A second look: Improving safety perceptions of urban alleys

by

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A REPORT

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Abstract

In the U.S., urban alleys often serve as rear access and service roads, but have been neglected as public spaces. The enclosed space of urban alleys attracts crime and other unwanted activity from the streets where it is less conspicuous. Many people perceive alleys as dangerous spaces or merely for parking vehicles outside of the adjacent buildings. This study looks at alleys as usable public space by mitigating people's safety perception. The study purposes are: To identify physical elements within urban alleys that are most associated with perceptions of safety; to examine the alteration of physical elements related to safety perception; and, to propose a design framework that can be applied to practices found in this study to improve the human perception of alleys. In this study, twenty-four subjects participated in a survey using virtual reality environments that consist of eleven physical element variables selected from the literature review. The two elements that had the most negative perceptions was the presence of trash and unmaintained pavement, while one of the most positive perceptions was through the introduction of vegetation. Lighting and increased surveillance were also among the elements that improved perceptions of safety. Based on the results, a design framework was created for transforming alleys into viable and usable public space for more economic and social activity.

Improving Safety Perceptions of Urban Alleys

A Virutal Reality Experiment

Marcos Aleman

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Acknowledgements

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Introduction

1.1 Dilemma and Background

Historically, alleys have been a part of the cultural fabric and infrastructure of cities, providing access to buildings and providing outdoor space for day-to-day activity (Beasley 1996). There is a long history of communities and activities that have settled within the compact urban environment of back alleys (Martin 2000; Martin 2002a; Williams 2015). Through a troubled and diverse history, alleys have become an environment surrounded by fear, crime, misuse, and general neglect within the last century (Liu 2016; Martin 2002b; Wang and Taylor 2006). There are various social factors (Beasley 1996; Borchert 1974), spatial factors (Herzog and Flynn-Smith 2001; Newman 1995), and individual factors (Altman 1975; Kaplan and Kaplan 1989; Nasar and Jones 1997) that affect perceptions of urban spaces including urban alleys. For many citizens nowadays in the U.S., whether they are living adjacent to alleys or walking by alleys, they mostly perceive them as dangerous places where crime often occurs (Liu 2016; Seymour et al. 2010; Wang and Taylor 2006). Perhaps, just as important as the actual occurrence of crimes, physical elements of the alley environment also have a significant effect on the perceptions of pedestrians (Wang and Taylor 2006). Physical elements, such as enclosure, lighting, and mystery, can cause various perceptions (either good or bad depending on individually formed attitudes) and behavior (more specifically, avoidance behavior) in alley and street environments (Herzog and Flynn-Smith 2001; Herzog and Miller 1998). The combinations of these physical element factors determine whether a pedestrian can anticipate danger or safety in most environments (Nasar and Jones 1997).

In 2018, the United Nations reported that urban populations are rapidly increasing, with 55 percent of the world's population living in cities. This number is expected to increase to 68 percent by 2050 (United Nations Department of Economic and Social Affairs, 2018). With more people migrating back to urban cities, there is a greater need for more efficient use of street space and public space. Despite many negative perceptions, urban alleys have potential to promote safe spaces for social and functional use within the urban and suburban context which many densely populated areas need (Gehl 1987, Liu 2016, Roncek 1981). While alleys serve as public space and building access, they also have a widely unused potential as public walking corridors and other public space. Cities in America, such as Chicago and Seattle, have worked towards better use of alleys. Many countries have been utilizing their alleys as effective space for hundreds of years. One of the major barriers of using alleys as more effective public space is the overwhelmingly negative perception of alleys by residents and developers (Martin 2000). Therefore, this research explores how, and what, physical elements of the alley affects citizens' perception of safety within a typical urban alley environment.

1.2 Definition and Scope

To begin with, it is important to identify the definition of an urban alley in this study, the extent of its uses, and its physical limitations relative to its connection with the rest of the urban street system. Cities typically define alleys through a municipal code of ordinances. For the purposes of this study, this study uses the city ordinance definition of an alley used by Kansas City, Missouri:

> Alley (Code of Ordinances of the city of Kansas City, Missouri, Chapter 88, Section 88-810-060):
>
> A public right-of-way that affords a secondary means of access to abutting property.

It is also important to understand the limitations of alley spaces as space for activity. Clearly, alleys in American cities are often not meant to hold much more activity than maintenance or as rear access and service roads. So how does that limit what activities can be plausibly held within alleys? Regarding city codes and legal activities, there are realistically few limitations of alley spaces. The code of ordinances for Kansas City, MO only limit activity in the alley in regards to leaving space, typically at least 10 feet across, for access through the alley and to any abutting property (Secion 70-529. Parking in Alleys). Most alleys will also need to retain their infrastructure and services such as powerlines,

trash collection, and utilities. Alleys also need to act as infrastructure to direct stormwater away from adjacent buildings. Most cities have a typical alley drainage detail. For this study, the typical alley for Kansas City (see Appendix A) will be used as a reference as a requirement for design decisions later in this study.

For further definition, we will also look to Martin (2002b)'s definition of an alley. Martin has observed alley spaces in neighborhoods in multiple studies by defining an alley as a narrow passage between or behind buildings that may have multiple functions (Martin 2002b; Williams 2015), specifically defined as: (a) An alley accommodates service vehicles such as garbage trucks and the storage of resident vehicles and (b) An alley typically does not function as a true street, but rather is used as the back-side access for buildings that also have a front access point.

An alley is primarily used for its service access capabilities but is not limited to only utilitarian needs. Alleys began a prominent role as residential space and as transportation infrastructure out of sight of the streetscape (Williams 2015). While buildings in urban alleys were widely used to house poor working-class citizens, they were also used privately as facilities such as stables and garages for the wealthy. During the late 19th and early 20th centuries, alley buildings were a controversial topic. Many health and social reformers wanted to replace alleys with more functional space, while others wanted to preserve the historic context that contribute to city social life (Williams 2015).

Although the alley is defined by its service to surrounding buildings and to the infrastructure of the city, it can be transformed into other space because of its versatile uses from surrounding people and buildings.

1.2.1 Alley Typologies

Considering a potential versatile use of alleys, it is necessary to establish a typology of physical form and activity of urban alleys. The alley typology used in this study is divided into three categories: dimension, density, and activity. Specifically, this study focuses the alteration of alley width (narrow vs. wide); for density, building height (taller vs. lower); and activity types (commercial, residential, etc.).

1. Dimension

Narrow Alley Space: Narrow Alleys (10-15 ft.) have limited uses. They can only accommodate one lane of vehicle traffic at once, meaning it is used primarily only by maintenance vehicles and serves as pedestrian access behind and into buildings (Fialko and Hampton 2011).

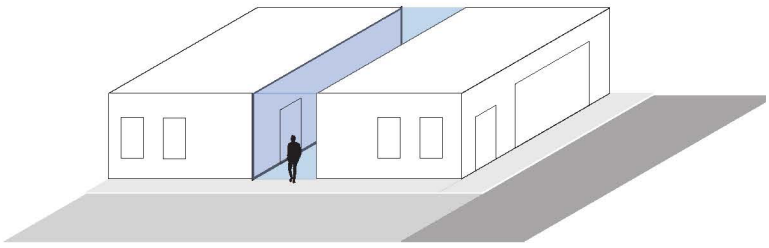


Figure 1.1 Narrow Alley

Wide Alley Space Wide Alleys (16-25+ ft.) can inherently have a wider range of uses. They can be found in industrial, commercial, or residential areas. Wide alleys are used mostly for heavier vehicle traffic and parking, typically with one or two lanes of parking on either side. Wider alleys can also accommodate for loading bays for adjacent buildings (Fialko and Hampton 2011).

