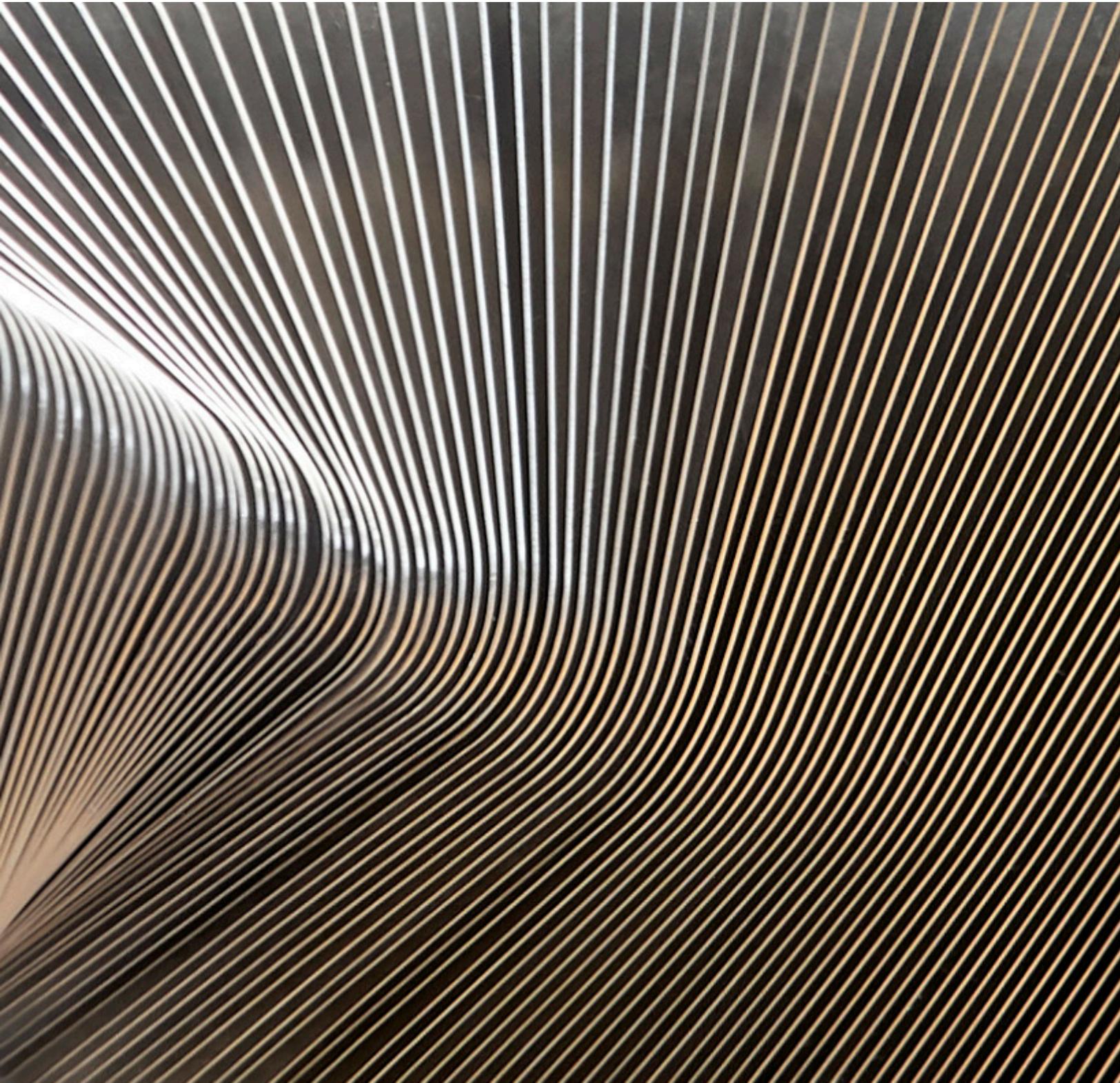


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## 02

# Design for School Safety: An Overview of Crime Prevention through Environmental Design

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### Abstract

Given the ongoing climate of fear surrounding gun violence in K-12 schools, safety and security for school facilities have come to the forefront as a top priority for architects and designers. Unfortunately, very little scientific research exists to recommend design approaches that measurably impact school violence rates. This article seeks to provide a brief overview of approaches to design for safety and security, highlights Crime Prevention through Environmental Design (CPTED) as the current forerunner among available strategies, outlines current research on CPTED, and indicates research gaps needing exploration. The authors summarize the limited number of current studies on CPTED in educational environments, highlighting the seminal findings of a recent survey that investigated the relationship between CPTED school designs and perceived safety among 900 students in three middle schools and four high schools in the American Southwest. Current research suggests that CPTED may provide students in school environments both objective safety, as well as a perceived sense of safety. Discussion also elucidates the need for consideration of students' perceptions of school designs, as they relate to their sense of safety and overall psychological wellbeing. The paucity of empirical studies on this topic suggests that much more research is needed.

**Keywords:** *violence prevention, education, security, school, safety, design*

### 1.0 Introduction

Frequent reports of school victimization and violence rates increasingly propose the insertion of security measures into K-12 school environments.<sup>1</sup> Unfortunately, research has found that such measures may be antithetical to a learner-friendly environment. Many studies have found that visible security measures such as metal detectors, locked doors, and hall monitors lead students to worry more about their safety, potential crime, and violence.<sup>2, 3, 4</sup> Not only do visible security measures negatively impact student perceptions, but there is little evidence to indicate that they effectively reduce school crime and violence.<sup>5, 6</sup>

As an alternative, designing schools that support a healthy psychosocial climate may also make them safer by reducing bullying, crime, and violence,<sup>7</sup> thereby leading to improved academic performance.<sup>8</sup> Because

positive school climates are associated with enhanced perceived safety,<sup>9</sup> the cultivation of design that increases perceived safety warrants greater attention in school security efforts.

