



BSc in Psychology
Department of Psychology

Perceived Safety in Urban Environments:
The Effect of Building Height, Brightness, and
Perceived Enclosure

June, 2021

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Foreword

Submitted in partial fulfillment of the requirements of the BSc Psychology degree, Reykjavík University, this thesis is presented in the style of an article for submission to a peer-reviewed journal.

This thesis was complete in the spring of 2021 and may therefore have been significantly impacted by the COVID-19 pandemic. The thesis and its findings should be viewed in light of that.

Abstract

Research has shown that factors in our built environment influence how we may perceive it, and hence our decision to make use of the area or to avoid it. Safety is one of the most important factors an area can provide for its' pedestrians. Research has shown that perceived enclosure, building height and brightness levels influence perceived safety. Knowledge about how these factors can either decrease or contribute to perceived safety is important to take into account when designing and constructing urban environments. The present study examined how building height, brightness and perceived enclosure affected perceived safety directly, as well as whether perceived enclosure mediated the effect of building height and brightness on perceived safety. A web-based survey was sent out, and participants ($N = 349$) were asked to assess how safe and how enclosed they perceived various virtual streetscapes, demonstrated on computer-generated images. Results showed that building height and brightness levels significantly affected participants' perceived safety as well as their perceived enclosure. Perceived enclosure was also shown to partially mediate the effect of building height and brightness on perceived safety.

Keywords: perceived safety, building height, brightness level, perceived enclosure, streetscapes

Útdráttur

Rannsóknir hafa sýnt fram á að ýmsir þættir í borgarumhverfi hafi áhrif á það hvernig fólk upplifir það, og þar af leiðandi ákvörðun þeirra um að nýta sér umhverfið eða forðast það. Að skynja öryggi er einn mikilvægasti þáttur sem að umhverfi getur veitt vegfarendum, en rannsóknir hafa sýnt fram á að skynjuð umlyking, hæð bygginga og birtustig hafi áhrif á upplifað öryggi fólks. Þekking á því hvernig þessir þættir geta ýmist dregið úr eða ýtt undir skynjað öryggi er mikilvæg, og sérstaklega þegar kemur að því að hanna og móta borgarumhverfi. Í þessari rannsókn eru áhrif hæðar bygginga, birtustigs og skynjaðrar umlykingar á skynjað öryggi fólks í borgarumhverfi athuguð. Vefkönnun var send út og þátttakendur ($N = 349$) voru beðnir um að meta annars vegar hversu mikla umlykingu og hins vegar hversu mikið öryggi þeir upplifðu tengt götumyndum sem teknar voru úr sýndarveruleika. Niðurstöður sýndu fram á að hæð bygginga og birtustig höfðu marktæk áhrif á skynjað öryggi sem og skynjaða umlykingu þátttakenda. Niðurstöður sýndu einnig að skynjuð umlyking miðlaði að hluta áhrifum hæðar bygginga og birtustigs á skynjað öryggi.

Lykilorð: skynjað öryggi, hæð bygginga, birtustig, skynjuð umlyking, götumyndir

Perceived Safety in Urban Environment: The Effect of Building height, Brightness and Perceived Enclosure

Research has shown that various factors in our environment affect how we perceive it (Mehta, 2014; Migliorini et al., 2008). Satisfaction with an area is one important factor that influences people's decision to either make use of the space or avoid it (Kawachi & Berkman, 2003). Perception of safety is known to increase satisfaction with an area and is considered one of the most important factors an environment can provide for its' pedestrians (Jacobs, 1961; Lovejoy et al., 2010; Mehta, 2014; Stamps, 2012). This study will examine how certain environmental factors; building height, brightness and perceived enclosure, can influence perceived safety in urban environments. Knowledge about how these factors influence safety perception is important and should be taken into account when designing and constructing dense urban neighborhoods.

Perceiving an environment as enclosed, that is, when a space evokes a feeling of being within it rather than being outside of it (Mehta, 2014), has been shown to influence how safety is perceived (Stamps, 2005a). Some studies suggest a U-shaped relationship between perceived enclosure and perceived safety (Mehta, 2014; Stamps, 2012), with wide-open spaces evoking discomfort due to lack of shelter and entirely enclosed spaces evoking claustrophobia (Alkhresheh, 2007; Carmona et al., 2010; Herzog, 1992). Hence, environments that are not considered too open or too enclosed, allowing people to observe their surroundings without being seen, are perceived as safe to seek and explore (Appleton, 1996).