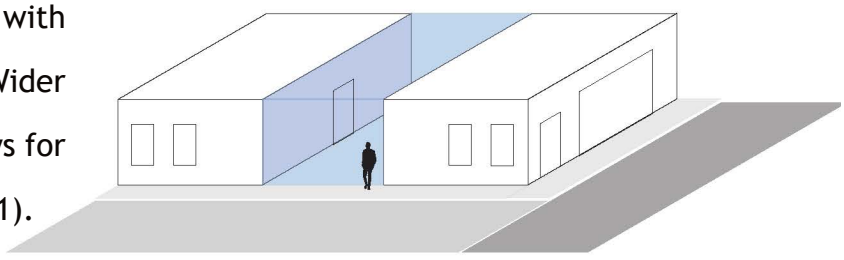


Figure 1.2 Wide Alley

2. Density

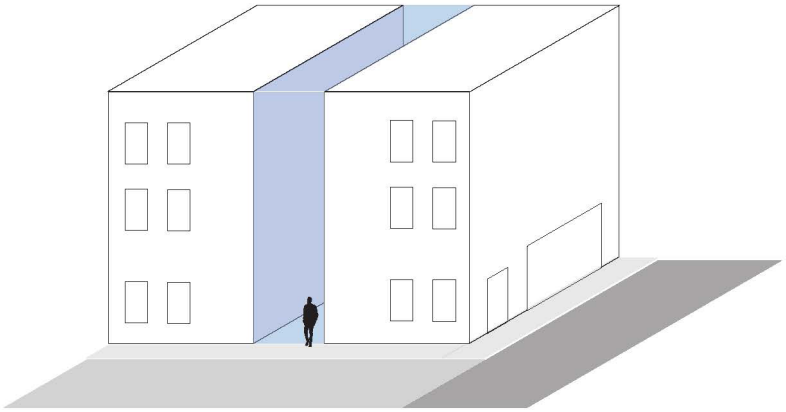


Figure 1.3 Alley surrounded by high density buildings

High Density Space: Larger surrounding buildings usually have a wide range of activities, from offices to restaurants, apartments, parking lots and retail. Alleys in this context are important for providing access (both pedestrian and vehicular) to the large buildings that surround them (Fialko and Hampton 2011).

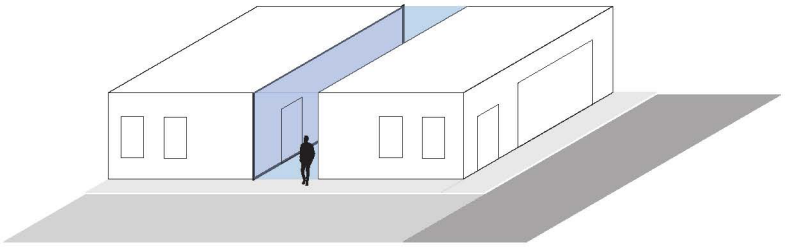


Figure 1.4 Alley surrounded by low density buildings

Low Density Space: Low density alleys typically provide access to buildings with activities such as offices, residents, retail, and parking lots. These alleys have more lighting due to the lower buildings. Both pedestrian and vehicle access are common in these alleys (Fialko and Hampton 2011).

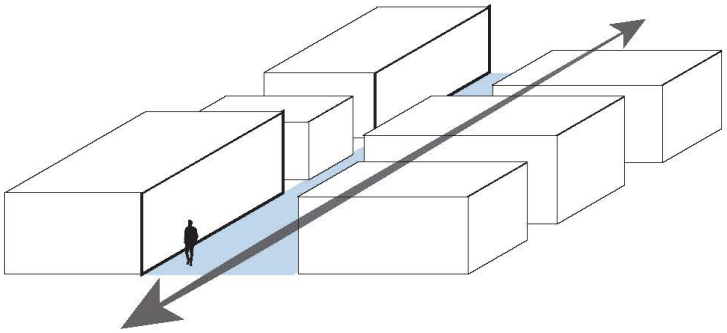


Figure 1.5 Alley surrounded by single family residential buildings

3. Activity

Single Family Residential: Alleys in these neighborhoods typically separate back yards of houses but often serve as the main access point for residents. These spaces often create open space for vegetation and some wildlife (Fialko and Hampton 2011).

Multi-Family Residential: These alleys service large buildings that house large amounts of people. These spaces are more likely to become semi-private spaces for the communities in these buildings. Pedestrian access might be more prominent but there may also be large parking lots/garages adjacent to these complexes (Fialko and Hampton 2011).

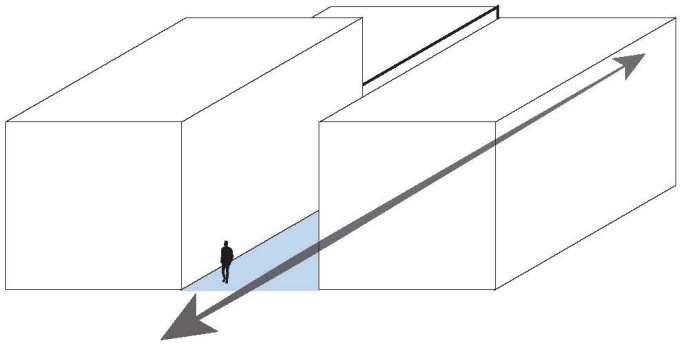


Figure 1.6 Alley surrounded by multi-family residential buildings

Nightlife Districts: These alleys provide access that are typically used later in the evening and at night. Buildings like bars, clubs, and restaurants may have a high rate of pedestrians at night and these alleys can bring more space that allows businesses to expand (Fialko and Hampton 2011).

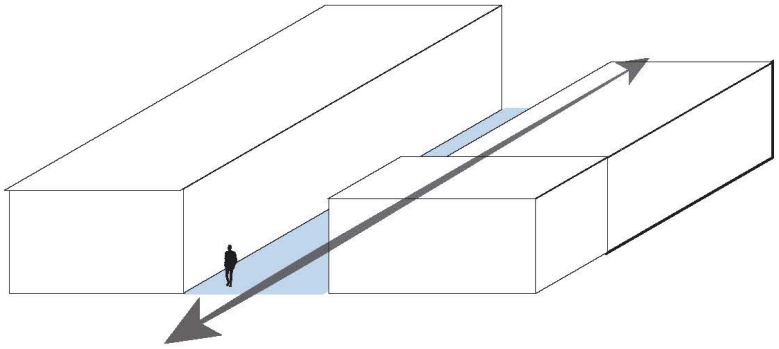


Figure 1.7 Alley surrounded by buildings with nightlife activity

Commercial Disricts: Alleys in commercial areas mostly provide more space for retail and other businesses. They may be wider to accommodate deliveries and loading docks. Pedestrian access is not prominent, but can be promoted as a means to easily access shopping and grocery amenities (Fialko and Hampton 2011).

