, affect the way a child views his or her world?” The maps compiled in this research show that as exposure to auto traffic volumes and speed decreases, a child’s sense of threat goes down, and his/her ability to establish a richer connection and appreciation for the community rises.

Without pedestrian and bicycle facilities to provide sanctuary for a child from automobile traffic, the negative senses of danger and dislike mean children cannot appreciate or possibly even identify the qualities of their neighborhood that are memorable, positive, or special. Additionally, exposure to threats posed by automobiles limits a child’s positive association with his or her neighborhood, including the area around the neighborhood school. Building complete and livable streets that are safe for travel via foot, bicycle, and yes, automobiles, is especially important if we want our children to establish a healthy sense of comfort, well being, and connection within their own community.

Supporting “youth livability” by achieving “street livability” objectives also helps engage children and adults in their street and community, ultimately making streets and public places safer for everyone. In closing, while new walking and bicycling facilities can improve a child’s physical health and safety, they also can allow children to explore, connect, socialize, and to be...kids!
ENDNOTES
2 Pedestrian injury is the 3rd leading cause of preventable death among children.
9 This process is very effective at analyzing the ability of children as a group to identify physical features as well as measuring their ability to associate between activities and physical space in their neighborhood. It also functions to represent the relationship between their feelings and preferences and physical space.
10 CalTrans Safe Routes to School report to the legislature, December 2003.

BIBLIOGRAPHY

ABOUT THE AUTHOR
Through his consulting practice, Appleyard Associates, Mr. Appleyard specializes in effective transportation, land-use and urban design strategies for vibrant, livable and sustainable community evolution. From neighborhood projects to national policies, Mr. Appleyard’s experience as a Neighborhood Planner, Smart Growth Expert, Planning Commissioner, etc., provide him with deep insight and expertise into a myriad of planning issues at the street, neighborhood and regional levels. Translating his experiences into the classroom, he has taught the graduate transportation and land use planning courses at Portland State University and the University of Virginia, as well as workshops for the National Center for Bicycling and Walking and The University of California.

CONTACT INFO:
Bruce Appleyard can be reached at bappleyard@msn.com, bruce@appleyardgroup.com, www.smartgrowthplanning.com, or at 503-810-7249.

NCBW FORUM is an online publication of the National Center for Bicycling & Walking.
EDITOR: John Williams <john@montana.com>
To learn more, visit the ncbw forum site at www.ncbwforum.infop.cc
Or visit our main website at www.bikewalk.org.