In support of this assertion, this article summarizes published research on the topic of design for safety as it applies to learning environments, and highlights current promising avenues of investigation regarding Crime Prevention through Environmental Design (CPTED). The article also reviews findings from a recent photograph-based survey of 900 adolescents indicating a positive relationship between students' perceived safety and the inclusion of features of CPTED school design. The authors close with a discussion of existing literature gaps and where future research is needed.

## 2.0 Methodology

To produce this literature summary, the authors drew on a collection of empirical literature amassed from the primary author's dissertation,<sup>10</sup> as well as a targeted search of online databases to explore more recent research. Rather than using an extensive, systematic review process, a more targeted "scoping review" process was utilized to find the most recent research on this topic. Varying iterations of key terms, such as "CPTED," "architecture," "school facilities," and "safety/security", were used in several major research and university databases. The main review of literature began with the primary author's doctoral dissertation literature collection, which was then extended to include 19 additional relevant articles published during the preparation of this article. The authors identified a total of 122 articles and four books for initial review, after which thirty-six of these were determined to merit final inclusion due to their relevance to the physical environment and its impact on crime, violence, safety, or various aspects of human functioning (i.e. learning, emotion, mental health, physical health, etc.).

## 3.0 Results

### 3.1 Literature Review

Findings from our literature review indicate that certain spaces in school environments are consistently associated with acts of violence, victimization, or fear.<sup>11</sup> Biag found that when thirty students were asked to take pictures of safe and unsafe spaces on their school campus, they indicated that unsafe locations were mainly outside of the traditional classroom, were under-supervised, and unknown by school personnel.<sup>12</sup> These included "undefined" and "unowned" spaces, such as hallways, cafeterias, parking lots, and bathrooms, corroborating earlier studies.<sup>13</sup> In addition, other research has noted related patterns, consistently finding that students associated safe spaces with the presence of supportive adults.<sup>11, 14</sup> Thus, cultivation of ownership over all school spaces as well as supervision by, and access to, trusted adults may be critical factors to consider in school facility design. This suggests that design that affords staff an increased ability to monitor students and lend support would be beneficial.