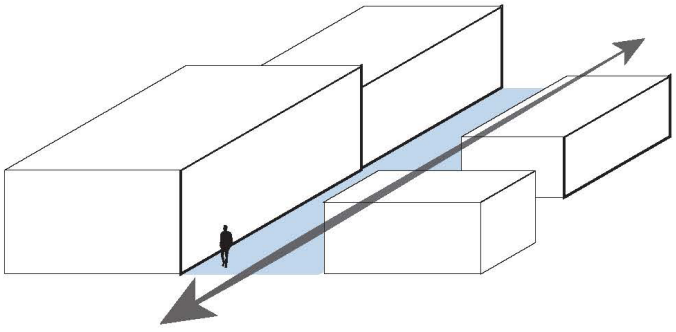


Figure 1.8 Alley surrounded by commercial buildings

1.2.2 Research Question

After establishing the historical background, definition, and the issues of activity surrounding the alleys, a question can be generated to examine the relationship between the alleys and the perception of urban alley environments. This study is meant to answer the primary question: *What physical elements in an urban alley affect human perception of safety?* To explore the primary question, another research question needs to be further explored: *How does the alteration of physical elements in an urban alley enhance its social and functional use?* Figure 1.9 describes the study design to answer these two research questions, depicting the idea that altering these spaces through a design process will lead to improved functions and well-being. To answer the first question, this study also explores the use of virtual reality in studying the perceptions of environments and human behavior. For the second question, this study explores data driven design interventions that can lead to improved functions and well-being of urban alleys (Figure 1.9) This ties into the primary question in means that will be discussed in detail later in this report.

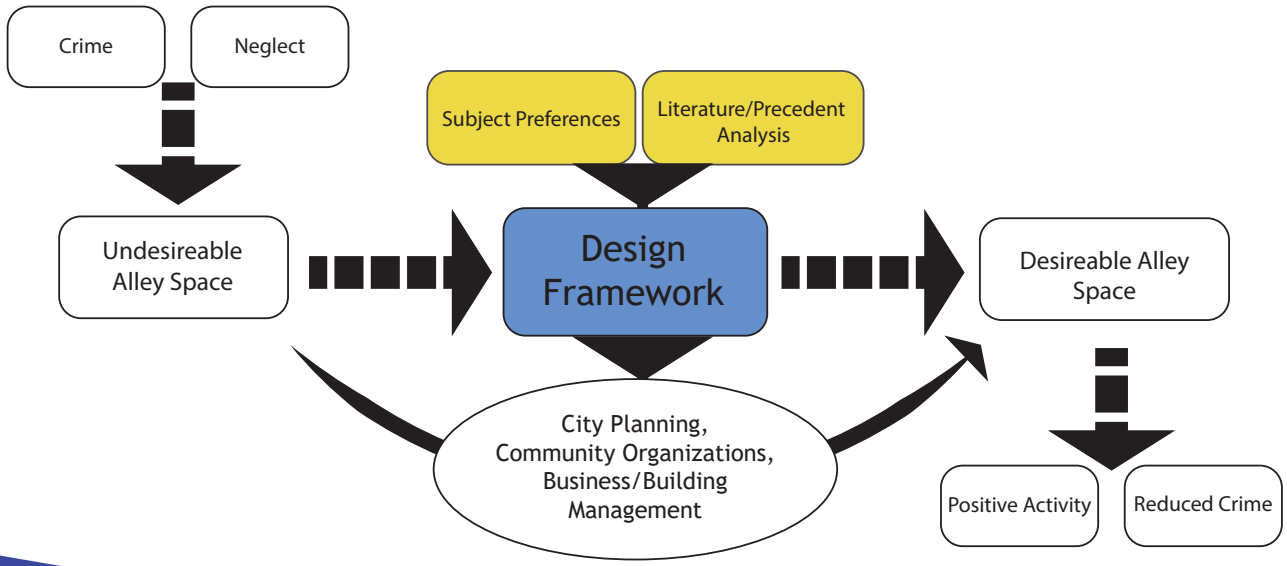
This study has three research objectives to investigate as below:

Research Objectives

- Identify key physical elements in an urban alley that contribute to safety.
- Examine the effects of physical interventions on safety perception and attitude in an urban alley.
- Create a design framework to inform developers, community organizations, and designers as to which physical elements will improve or impair perceptions of an urban alley.

Understanding the effect of certain design elements and physical design will generate a better design process for further studies and practices. Figure 1.9 show how this study and the resulting design framework will contribute to the design of more active urban alley space.

Figure 1.9 Study Concept. This shows how this study and resulting design framework will be used to improve urban alleys.



1.2.3 Significance

Alleys make up a significant portion of outdoor space in many cities. Because of heavy vehicle traffic in cities and urban neighborhoods, there is a need for more usable public space for activity and where people can interact (Gehl 1987). Space such as courtyards, parks, and riverfronts are home to many prominent designed spaces in cities. Pop-up parks are also taking advantage of empty lots to create more community spaces. Despite all these efforts to further engage a growing community and utilizing space, the alleys are left largely untouched due to the negative connotations that have resided in them for years. Walkability is becoming a much more prominent factor in design. Given their historical use of pedestrian access, urban alleys could contribute significantly by providing these walkable and safe spaces that cities are looking for.

One of the main reasons why alleys are underutilized is because they are perceived as unsafe spaces. Crime occurring in these urban alleys, compounded with the fear of crime in these spaces, is a leading source of stress in urban communities (Blöbaum & Hunecke 2005; Nasar & Jones 1997; Roncek 1981). Even without a definite sign of crime occurring in an alley, people feel unsafe because the negative connotations we often receive from media about alleys. Overall, redefining the role of alleys in the American street system is an opportunity to address crime rates and fear in urban communities.

For example, large cities, such as Los Angeles and Chicago, are home to several thousand linear miles of alleyways. While many people see these spaces strictly for maintenance use and utility, it creates a large amount of space that is not used during most of the day. Along with walkability, cities are starting to incorporate various uses for streets and urban areas that utilize a space during all times of the day. During the day, streets may be open to shops and pedestrians while in the evening it becomes filled with nightlife activity. Early mornings when there is no one using the space is when services like trash and cleaning can occur. While many urban alleys are utilized heavily by communities and businesses, there are many others that are filled with crime or are not used at all.

Literature Review

2

2.1 Literature Overview

The literature review begins with a look into the background of urban alleys, how they were used, and why they have become more synonymous with danger and crime in cities. Understanding the history of alleys and why they are in their current state of general neglect helps analyze urban use of outdoor space and what people look for in usable space. This review also looks at studies that focus on safety based on physical elements of all kinds. Since one of the goals of this study is to determine which physical elements are most related to safety perceptions, this study uses literature to identify some of the most common and important physical elements to use regarding safety perceptions (See figure 2.1). Some studies are also used to determine methods that have been used to effectively determine visual preferences and perceptions of physical environments.