Several other studies, however, have come to the conclusion that as perceived enclosure increases, perceived safety decreases, in a more linear relationship (Baran et al., 2018; Stamps, 2005b; Tabrizian et al., 2018). Herzog and Chernick (2000) emphasized on investigating the

relationship between safety and enclosure in urban environments. Participants were shown images of different environmental settings and were asked to rate each image on how safe and how enclosed they perceived it. A negative relationship between safety and enclosure was found; as perceived enclosure increased, participants' perceived safety decreased. The reason these results, as well as other supporting studies, do not demonstrate the U-shaped relationship is most likely because the stimuli used varied from moderately enclosed to entirely enclosed spaces, rather than from entirely open to entirely enclosed spaces. But whether this relationship is linear or U-shaped, earlier mentioned studies still agree that people's perceived safety can generally be affected by how enclosed they perceive their environments.

Perceived enclosure is one of the basic concepts of urban design, and it can vary as a result of difference in building height surrounding an open area, and the distance between the buildings, or street width (Kahraman & Cubukcu, 2017). Stamps (2005c) examined the effect of building height on perceived enclosure. His results demonstrated that as building height increased, perceived enclosure increased as well. He also found that perceived enclosure and depth of view had a negative relationship, that is, a greater distance the eye could see, the less enclosure was perceived. Supporting Stamps' findings, Lindal and Hertig (2013) found that perceived enclosure and building height had a positive and almost perfect correlation, showing that increased building height, contributed to an increase in perceived enclosure.

In his research, Alkhresheh (2007) examined the ratio of building height and street width, and how it affected perceived enclosure. He concluded that as the ratio increased (when building height exceeded the street width), perceived enclosure increased. His findings indicate that building height's effect on perceived enclosure depends somewhat on how wide the street is, but they also further emphasize that building height can affect how enclosure is perceived in urban

environments. Alkhresheh obtained his results from images of virtual streetscapes, with buildings on either side of the street, but with no buildings at the end of the street. That is, he did not take into consideration the effect of depth of view.

Different brightness levels are also considered important determinants of how enclosed or open an area is perceived, and consequently how safe it is perceived. Even though brightness cannot physically affect how enclosed a certain space is, research has shown that increased brightness can in fact decrease people's perception of enclosure (Lindh, 2012). Similarly, it has been shown that in darkness or poorly lit areas, people tend to perceive the environment as more enclosed (Loewen et al., 1993; Stamps, 2005a, 2009). In Stamps' study (2005a), his results demonstrated that of all factors considered, including walls, depth of view and number of open sides, perceived enclosure was most strongly affected by brightness. He also found that safety was most strongly correlated with brightness, that brighter areas were perceived as safer to seek than darker areas. More recent studies have supported these results, further emphasizing brightness's effect (Bokharaei & Nasar, 2016; Lindh et al., 2020).

Several studies have also found that brightness can directly affect perceived safety (Boyce, 2019; Soyeon & Mikyoung, 2016). In her study, Painter (1996), indicated that after-dark hours cause the least perception of safety due to poor visibility, resulting in more spaces where crime can take place. Her point was that increased brightness, for example from streetlights, reduces fear of crime, hence increasing perceived safety. A recent study that investigated perceived safety in urban streetscapes supported Painter's findings, showing that darkness was strongly associated with negative feelings and that proper lighting was critical for perceived safety. The results also showed that people seemed to prefer different street settings based on the time of day. At night, streetlights strongly affected how safety was perceived, but during the day,

perceived enclosure, among other factors, seemed to cause more concern (Park & Garcia, 2019). Proper outdoor lighting is considered especially important in the Nordic countries, where daylight hours are highly limited for a large part of the year. There, pedestrians are believed to depend more on outdoor lighting, as overall visibility can contribute to their perceived safety (Rahm et al., 2021).