### 3.2 Reducing Crime by Design

Many published theories have been proposed to mitigate crime and violence by virtue of the design of the built environment. Rational choice theory suggests that offenders engage in a decision-making process weighing the pros and cons of a crime, and that if the utility of what can be gained from the crime is sufficient, an attempt will be made.<sup>15</sup> However, a large body of literature discredits this theory due to its untestable nature and its assumption that humans are self-serving, which is at odds with more broadly accepted scientific views that humans are social animals.<sup>15</sup> Routine pattern activity posits that changes in people's daily routines at the individual, community, and societal levels lead to changes in crime trends; further, the variable relationship between the offender, a target, and the presence/absence of a capable guardian affects opportunities for crime occurrence.<sup>16</sup> Crime pattern theory integrates the rational choice and routine pattern activity theories and expands them by emphasizing other factors such as socio-cultural, economic, and physical environment factors. It asserts that "how targets come to the attention of offenders influences the distribution of crime events over time, space, and among targets."<sup>17</sup> Similarly, Crime Prevention through Social Development (CPSD) recognizes the complex social, economic, and cultural factors contributing to crime, thus it encourages social programs that target racial disparities, socioeconomic challenges, and family-oriented policies.<sup>18</sup>

While all of the above-mentioned theories account for the role of built settings in crime, architect Oscar Newman's defensible space theory more explicitly explored how the physical environment can reduce the opportunity for crime.<sup>19</sup> His original framework relied on the principles of territoriality, natural surveillance, and image/milieu to manipulate the design and layout of physical space. Empirical evidence generally supports the impact of these approaches in reducing crime, and later work has confirmed the importance of Newman's image/milieu concept. For instance, the "broken windows" studies show increased crime and antisocial acts in spaces that are poorly maintained and in disrepair.<sup>20</sup>

### 3.3 Crime Prevention through Environmental Design (CPTED) Principles

Building on the ideas of defensible space, the Crime Prevention through Environmental Design (CPTED) framework provides a structured and design-specific approach that has been utilized by architects and designers for several decades. Based on the idea that the physical environment influences human choice and behavior, CPTED was first formally outlined by C. Ray Jeffery,<sup>21</sup> who acknowledged crucial contributions from Oscar Newman and Jane Jacobs,<sup>22</sup> who put forth ideas about elements needed for safe urban environments. In the simplest terms, CPTED seeks to use the physical environment to discourage criminals from engaging in crime and reduce opportunities for crimes to be committed.<sup>23</sup> Since its initial conceptualization, CPTED has undergone several phases of evolution,<sup>24</sup> and while it has regularly changed form, it has mostly maintained its core pillars.

While the literature is mixed in determining which concepts are considered central to CPTED,<sup>25</sup> the following four are nearly always included and are often referenced in school design literature<sup>26</sup>:

- *Natural Surveillance*: Supports the idea of “see and be seen”; advocates the use of windows and open layouts, among other strategies, to optimize sight lines and facilitate the continual monitoring of important spaces.
- *Access Control*: Refers to selecting who is allowed to enter and exit a space, which primarily involves minimizing the number of entry/exit points and channeling visitors to secure locations where they can be monitored and vetted.
- *Territoriality*: Involves delineating clear and discrete spaces by providing visual cues in the built environment, such as landscaping elements to mark borders, sidewalks to designate where visitors can walk, and signage that communicates behavior expectations (i.e. “drug free campus” signs).
- *Maintenance*: supports the concept of territoriality, as dirty, neglected, and vandalized spaces send a message that no one feels a sense of ownership or concern about such spaces.

CPTED represents one approach that could allow for an increased sense of safety in students, while addressing school security and violence prevention. By utilizing subtle, covert methods “baked in” to the design and layout of school campuses, CPTED could also allow for a positive, welcoming, and supportive environment with enhanced safety, including visual and physical access to school staff. For example, the principle of natural surveillance encourages windows and openness, which promotes classroom daylighting and nature views. Also, territoriality and maintenance may be promoted by design that considers cleanliness, materials durability, and visual orderliness. The use of vegetation and stress-reducing natural elements (i.e. rocks, trees, shrubs) to mark boundaries may also foster mental restoration on campus.