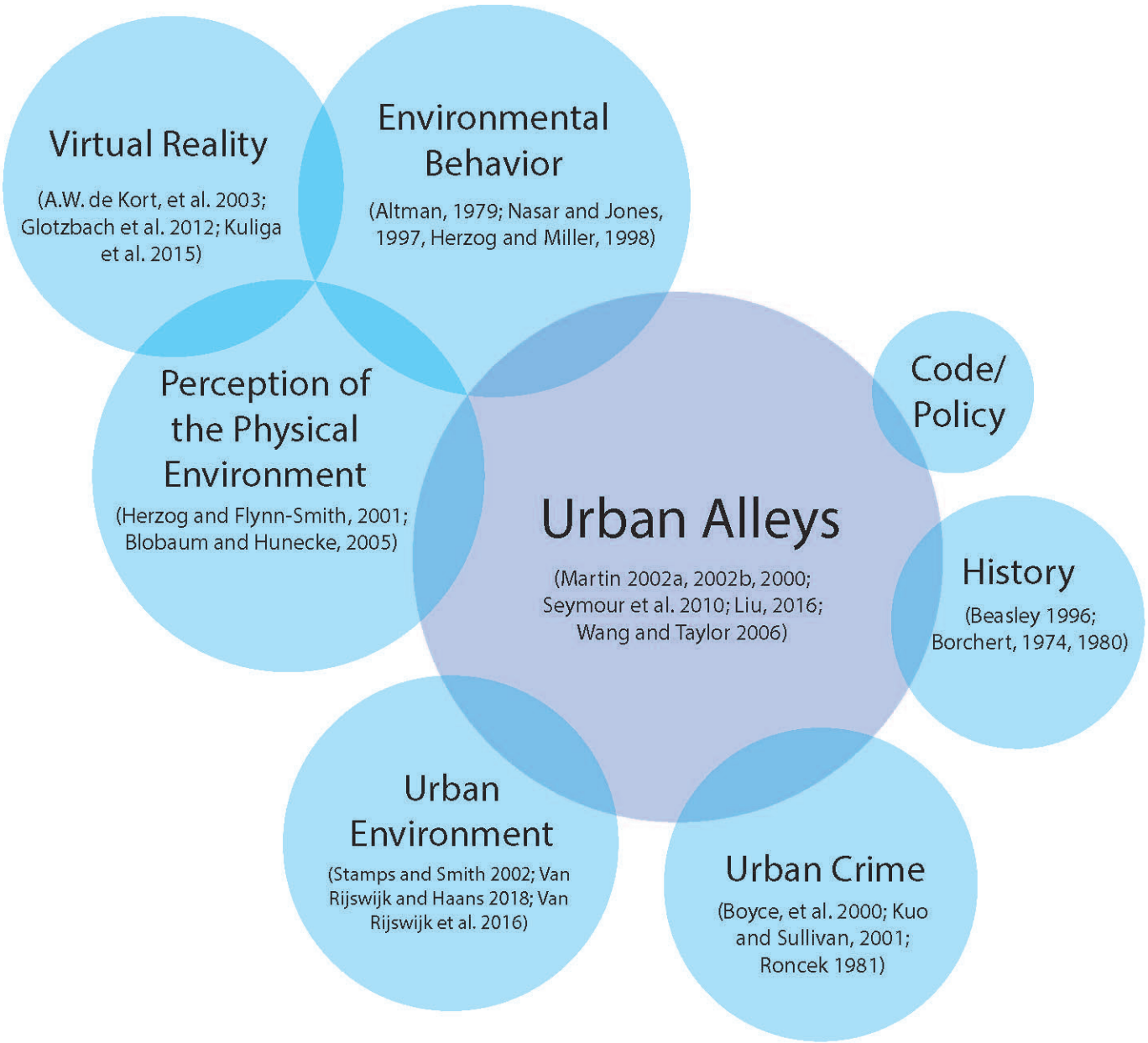


Figure 2.1 Literature Review Concept diagram. A diagram of different literature topics and their connections to urban alleys.

2.2 Urban Alleys

For years we have all heard the negative connotations of walking in alleys. Any story or article starting with “in a dark alley”, we know it will be a story of some heinous crime or worse. How did this become the norm for this small pathway that some people and cultures use every day? For this, we look at what an alley is, what its role has been in our cities, and what it has become in the last few decades.

2.2.1 Historic Use of Alleys

Alleys are defined as a narrow passage between two or more abutting buildings. So long as there have been cities and street systems, alleys have been a means of transport and access into buildings. Since the creation of cities and the urban environment, alleys have been a part of the cultural fabric and infrastructure of cities, providing access to buildings and providing outdoor space for day-to-day activity (Beasley 1996). Alleys have been used as secondary routes in cities dating back to 400 B.C. and served a supportive role as low-income residents and part of the street system (Williams 2015). There is a long history of communities and activities that have settled within the compact urban environment of back alleys (Martin 2000; Martin 2002a; Williams 2015). James Borchert’s study of photographs and documents in his article “Alley Life in Washington: An Analysis of 600 Photographs (1974)” reveals that alley housing spawned because of the inadequate transportation and the failure of cities to appropriately expand the population.

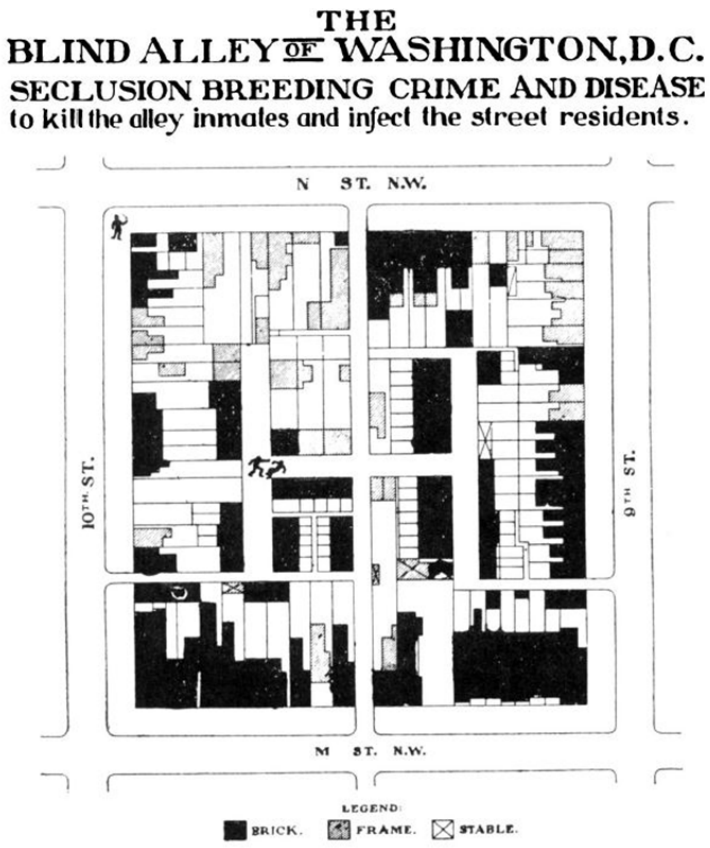


Figure 2.2 Map of Alleys in Washington D.C. Poster depicting the cultural and racial connotations behind alley use and how fear of crime is introduced to the public (Borchert 1974).

Many alley neighborhoods consisted of minority groups and consisted of housing of low quality (Beasley 1996). Borchert (1974, 1980) analyzes building records from the late 19th century and early 20th century. Early in the development of more modern cities, alleys were often used as semi-private space developed by the owners for the buildings that fronted the adjacent street (Beasley, 1996; Borchert, 1980). After Congress approved legislation to stop further residential building in alleys in 1892, the alley saw a rapid decline in its varied uses and began to transition into what we think of alleys today. A cycle of poor maintenance and upkeep occurred as residents did not have the ability to maintain their dwellings and environment, and the building owners left many of these neighborhoods alone to deteriorate. In the bigger cities, this is how many alleys were treated, and thus were perceived poorly by the rest of society (See Figure 2.2). But while the livability wasn't satisfactory, it was still considered a sociable space by many.