In sum, previous studies are unanimous in the conclusion that building height significantly affects perceived enclosure (Alkhresheh, 2007; Kahraman & Cubukcu, 2017; Lindal & Hertig, 2013; Stamps, 2005c). But very few, if any, studies have examined building height's direct effect on perceived safety. Brightness has been shown to both directly affect people's perceived safety (Boyce, 2019; Painter, 1996; Park & Garcia, 2019; Rahm et al., 2021; Soyeon & Mikyoung, 2016), as well as how enclosed they perceived their environments (Bokharaei & Nasar, 2016; Lindh, 2012; Lindh et al., 2020; Loewen et al., 1993; Stamps, 2005a, 2009). Previous studies have also unanimously shown that people's perceived enclosure affects their perceived safety (Alkhresheh, 2007; Appleton, 1996; Baran et al., 2018; Carmona et al., 2010; Herzog, 1992; Herzog & Chernick, 2000; Mehta, 2014; Stamps, 2005a, 2005b, 2012; Tabrizian et al., 2018). Few studies, if any, have examined whether perceived enclosure mediates the effect of building height and brightness levels on perceived safety, but from the findings mentioned above, it can be assumed to be the case.

This study will focus on examining building height's direct effect on perceived safety, as little knowledge is available on that specific relationship. How perceived safety is affected by different levels of brightness is also focus of attention, as well as whether perceived enclosure mediates the effect of building height and brightness on perceived safety in urban streetscapes. Three hypotheses, summarized in Figure 1, were generated:

1. When building height increases, perceived safety decreases.
2. When brightness increases, perceived safety increases.
3. Perceived enclosure mediates the effect of building height and brightness on perceived safety.

Method

Participants

In their participation, a total of 349 participants (74.2% women, 25.5% men, and 0.3% other) responded to one image or more, of which 284 (81.4%) responded to all 10 images presented to them. A large majority, or 338 (96.8%), of the participants were Icelandic. A majority, or 298 (85.4%), were situated in Reykjavik's metropolitan area of Iceland, 27 (7.7%) were situated in rural areas, and 24 (6.9%) abroad. All participants were 18 years old or above, the average was 34 years ($SD = 13.7$) and the age ranged from 18 to 74 years. Slightly over half (52.7%) of participants participated via smartphone, little less than half (43.8%) via computer and only a small portion (3.4%) via smart tablet.

Visual Stimuli

The stimuli used in the study were 100 computer-generated images of simulated streetscapes. Each image had blocks of residential buildings on either side of an 8 m wide street, with two 4 m wide sidewalk on each side (16 m between the buildings in total). Each street was 56 m long, with buildings also located at the far end of the street to close it off. Streetlight poles were located on both sides of the street. Building height and time of day (brightness levels) were systematically controlled.

The buildings were built on sunken cellars and each had one to three floors (story height = 2.5 m). The building height, from the ground with roof included, were 7.1 m (one floor), 10.6

m (two floors) and 14.1 m (three floors). Of the 100 images, 33 images had buildings with one floor, 34 images had buildings with two floors and 33 images had buildings with three floors. Every building had four windows on each level and a set of steps at the middle of the building, from the sidewalk to the main door on the first floor. On each image, the buildings had the same height throughout the streetscape.

The image pool was also split into three sets according to brightness conditions; 33 images demonstrated a midnight condition (low brightness), 34 images demonstrated an afternoon condition (medium brightness) and 33 images demonstrated a noon condition (high brightness). Streetlights were off in the medium and high brightness conditions, but turned on in the low brightness condition. No lights came from the residential buildings, hence the only brightness available for low brightness conditions were from the streetlight poles.

The buildings in each streetscape also varied when it came to roof type (two types) and level of surface decorations (three levels). The two roof types had the same height, so buildings with the same number of floors, but different roof types, still had the same overall height. Buildings in each image had the same roof type and level of surface decorations throughout the streetscape. The reason for including these two variables in the analysis was to increase the streetscape diversity, and hence hoping most participants would find at least some streetscapes familiar. The 100 images were divided equally into 10 folders, each containing 10 images. Each folder had a fairly good variation of stimuli.

Measures of Perceived Enclosure and Perceived Safety

Below every image, participants were asked to respond to the statement “I perceive this environment as...”, using 11-point scales (0 = *Very unsafe*, 10 = *Very safe*) to measure how unsafe or safe participants perceived the streetscapes presented, and (0 = *Open*, 10 = *Enclosed*)

to measure how open or enclosed participants perceived the streetscapes. This type of measurement, demonstrating images of environmental settings, followed by questions about perception of safety and/or enclosure, has been used before in several studies (Alkhresheh, 2007; Herzog & Chernick, 2000; Loewen et al., 1993; Stamps, 2005a).