### 3.4 School Security Technologies

Along with ongoing development of crime-prevention design frameworks, there has also been an increased focus on security technologies in recent years, though some technologies appear to be at odds with CPTED principles. For example, American public schools have seen a continual increase in the use of security cameras and metal detectors,<sup>27</sup> but these do not represent the “natural” form of surveillance espoused by CPTED. Additionally, as previously mentioned, studies suggest that visible security measures can actually increase student fear.<sup>3</sup> Other novel technologies, such as remote door-locking controls and alarm systems triggered by gunshot noise, take a less outwardly-visible approach and may be more conducive to maintaining a non-threatening environment; however, most new technologies are implemented with minimal-to-no scientific evidence of their efficacy in creating safer schools.<sup>28</sup> Furthermore, many scholars warn that a “target-hardening” approach that over-relies on security technologies can have adverse effects on students and the school environment.<sup>29</sup> Therefore, a tempered approach using CPTED may more effectively strike a balance between safety and student wellbeing, though research on this matter is nascent.

### 3.5 School-Based Implementation of CPTED

General research on the implementation of CPTED strategies shows efficacy in residential and commercial settings.<sup>24</sup> However, research on CPTED in educational settings is limited to only a handful of studies, and it is unclear how the use of CPTED impacts student sense of safety and school climate. An early school-based application was demonstrated by Wallis and Ford, in which the implementation of CPTED informed design alterations at four high schools and resulted in increased surveillance and reduced crime victimization.<sup>30</sup> Surprisingly, a positive impact on student perceived safety was not evident. Recently, Vagi et al. found that secondary school facilities with closer adherence to CPTED principles tended to have lower reported rates of violence and aggression.<sup>31</sup> Their results also indicated that schools with greater use of CPTED design elements had lower rates of absenteeism stemming from fear for safety. Additionally, Shariati and Guerette indicated that students living in residential university dormitories with higher utilization of CPTED strategies perceived greater safety than those in dormitories with low use of CPTED elements.<sup>32</sup> While each of these studies indicates promise, school-based CPTED research is scarce and much more is needed.

### 3.6 Student Perceptions of CPTED

Lamoreaux and Sulkowski investigated whether schools designed around CPTED principles are perceived as being safer and more psychologically comfortable when compared to schools that do not adhere to CPTED.<sup>33</sup> The study recruited 900 middle and high school students ranging in age from 11 to 19 years and of diverse gender, cultural, and racial/ethnic backgrounds in southern Arizona. Forty-four percent of participants were male, 54 percent were female, 0.7 percent indicated "Other," and 1.2 percent did not indicate their sex. Student preferences were gathered via a photograph-based survey using images gathered via Google image searches, digital photographs donated by Perkins&Will design firm, and photographs taken of local schools in the region where the study was carried out. A group of graduate-level psychology students and their instructors assisted in narrowing an initial batch of 72 images down to 24 final images. The survey presented pairs of

photographs that depicted similar school areas with and without design elements representing the primary CPTED principles: (1) Natural Surveillance, (2) Access Control, and (3) Territoriality/Maintenance (See Tables 1, 2, and 3 below). Students completed the survey while at their campuses using Qualtrics online survey software and school computers.

Lamoreaux and Sulkowski's survey results indicated that students had a significantly greater preference for CPTED versus non-CPTED school designs, both in terms of perceived physical safety ( $p < .01$ ,  $d = .84$ , large effect size) and psychological comfort ( $p < .01$ ,  $d = .70$ , large effect size).<sup>33</sup> Lamoreaux and Sulkowski's analyses indicated that age, ethnicity, and gender did not demonstrate meaningful impacts on CPTED preferences. Similarly, a student's prior exposure to violence did not correlate with a meaningful difference in the overall preference for CPTED designs, neither for perceived safety ( $p > .05$ ) or psychological comfort ( $p > .05$ ). Students with a history of delinquent behavior demonstrated a statistically significant preference for non-CPTED design photos for perceived physical safety ( $p = .05$ ,  $d = .25$ ) and psychological comfort ( $p < .05$ ,  $d = .26$ ), however the effect sizes ( $d$ ) for both of these results are considered small and of marginal practical significance. Lastly, self-reported academic achievement did not show a statistically significant correlation ( $r$ ) with students' CPTED preferences regarding perceived safety ( $r = .02$ ,  $p = .51$ ) or psychological comfort ( $r = .03$ ,  $p = .46$ ). In short, most of the individual differences among survey participants did not exert an impact on the collective preference for the depicted CPTED design strategies.