2.2.2 Alleys in Contemporary Urbanism

The relationship between the environment and community interaction is becoming a more prominent topic. The street life in residential neighborhoods has changed overtime due to privatization and the reliance on vehicles. This often creates a lack of cohesiveness and diminishes social interactions within the community (Lund 2003). Martin (2000) looks at alleys as a deteriorating landscape that is being overcome by vehicle use (Figure 2.3). New Urbanism has been reforming the neighborhood systems in recent decades to improve social life in cities. The goal of many of these movements is to address the issues of suburban sprawl and to accommodate space for more sociability. Many New Urbanists solutions include increasing social interactions by creating amenities near urban neighborhoods (Hess, 2008; Lund 2003). Since alley spaces are perceived as more dangerous and unwanted public space, New Urbanism principles of walkability and sociability could be applied to assist in revitalizing alleys as the connecting corridors of the city.

Paul Hess (2008) observes how neighbors interact and use their front (facing the street) yard and their back (facing the alley) yard. Many people reported using their back yards more and had more social interaction with people walking through the alley, whereas the front yard was used ornamentally and was often devoid of constant interaction. The parking restrictions (limited to the residents adjacent to the alleys), local retail opportunities, and the auto-

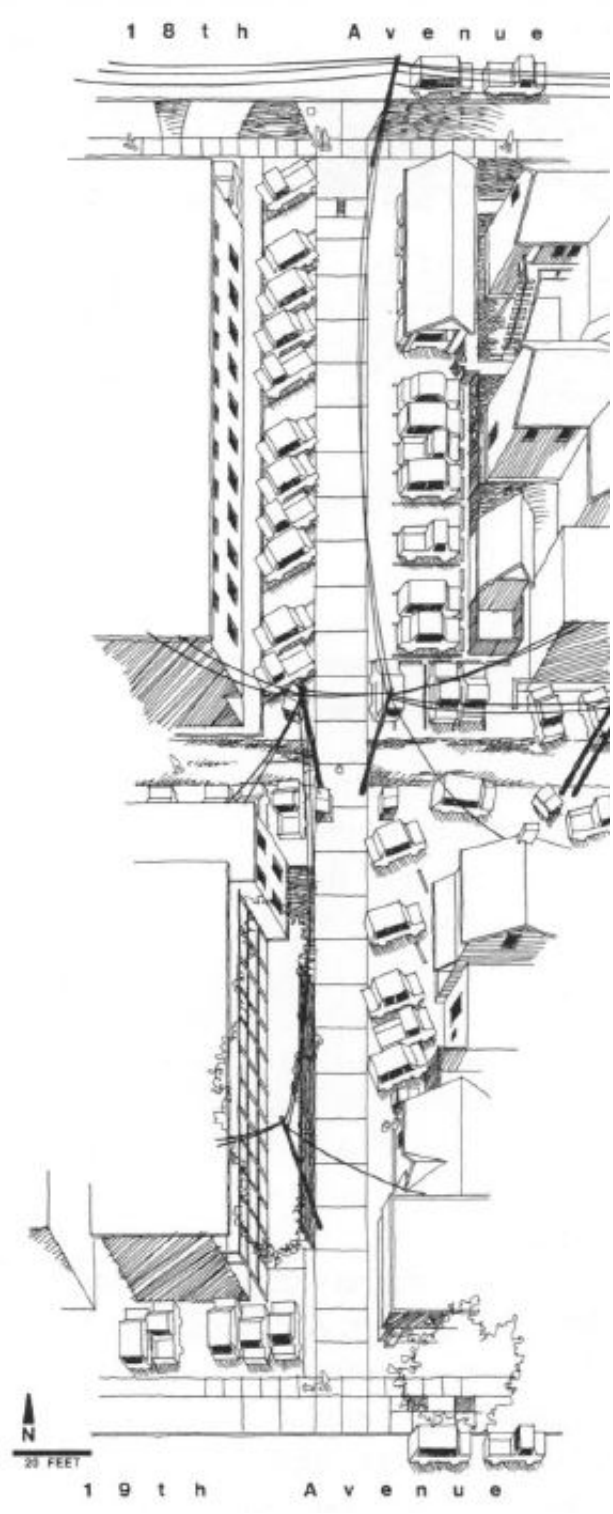


Figure 2.3 Alley sketch. A bird's eye view depiction of an alley dominated by vehicle use. (Sketch by Martin 2000)

dependence of the region are all influencing factors on the behavior around the house (Hess 2008). While there are still some social issues, this new urbanism approach is more of a response to the post World War II neighborhood development such as suburban sprawl and the dominance of vehicles. Alleys create a secondary shared space that supports the infrastructure of the street, but also support the walkability and sociability of neighbors (Hess 2008). Many residents see their alley space as a "social hub" that they can socialize and perform recreational activities even if the alley is perceived as ugly or unsightly (Hess 2008). This connects to many resident perceptions of alleys such as residents in Galveston (Beasley 1996) who, despite having dirt alleys that are often overgrown or are "unsightly", still see the space as an opportunity for recreation and sociability.

2.2.3 Walkability in Alleys

For years, many communities in America have been dominated by vehicle use. New Urbanists seek to counter this in urban and suburban neighborhoods by increasing the walkability of neighborhoods. Walkability refers to the ability of residents to have walking access to any amenity they may need (groceries, work, etc.). Improvements to walkability are typically done through more thoughtful street design to incorporate improved walking conditions and safety measures for pedestrians in high traffic areas. Cities like Portland that have smaller block sizes inherently promote a higher priority to pedestrian and other modes of traffic rather than private vehicle use. Hassen and Kaufman (2016) compile a literature review to determine the most important factors to increasing community engagement through street design. Their study shows that walkability is one of the biggest factors that contribute to social engagement, along with aesthetics and safety. Walkability is coming to the forefront of urban planning and design to reconnect communities and counter widespread issues like suburban sprawl and vehicle dominance in cities.

Urban alleys used to be a prominent part of getting around the city. Many residents use them as access to their homes and for other social activities. Alleys have also been overcome by vehicle dominance, making them less walkable

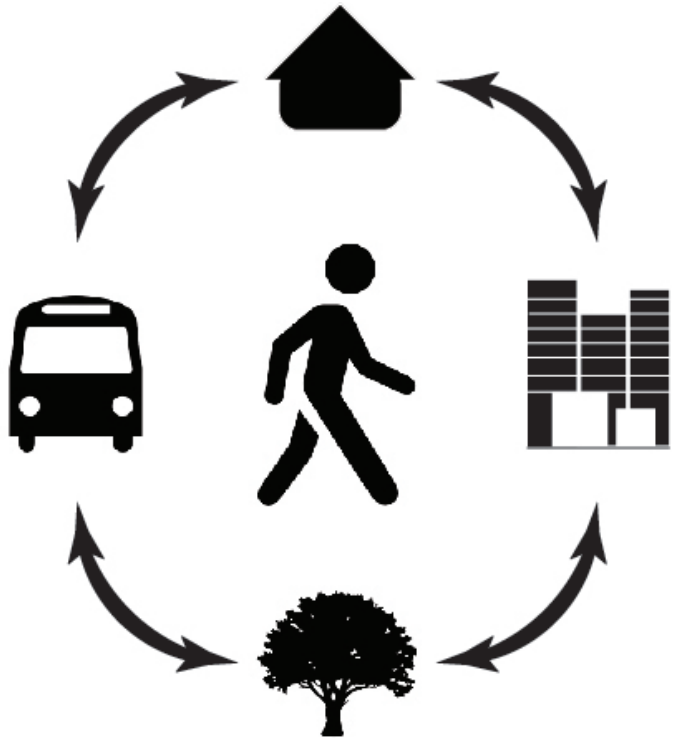


Figure 2.4 Walkability diagram. Visual representation of accessibility to home, work, and amenities through walking.