Procedure

Participation was voluntary and participants were approached via personal email or the social networking website Facebook with a link to the online internet survey. Participants were able to participate via computer, smartphone, or tablet, but they were encouraged to do so via computer to get the best possible view of the images. They were informed that their participation was anonymous, that no personal or traceable information would be collected, and that the data would only be used for research purposes. They were also informed of their right to discontinue at any time. No rewards were granted for participation.

Before beginning their participation, participants were informed of the purpose of the study as well as instruction on how the survey would take place. Next they were asked to provide background information, such as their gender, year of birth, nationality, and postal code. The participants were then asked, when looking at the images, to imagine they were walking from work by themselves, appreciating having a chance to stroll on their way home.

Each participant received one folder of images, hence only judging 10 images. Which of the 10 folders they received was randomly chosen by the computer. Then, 10 images appeared in random order, one at a time, as well as the two scales measuring perceived safety and enclosure. When completed, the participants were asked how familiar they were with the environments demonstrated in the images (0 = *Completely unfamiliar*, 10 = *Completely familiar*).

Research Design and Data Analysis

In the current study, the streetscape images were the units of analysis, where different building height and brightness levels in each image reflected the environmental variability. The values for the two independent variables, building height and brightness level, were manipulated by the researcher, while the mediator, perceived enclosure, and the dependent variable, perceived safety, were measured with ratings from the participants. As participants were allowed to discontinue at any time, the ratings provided for each of the 100 images varied from 11-31. Mean scores of both scales for each image were used for further analysis.

The data was analyzed in the statistical software program, SPSS. Descriptive statistics were conducted for background variables (gender, year of birth, nationality, postal code, and familiarity). The main analytic focus was on measuring the direct effect of building height and brightness levels on perceived safety, and whether perceived enclosure mediated the effect of the two independent variables on perceived safety. For statistical analysis, a multiple linear regression and the logic of mediation test proposed by Baron and Kenny (1986) were used.

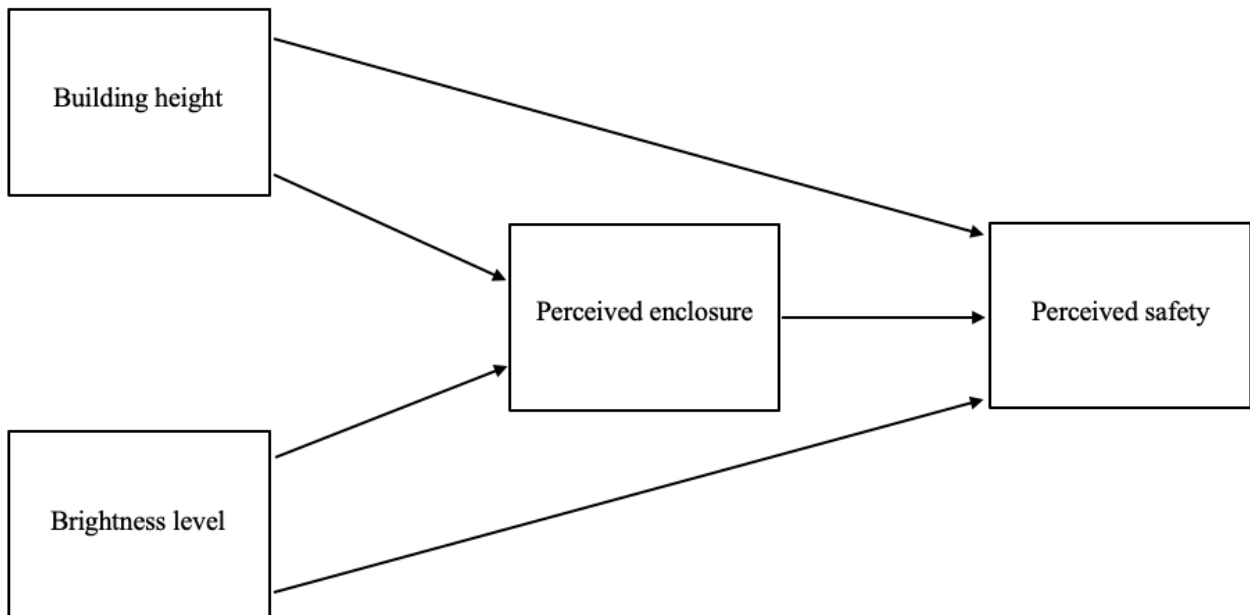
At the first step of the regression, building height and brightness level were entered with perceived safety as the dependent variable. Perceived enclosure was added to the regression in the second step. To determine whether perceived enclosure reduced the effect of building height and brightness levels on perceived safety, significant coefficients were examined. A third regression was then carried out, to examine whether building height and brightness levels affected perceived enclosure. This was done in line with conditions set by Baron and Kenny (1986). Assumptions of both the regression and the mediation test were tested and met.