Tables 1, 2, and 3 present the images used in the electronic survey and indicate what percentage of students preferred each CPTED school image. While student preferences favored CPTED designs overall, analysis of preference trends within each of the three CPTED principles indicates notable differences.

Lamoreaux and Sulkowski's survey also used open-ended questions that asked students to write about specific design elements that were depicted in the survey. This qualitative data was used to expand on and elucidate the quantitative data regarding student preferences. In some cases, there were conflicting response trends relating to preference for transparency and openness, as well as fencing and gating. These will be detailed below.

Table 1 reveals that a solid majority of the student participants favored the Natural Surveillance images for both perceived safety as well as psychological comfort. The preference for CPTED was slightly stronger for all four image pairs as it applied to students' sense of psychological comfort versus physical safety. A primary response pattern among the survey's open-ended text responses suggested that a large number of students perceived windows and openness as conducive to safety; for example, one student stated, "The ones with the windows were safer to me because I could see if anyone is coming by looking through the windows." Interestingly, this comment, and many others like it, accurately described the premise behind natural surveillance, which is to allow users to passively monitor common spaces for unsanctioned behaviors. Students also tended to use fear-based descriptors such as "trapped" to describe windowless, enclosed spaces.

Conversely, a smaller subset of students described a sense of fear and vulnerability associated with windows and openness. These students tended to prefer less window transparency and more fencing in order to feel safe. For instance, many responses reflected this student's fear: "Some specific things that I saw that made me uncomfortable is windows because they could see you and kill you..."

The above-mentioned preference for enclosed, restricted space appears to contradict research findings that fear is greater in enclosed spaces<sup>34</sup> and, more specifically, in spaces having low prospect (i.e. low visibility), high opportunity for concealment (of perpetrators), and blocked escape.<sup>35</sup> One possible explanation for this contradiction in student preferences for design transparency was exposed by Lee and Ha.<sup>36</sup> They explored the effect of windows/visibility on Korean students' fear of crime in interior school environments, and their results suggested that either too much or too little visibility led to decreased sense of safety. However, this is the only study of its kind, and further investigation is needed to clarify if this phenomenon generalizes to student populations in other communities and cultures. Thus, future research will need to clarify why some students' explicit preferences are for enclosure; it is possible that the current media focus on school-based violence fuels student fear and thereby alters their perceptions of potential threat in the physical environment.

In observing the preference percentage rates in Table 2, it is apparent that Access Control may produce less perceived safety and comfort than the other CPTED principles explored by Lamoreaux and Sulkowski's survey. Only two of the four Access Control image pairs were favored by a majority of students for physical safety, and none of the pairs were favored for psychological comfort. One trend in the qualitative response patterns that discussed images of fences and gates provides a possible explanation for this. Many students described gates and fences as restrictive of movement, some alluding to hypothetical scenarios when they would want rapid egress. One student's comment on the survey images embodied the collective viewpoint in this way: "I really felt more comfortable with the pictures that didn't show gates. It gives off a feeling that you are trapped, and you can't leave." This sentiment aligns with Fisher and Nassar's<sup>35</sup> finding regarding elevated fear in environments with blocked escapes. Nevertheless, the percentages in Table 2 seem to indicate that at least some students favor the depicted access control strategies, and future research will need to determine the factors responsible for these opposing viewpoints.