and safe. While New Urbanism focuses more on safety in a transportation view, applying these principles in urban alleys would consider safety more than social interaction, although safety can be a precedent for increased social interaction. A study by Sullivan et al (2015) notes that social capital is increased by more walkable spaces in urban areas like streetscapes. Not only will improving urban alleys generate social connections and potentially lower crime rates, it will also create a safer relationship between pedestrians and vehicles by establishing a clearer role of walkable space in urban areas.

2.4 Culture in Alleys

Alleys have been part of urban street systems around the world for centuries. American cities have become dominated by neglect and vehicle use, but this is not the same for alleys across the world. Other cultures and cities have many ways of utilizing alleys and similar pathways between buildings. Whereas American alleyways are considered more for infrastructure, alleyways in Asian and European cultures can be more dynamic and organic. On the other hand, alleys in some cultures are just as prone to being redeveloped and losing their sense of cultural attachment and history. In many respects, alleys are a product of the needs of the city and are often observed as space that serves a dynamic role of fulfilling the needs of the community.

Alleys in European cities are much more organically-structured than in the more extensively planned American cities. Alleys form over centuries of organic growth of the city and appear as needed to provide access and

Fig. 2.5. Alley in Italy. A narrow passageway between the buildings of Orvieto, Italy. (photo by Author)

passage between buildings (Figure 2.5). This also comes from centuries of cities being rebuilt, re-planned, and reorganized, compared to American cities that have a more definite shape and follow a strict organization.

Alleyways in Japan are small pathways known as “roji” and are part of the cultural and social identity of Japanese cities. The roji is typically a narrow and winding alleyway that was historically formed behind streets as a semi-private space (Figure 2.6). Modernization of cities is also taking a toll on alleys in Japan. The small, culturally rich alleyways and the neighborhoods they are in are being redeveloped into large scale office and residential complexes (Imai 2013). Heide Imai (2008) reviews how people interact on Japanese streets and alleyways, describing how street vendors especially contribute to social interaction and activity in public spaces.

Fig. 2.6. Alley in Japan. Photo of a Japanese ‘roji’ Alley by Imai, Heide (2013)

2.5 Precedent Programs for Urban Alleys

Alleys have been receiving some attention as newfound space for better urban environments in both America and many other countries across the world. There have been numerous claims against the use of alleys as anything other than space to accommodate garbage trucks and necessary back entrances to buildings (Martin 2000). Despite this, some cities have already begun to investigate their alleys as space they can use. Cities such as Chicago and Los Angeles are beginning to use their alleys for more ecological uses. Joshua Newell created a study in 2013, listing all alley programs in the United States. The purpose of these programs ranges in focus from ecological to social benefits. Chicago's Green Alley Program is one of the oldest programs, beginning in 2006 with a focus in stormwater management, urban heat island mitigation, and energy conservation (Newell et al. 2013). This program is one-dimensional, focusing mainly on the infrastructure of alleys and environmental impacts rather than the social impacts. Many other cities have followed this example, with Los Angeles, Baltimore, Seattle, and Washington D.C. all creating their own programs within a few years (2007-2011) with varying goals and methods. Chicago is by far the most effective, having replaced over 100 alleys with vegetation, new pavement, and recycled materials. Seattle has developed a guidebook to providing better uses of alleys by using a typology of uses depending on size, activity, and context within each space (Fialko and Hampton 2011).

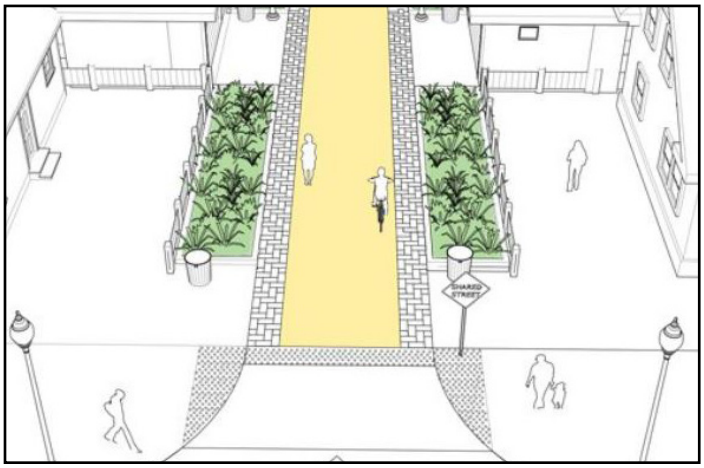


Figure 2.7. Green Alley Design Concept. This design promotes permeable paving and bioswales while improving pedestrian access (National Association of City Transportation Officials 2014) .

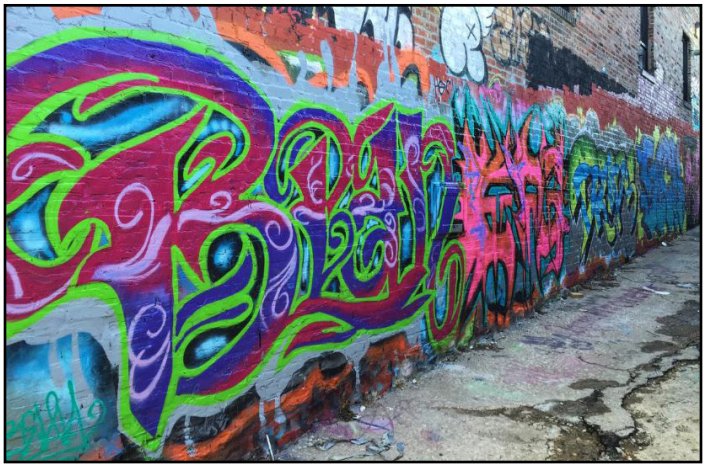


Figure 2.8. Art Alley in Kansas City, Missouri. An alley that showcases local graffiti artists as part of the city's unique identity. (Photo by Brent Anderson)

Figure 2.9. Los Angeles Green Alley installation. This alley promotes walkability and the use of vegetation in neighborhoods. (The Trust for Public Land)

Figure 2.10. Post Alley in Seattle Washington. Post Alley is a popular place for shopping and pedestrian activity. (Photo by Ian Brooke 2015)

The City of Los Angeles has over 12,000 individual alleyways of varying contexts and uses, which constitute a combined total of 914 linear miles of land, or 3.14 square miles of land (Seymour et al. 2008) (See Figure 2.11). Their Green Alley Program (2008) includes green practices and storm water maintenance practices while also trying to promote stronger social connections. Local universities and residents work together with the city to maintain and develop the program. While Los Angeles does not have as many completed projects through this program (as of Newell et al. analysis in 2013), it has one of the largest potential areas for alley improvement.