Results

Descriptive Statistics and Bivariate Correlations

Figure 1

Mediation Model with Perceived Enclosure as the Mediator of Building Height's and Brightness Levels' Effect on Perceived Safety



The four variables examined in the study, and their hypothesized relationships, are summarized in Figure 1. Averages of judged scores of perceived safety and of perceived enclosure were gathered for each of the 100 images used in the analysis. Table 1 demonstrates descriptive statistics of the two variables. The mean judged scores for both perceived safety and perceived enclosure were close to the midpoint of the scale, indicating that the images used demonstrated a decent variety of unsafe, safe, open and enclosed streetscapes.

Table 1*Descriptive Statistics and Correlation Matrix for all Variables in the Analysis*

	<i>M</i>	<i>SD</i>	Min	Max	1	2	3	4
Perceived safety ^a	5.40	1.52	2.47	8.23	1.00			
Perceived enclosure ^b	4.90	1.24	2.03	7.41	-.81**	1.00		
Building height ^c	-	-	-	-	-.18*	.42**	1.00	
Brightness level ^c	-	-	-	-	.93**	-.70**	.00	1.00

^aRatings given on a 11-point scale (0 = *Very unsafe*, 10 = *Very safe*). ^bRatings given on a 11-point scale (0 = *Open*, 10 = *Enclosed*). ^cHigher values indicate higher levels.

* $p < .05$. ** $p < .001$.

Between building height and perceived safety, a weak, but still a significant, bivariate correlation was found. A moderate correlation was found between building height and perceived enclosure. The bivariate correlations between brightness levels and the two measured variables, perceived safety and perceived enclosure, were strong (see Table 1).

Streetscape images receiving the lowest, closest to average, and the highest score in perceived safety are shown in Figure 2 and in perceived enclosure in Figure 3. Interestingly, the same streetscape image received the lowest score in perceived safety and the highest score in perceived enclosure. However, the image that received the highest score in perceived safety and the image that received the lowest score in perceived enclosure, both demonstrated buildings with the same height and had same brightness level.

Figure 2

The Three Streetscapes With the Lowest (Left), the Average (Middle), and Highest (Right)

Ratings of Perceived Safety



Note. The image to the left includes buildings with three floors and the lowest level of brightness. The image in the middle includes buildings with one floor and the medium level of brightness. The image to the right includes building with one floor and the highest level of brightness.

Figure 3

The Three Streetscapes With the Lowest (Left), the Average (Middle), and Highest (Right)

Ratings of Perceived Enclosure



Note. The image to the left includes buildings with one floor and the highest level of brightness. The image in the middle includes buildings with two floors and the medium level of brightness. The image to the right includes building with three floors and the lowest level of brightness.

Hypotheses Testing

Results of the regression are shown in Table 2. Building height and brightness levels, entered at the first step of the analysis, accounted for 90.00% of explained variance in perceived safety. In line with Hypothesis 1, a significant direct negative relationship was found between building height and perceived safety, when adjusted for brightness. With adjustments for building height, a significant direct positive relationship was found between brightness levels and perceived safety, thus supporting Hypothesis 2. As indicated by the β value, brightness levels were more predictive than building height of how safety was perceived.