Overall, the results outlined in Table 3 indicate that three out of four of the depicted Territoriality and Maintenance design strategies foster greater sense of safety and comfort than non-CPTED designs. More specifically, it would appear that students indicate a benefit to well-manicured outdoor landscaping, a front office approach/entry with clear visual cues and legibility, and "territorial" signage stating behavior restrictions on school grounds. However, it was only a slight majority that preferred the drug free school signage for psychological comfort (51 percent for CPTED versus 49 percent for non-CPTED), and the preference for the same image regarding perceived safety was also modest (60 percent for CPTED versus 40 percent for non-CPTED). The first image pair depicting neat versus inadequate grounds maintenance demonstrated the most overwhelming CPTED preference out of all twelve image pairs. Indeed, the open-ended text responses from students regarding Territoriality/Maintenance issues made frequent mention of a preference for well-maintained grounds. One out of many comments in this response trend stated, "I saw that when the school was more well kept and clean it gave me a sense that it was safer as well." Notably, a slight majority of students preferred the non-CPTED image that

Table 1: PSDM Natural Surveillance survey items and percentage of response preference (N = 900).

CPTED PRINCIPLE DEPICTED	IMAGES USED IN SURVEY		PERCENT THAT PREFERRED CPTED FOR PSYCHOLOGICAL COMFORT	PERCENT THAT PREFERRED CPTED FOR PHYSICAL SAFETY
	NON-CPTED	CPTED		
Natural Surveillance	 <p>Windowless classroom</p>	 <p>Windowed classroom</p>	78%	67%
Natural Surveillance	 <p>Minimal Observation of common spaces</p>	 <p>Observable common spaces</p>	74%	63%
Natural Surveillance	 <p>Impeded front desk view of main entry doors</p>	 <p>Front desk view of main entry doors</p>	59%	57%
Natural Surveillance	 <p>Hall with no exterior views</p>	 <p>Hall with exterior views</p>	77%	67%

**Table 2:** PSDM Access Control survey items and percentage of response preference (N = 900).

CPTED PRINCIPLE DEPICTED	IMAGES USED IN SURVEY		PERCENT THAT PREFERRED CPTED FOR PSYCHOLOGICAL COMFORT	PERCENT THAT PREFERRED CPTED FOR PHYSICAL SAFETY
	NON-CPTED	CPTED		
Access Control	 <p>No perimeter fence around campus</p>	 <p>Perimeter fence around campus</p>	47%	57%
Access Control	 <p>No gated parking</p>	 <p>Gated parking</p>	30%	41%
Access Control	 <p>No fence around basketball court</p>	 <p>Fence around basketball court</p>	32%	42%
Access Control	 <p>No fence around bike racks</p>	 <p>Fence around bike racks</p>	54%	65%

Table 3: . PSDM Territoriality/Maintenance survey items and percentage of response preference (N = 900).

CPTED PRINCIPLE DEPICTED	IMAGES USED IN SURVEY		PERCENT THAT PREFERRED CPTED FOR PSYCHOLOGICAL COMFORT	PERCENT THAT PREFERRED CPTED FOR PHYSICAL SAFETY
	NON-CPTED	CPTED		
Territoriality/ maintenance	 <p>Windowless classroom</p>	 <p>Windowled classroom</p>	85%	83%
Territoriality/ maintenance	 <p>Minimal Observation of common spaces</p>	 <p>Observable common spaces</p>	43%	48%
Territoriality/ maintenance	 <p>Impeded front desk view of main entry doors</p>	 <p>Front desk view of main entry doors</p>	73%	67%
Territoriality/ maintenance	 <p>Hall with no exterior views</p>	 <p>Hall with exterior views</p>	51%	60%

lacked a designated pedestrian walkway, both in terms of perceived physical safety and psychological comfort. This could be due to the lack of any true association with sidewalks and perceived safety or psychological comfort, or it could be due to a flaw in the selected images, such that they may not correlate sufficiently to the concept of Territoriality, even at the subconscious level among survey respondents.

#### 4.0 Conclusions and Future Directions

In reviewing the limited body of current publications on CPTED use in schools and original studies, results indicate substantial benefits from using a CPTED framework to inform design. For instance, the inclusion of CPTED principles in design may be an effective approach to engender feelings of both safety and psychological wellbeing among a majority of students.<sup>33</sup> In addition, findings reviewed here strengthen the case that students' sense of safety and their academic achievement may be improved as school buildings take a softer approach to safe school design.<sup>31</sup> In contrast, a fortress-like approach to design may neither improve safety nor the perception of safety.