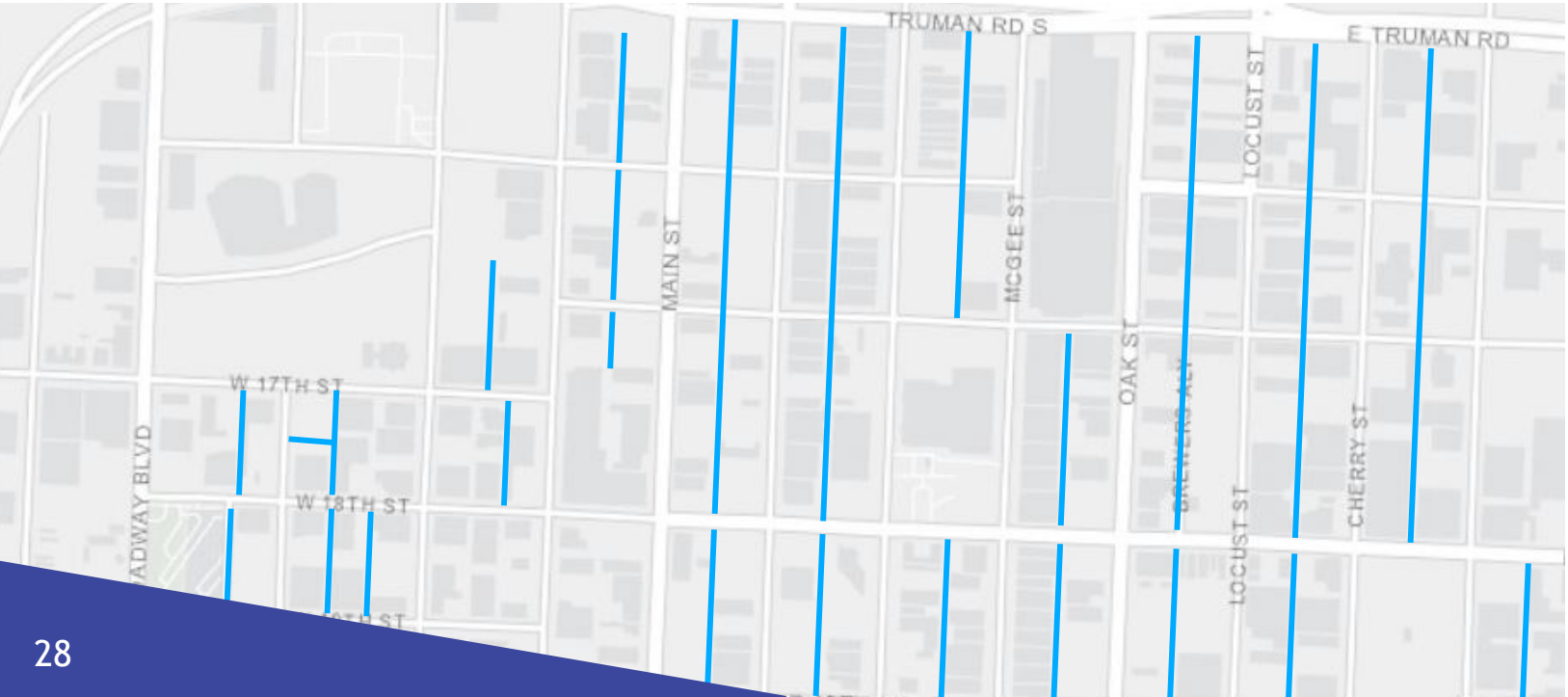
Figure 2.11 Alley Map - Los Angeles. A map of alley ways in Los Angeles, California (lacity.org)

The city of Chicago holds over 1900 linear miles of alleyways (5.3 square miles) (See Figure 2.12). For over a decade, Chicago has implemented its own Green Alley Program, which promotes permeable pavement, recycled materials, and other environmentally friendly practices in alleys. Chicago's program has the widest application, having replaced over 100 alleys with vegetation, new pavement, and recycled materials. These alleys are also dedicated to energy reduction by using energy efficient lighting and minimizing light pollution (Green Alley Handbook 2010). The goal of these alleys is to improve water management in Chicago while also inspiring residents to promote green practices such as green roofs, energy efficiency, and a reduction to pollution.

Figure 2.12 Alley map - Chicago. A map of alley ways in Chicago, Illinois (interactive.wbez.org)

As many other cities are looking at their alleys with more purpose, owners and residents in Kansas City are already rediscovering their alleys. Kansas City has approximately 1,200 alleys that add millions of square feet to the open spaces of the city (KCMO parcel viewer 2019) (See Figure 2.13). Within the last few years, many art projects, shops, and redesigns have come to dozens of alleys in Kansas City. A narrow alley between 10th and 11th street, now called “The Commons” was reworked by the Art in The Loop Foundation to help bring a visual identity to the city. The alley provides small seating elements at the mouth of the alley entrance and art installations on the abutting building walls. These elements give a sense that the space should be occupied much like a park or a walkway.

Figure 2.13. Alley Map - Kansas City. Map of alleys in Kansas City, Missouri (KCMO Parcel Viewer 2019)



2.6 Measuring Psychological Safety

One of the largest influences on safety is the psychology behind perceiving the surrounding environment. This mostly bases from the five senses, but generally focused on visual stimuli, which is what this study primarily looks at. Environmental behavior mostly stems from survival abilities and the identification of danger (or potential danger). Brian Goodey conducts an overarching study in his book *Perception of the Environment* (1971) to break down the basics of human perceptions and danger. Man perceives its environment and arranges its components into frameworks that exist or are acceptable to the individual (Goodey 1971). Behavior is determined by social, political, and economic factors, but is based on available information when regarding the environment itself (Goodey 1971). Our actions are also based on attentional hierarchy, meaning humans are more concerned with smaller more intimate relations with our environment and tend to be less considerate of larger factors and "far places" that might influence our perceptions. Therefore, alleys are perceived not only through general perceptions that are accepted by the general masses, but are largely influenced by the personal interaction or initial perception of the environment. These perceptions can be divided into two categories: social and physical elements.

Social elements can be thought of through the idea of territoriality and personal space. Altman (1975) explores how people use the environment through

social interaction, while focusing on the concepts of privacy, personal space, territoriality, and crowding. Altman describes personal space and territory as two of the main elements of social interaction (See Figure 2.14), the boundary of which varies from location to location. If these boundaries are intruded upon, an individual may experience mental stress and other negative emotions. According to Altman there are three main areas of territory: public, social, and personal space. Public space is where most interactions with the world happen. The social space is smaller and is where closer relationships occur. Personal space is the most private. People begin to feel more uncomfortable in crowded situations. Roncek (1981) reinforces this in his study, stating that buildings with a high density of residents tend to have higher crime rates and poorer health. The unique perception of alleys (at least by the residents) is that the alley is used as both a private and a social space and blur the lines of territorial boundaries (Martin 2002a). On the other hand, those outside of the neighborhood see alleys as unfamiliar, and a space of potential danger (Herzog et al 1982).