Table 2

Results of the Multiple Linear Regression Analysis with Perceived Enclosure Being Treated as a Mediator of Building Heights' and Brightness Levels' Effect on Perceived Safety for 100 Images

Variable	Step 1			Step 2		
	B	Std. E	β	B	Std. E	β
Building height	-0.33	.06	-.02**	-0.13	.07	-.07*
Brightness level	1.74	.06	.93**	1.42	.08	.74**
Perceived enclosure				-0.30	.06	-.25*
R^2	.90			.92		

Note. Both changes in R^2 are statistically significant.

* $p < .05$. ** $p < .001$.

When perceived enclosure was added to the model, the R^2 increased by 2.00%, indicating that the two independent variables, as well as the mediator, accounted for 92.00% of explained variance in perceived safety. The β values for both building height and brightness levels reduced,

but remained significant. This indicates that perceived enclosure only partially mediates the effect of the two variables on perceived safety. Therefore, the results are partially in line with Hypothesis 3 (see Table 2).

In line with conditions set by Baron and Kenny (1986), an additional regression was carried out, testing the effect of building height and brightness levels on perceived enclosure. Results of the regression indicated that building height had a significant positive effect on perceived enclosure ($\beta = .42$). For brightness levels, results indicated a significant negative effect on perceived enclosure ($\beta = -.70$). The two independent variables explained 66.40% of the variance in perceived enclosure.

Discussion

The main purpose of this study was to examine whether building height and different brightness levels affect people's perceived safety in urban streetscapes, as well as whether their perceived enclosure in the streetscapes mediates the effect of the two factors on their perceived safety. All three hypotheses were supported and are, in one way or another, in line with previous studies on the subject.

Supporting Hypothesis 1, results demonstrated that people perceived streetscapes with higher buildings as less safe than streetscapes with lower buildings. Few, if any, studies have investigated building height's direct effect on perceived safety, comparison to previous studies was thus limited. But previous studies have though shown that building height might have an indirect effect on perceived safety, through its' effect on perceived enclosure (Alkhresheh, 2007; Kahraman & Cubukcu, 2017; Lindal & Hertig, 2013; Stamps, 2005c).

Although perceived safety was found to be significantly affected by building height, results showed that it was more strongly affected by brightness levels. In line with Hypothesis 2,

people's perceived safety increased as brightness levels in the streetscapes increased. These findings are in line with previous studies, that unanimously have shown that people perceive environments safer when there is brightness than when there is darkness. Although previous studies have varied in whether the effect of natural or artificial lights is examined, all have come to the conclusion that general visibility, resulting from brightness in urban environments, contribute to people's perceived safety (Boyce, 2019; Painter, 1996; Park & Garcia, 2019; Rahm et al., 2021; Soyeon & Mikyoung, 2016).

The results also demonstrated that perceived enclosure partially mediated the effect of both building height and brightness on participants' perceived safety, hence supporting Hypothesis 3. That is, the effect of building height and brightness on perceived safety could somewhat be explained by the effect the two factors have on perceived enclosure, which consequently affects perceived safety. Previous studies have not explicitly examined whether perceived enclosure mediates these effects on perceived safety, but from previous studies it can be assumed that this mediation effect does in fact take place (Alkhresheh, 2007; Baran et al., 2018; Bokharaei & Nasar, 2016; Carmona et al., 2010; Herzog, 1992; Herzog & Chernick, 2000; Kahraman & Cubukcu, 2017; Lindal & Hertig, 2013; Lindh, 2012; Lindh et al., 2020; Loewen et al., 1993; Stamps, 2005a, 2005c, 2009).

The results of this study support conclusions of previous research, that factors in our urban environment can reduce or enhance how safety is perceived, and hence determine whether a public streetscape will be used or not (Kawachi & Berkman, 2003; Mehta, 2014; Migliorini et al., 2008).

Whether an individual lives in a city, small or large, or in the suburbs or exurbs, they are unavoidably surrounded by built environment (Goldhagen, 2019). In 2018, the United Nations

(2018) reported that approximately 55% of the world's population lives in cities, a number that is expected to increase to 68% by 2050. Urban areas need to be planned to accommodate this increase in population and to guarantee enough supply of housing. In time of great demand for housing, it is a challenge to create livable neighborhoods, and pleasant urban spaces in general, that do not come down on people's perception of the environment. Current emphasis in urban planning in Europe is to protect natural areas surrounding the cities and to curb urban sprawl. Hence, the main focus is on densification within current urban structure (Wolff et al., 2018).