Compared with other crime prevention models, CPTED has advantages in that it provides a structured and design-specific approach based on multidisciplinary perspectives from sociology, psychology, criminology, and other fields. Second generation versions of the CPTED framework have expanded to include emphases on social cohesion, community connectivity, and community culture. The inclusion of social factors that play a critical role in neighborhood safety may provide another advantage of this approach.<sup>24</sup> Finally, empirical research indicates a positive effect of using CPTED in residential and commercial settings. However, current literature surrounding CPTED in school design is scant, thus continued studies are warranted.

##### 4.1 Possible Limitations of CPTED

A CPTED approach presents with a few considerable limitations. First, as research on the use of CPTED specifically in K-12 schools is highly limited, current practices that use security design strategies are not based upon a repeated or rigorous evidence base.

Also, critics citing the limitations of CPTED point out that some iterations of its framework, particularly in the early years of its application, have been reductive and overly simplistic in suggesting physical/architectural parameters that can be manipulated in order to reduce criminal behaviors.<sup>23</sup> Others have suggested that CPTED approaches are deterministic, arguing that it overestimates the influence of the built environment.<sup>24</sup> As a result, scholars have recently suggested that a "third generation CPTED" framework is needed that includes a more holistic and ecological perspective.<sup>23</sup> Proponents suggest that CPTED be folded into a broader public health or "community liveability" perspective that accounts for increasing knowledge in sustainability and "green technology," as well as advances in cognitive, behavioral, neurological, and environmental sciences.

##### 4.2 Future Research Questions

Lamoreaux and Sulkowski observed a dichotomy in student preferences for open versus enclosed environments that could be more accurately tested in on-site studies to determine the specific design impact of windows.<sup>33</sup> Of interest are studies to clarify the effect of transparency and visibility on perceived safety, given current trends in architectural design that favor increased transparency, windows, and visual permeability in school buildings. Specifically, investigation is needed to understand if transparency's impact on perceived safety is a function of quality or quantity (how much and where is transparency afforded in a given school design). Additionally, investigations should explore whether the impact of transparency is mitigated by individual student characteristics (i.e. demographic traits or cultural experiences). Research is also needed to investigate design solutions that both permit transparency and, at the same time, provide places for visual refuge and protection from perpetrators.

Future studies exploring the impact of CPTED school designs on student perceptions also need to ask if there are personality factors such as a predisposition to anxiety or introversion that contribute to the differing preferences observed by Lamoreaux and Sulkowski.<sup>24</sup> In addition, studies on the impact of specific designs of fencing and gates are of interest to determine if perimeter fencing alone has a measurable impact on perceived safety, and if different types of fencing (chain link, bars) have different

effects on perceived safety. We also propose that studies should evaluate how specific design manifestations of each CPTED principle (i.e. natural surveillance, access control, territoriality, etc.) might support perceived safety and mental wellbeing in schools.

Furthermore, a more nuanced understanding of the impact of design will result from continued analysis of the other CPTED principles, beyond the four analyzed in this paper. Analysis of the specific qualities and context of design features must consider the social, economic and local conditions. Importantly, the interactions between design, individual perceptions, and the school's culture and pedagogical styles will help to reveal those design elements that are most likely to have the greatest impact on safety and student wellbeing.

Other CPTED research will need to focus on teachers' (not just students') perceived safety and comfort in CPTED-based schools, and whether CPTED objectively reduces crime and violence rates in educational settings. Finally, the potential influence of built features on the school social environment should be investigated. For instance, the assertion that transparency enhances school connectedness demands empirical investigation; this research topic has not yet been adequately addressed, but is of great importance. As future studies explore the gaps highlighted here, thought leaders will be able to work towards a refined iteration of the CPTED framework, one that more effectively reduces violence while fomenting a stronger sense of psychological and physical safety.

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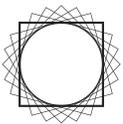
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