The main goals of the municipal plan of Reykjavik for the planning period of 2010-2030, is in this fashion, with heavy emphasis on urban densification. This generally means a higher density of new residential neighborhoods and mixed used areas, with more continuous streetscapes and buildings up to six floors along relatively narrow streets (Reykjavíkurborg, 2014). The main findings of this study are highly relevant in respect to current planning practice in Reykjavik. Increased building height, as well as pedestrians' increased perception of enclosure, can come down on their perceived safety. This effect should therefore be acknowledged and taken into account when designing and planning new streetscapes and neighborhoods.

The virtual streets used in this study had fixed length and width, but previous research has shown that perceived enclosure is not only influenced by building height, as was measured in this study, but also by street width and length (Alkhresheh, 2007; Kahraman & Cubukcu, 2017; Lindal & Hertig, 2013; Stamps, 2005c). The results of this study indicated that a decrease in perceived safety was caused by an increase in building height. But it can be assumed that if the streets had been wider and longer, an increase in building height might have increased people's perceived safety rather than decreased it. This would be in comparison with previous studies on

the U-shaped relationship between perceived enclosure and safety (Alkhresheh, 2007; Carmona et al., 2010; Herzog, 1992). Although the results of this study demonstrated a negative relationship between building height and perceived safety, it should not be ignored that other factors are at play.

Brightness was shown to have the strongest relationship with people's perceived safety, but this study emphasized on comparing different settings of natural light (at noon, afternoon, and midnight). But as mentioned above, proper visibility in general, whether it is caused by natural or artificial lights, has an immense effect on people's perceived safety (Painter, 1996). If we consider the Nordic context, for example in Iceland, daylight hours are highly limited for most part of the year. Darker areas are perceived as less safe and different factors seem to be of concern when there is daylight. Pedestrians might hence be more dependent on outdoor lighting in the night, as it can increase their perceived safety during darker hours (Park & Garcia, 2019; Rahm et al., 2021). How different levels of brightness affects pedestrian's perceived safety, can be considered especially important in the Nordic countries. But judging from the results of the current study, as well as from previous ones, measures to promote pedestrian safety during darker hours, especially in more enclosed spaces, is of high relevance.

The current study had several limitation. First of all, the stimuli used were computer-generated images of virtual streetscapes, which might result in participants interpreting the environment differently than they might have if they were either situated in virtual reality or in actual streetscapes. Second of all, it should not be generalized that safety perception generally decreases as either building height or perceived enclosure increases, as it is known that other factors are also at play. The streetscapes demonstrated in this study ranged from what was expected, from previous studies, to be perceived as moderately enclosed to highly enclosed,

which most likely is the reason perceived safety decreased, rather than increased, as the two factors increased.

A third limitation is that the current study only examined the effect of natural light, and the streetlights demonstrated were not manipulated in any specific way. During darker hours, there usually is at least some amount of lights coming from residential buildings, but the images used had buildings that might be believed to be vacant, and that may have had its' effect on how safe participants judged the streetscapes. But the factors were mainly arranged in this way to isolate the effect natural light might have on the participants' experience of the streetscapes.

Strengths of the study were several as well. Environmental factors in urban streetscapes and their effect on pedestrians' perceived safety has not been examined in Iceland before. But knowledge on how different brightness levels can affect safety perception is highly relevant in Iceland, and Nordic countries in general, due to lack of natural daylight through the long winters. The fact that the results of this study showed that safety perception decreased when building height increased, sheds a light on a relationship that might not have been examined before, as little knowledge is on the specific topic in current literature.

In future studies, it might be interesting to measure people's perception of safety in streetscapes with more diverse stimuli's, for example ranging from more open areas (wider and longer streets) to more enclosed one's (more narrow and shorter streets, and higher buildings). It would also be interesting to see whether people perceive streetscapes differently when there are only residential spaces and when restaurants, stores or bars are on the ground floors. Whether pedestrians in the streets contribute to higher perception of safety than brightness does, is also an interesting topic worth examining. Perceived safety seems to be affected by multiple factors in

the environment, further research is hence needed, as not all factors or interplay of factors are fully known.

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