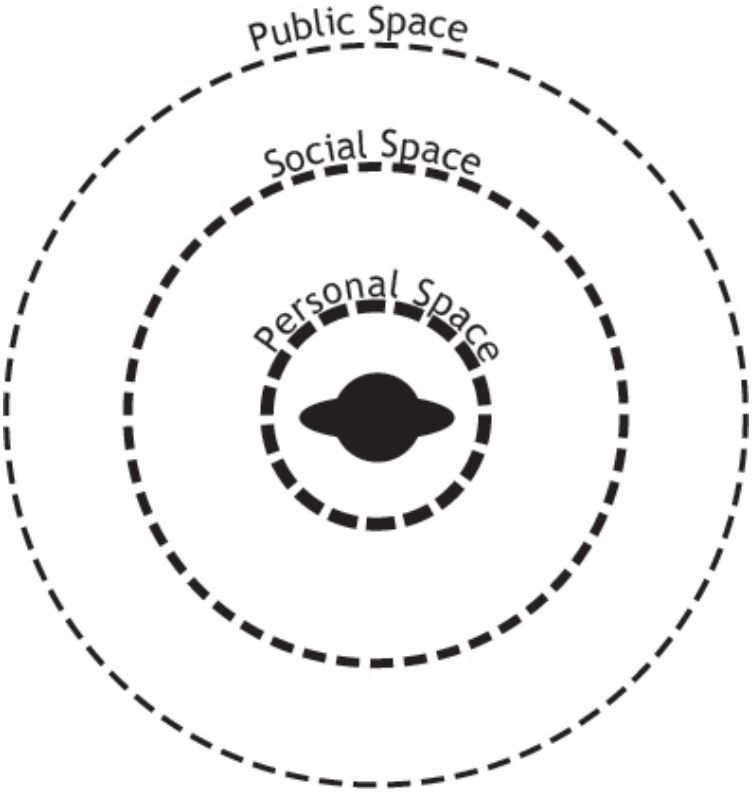


Figure 2.14 Territoriality Diagram. This shows the different levels of space defined by Altman and where all interactions with other people occur.

2.7 Environment and Safety Perception

Crime and fear of danger are two of the largest influences on perception and behavior in urban environments (Blöbaum and Hunecke 2005; Caracci 2006; Nasar and Jones 1997; Roncek 1981). This is taken from a "environmental criminology" perspective, which is the study of crime and victimization related to places and the way people and organizations shape activity in those spaces based on environmental factors (Cozens and Davies 2013). Crime can have significant negative influences at all levels of the community (Weisburd et al. 2018), and varies based on many factors at the city, community, and individual level (Caracci 2006; Roncek 1981). Any negative perceptions of one's environment such as intrusion of personal space (Altman 1975) can lead to health issues and negative effects on the community (Bowling et al. 2006; Caracci 2006; Roncek 1981; Weisburd et al. 2018). Physical features of the urban environment are often considered to affect the amount of crime (Herzog and Flynn-Smith 2001; Roncek 1981). In Landscapes of Fear and Stress (1997), Nasar and Jones explain the different stimuli that generate fear and how crime is linked to different environmental elements. Areas that have dense vegetation (Kuo and Sullivan 2001; Nasar and Jones 1997), poorly lit paths (Blöbaum and Hunecke 2005; Boyce et al. 2000; van Rijswijk and Haans 2018), and lack of people present were observed as more fearful since these elements may provide potential spaces for crime to occur. Despite this, Nasar and Jones (1997) argue that these elements

shouldn't necessarily be removed, as they may be beneficial to the space in other ways. For example, lighting is regarded as part of the immediate environment and alters perception either as an indication of safety or may create an indirect negative influence on the perception of safety (Boyce et al. 2000; van Rijswijk and Haans 2018).

While there are many social, environmental, and economical factors at play within cities, the issue of crime and safety is especially linked to how public spaces like streets and alleys are perceived (Herzog and Flynn-Smith 2001; van Rijswijk, Rooks, and Haans 2016; van Rijswijk and Haans 2018; Wang and Taylor 2006). Many studies identify a correlation of fear to physical elements (Blöbaum and Hunecke 2005; Gehl 1987; Herzog and Miller 1998; Herzog and Flynn-Smith 2001) such as enclosure and complexity, but they do not study the alteration of these elements in an alley space. These studies identify the elements through different environments. Although this may not be completely practical, this result does show how important lighting and other elements are for creating safer environments. Applying this to alley spaces could also help with changing general perceptions of safety in urban environments.

Blöbaum & Hunecke (2005) investigate the concept of fear in urban space through sociodemographic and sociological variables. Anticipated entrapment is one of the most significant predictors of perceived danger (Herzog and Miller 1998; Herzog and Flynn-Smith 2001), followed by biological sex, concealment (Gehl 1987), and lighting (Blöbaum and Hunecke 2005; Boyce et al. 2000; van Rijswijk, Rooks, and Haans 2016; van Rijswijk and Haans 2018). Entrapment, which is the perceptual disability of an individual to escape from potential danger, is another distinct element in alleys (Herzog and Flynn-Smith 2001). Van

Rijswijk et al (2016) also reveal similar factors to the perception of safety such as concealment and entrapment. The physical geometry of alleys such as the width, length, and curvature of the streetscape and abutting buildings contribute to these perceptions of entrapment and are important factors to address in alleys (Herzog and Flynn-Smith 2001; Stamps III and Smith 2002). Herzog and Flynn-Smith (2001) find that the elements in question are not the main indicators of fear, but rather the element of mystery is more prevalent. Wang and Taylor (2006) define a few elements such as prospect, the ability of an individual to anticipate other people and encounters; refuge, features that can block the view of pedestrians and provide hiding space for attackers; and the ability for individuals to create an escape route should they be attacked or feel overwhelmed (Wang and Taylor 2006). Gehl (1987) continues this concept by stating that one of the major influences in activity in public urban spaces is the access to adjacent buildings. The physical dimensions of the space itself, physical barriers, and social density can all influence human perceptions of safety.

Especially in urban areas, vegetation is often an important part of enhancing public space and enriching the community. In some contexts, it can help prevent crime (Kuo and Sullivan 2001) and blight and enhance social activity (Holtan, Dieterlen, and Sullivan 2015). In other instances, it can also create more opportunity for crime (Kuo and Sullivan 2001). Herzog and Flynn-Smith observe that these elements have the potential to either invoke preference or fear depending on the context in which they appear (Herzog and Flynn-Smith 2001).

2.7.1 Eyes on The Street

Crime has an obvious effect on the use of public space and mental behavior. Crime occurs more often in places where potential offenders can be concealed or where the crime cannot be easily deterred. Because of this, people avoid places they feel they are at high risk of being a victim of crime. On the other hand, potential offenders only choose places where they can be unobserved by others and where they can commit to the crime with ease. The typical solution for residents and organizations is to set up “defenses” to prevent crimes such as video surveillance, gates and fences, and other “target hardening” methods. Cozens and Davies (2013) observed neighborhoods in suburban Australia with some of these measures. They find that while these hardening measures did reduce crime, it came at the cost of reduced surveillance and reduced social interaction. Another method is to promote more natural surveillance and allowing these spaces to have visual connections. This theory of “eyes on the street” suggests that having these spaces more open to human surveillance will deter potential crime without creating a harsh environment for social interactions. Since alleys are typically highly enclosed spaces where it may be easy for criminal offenders to conceal themselves, promoting “eyes on the street” methods of surveillance could dissuade people from these activities (Cozens and Davies 2013).

Many residents and developers suggest installing gated entrances into alleys (Rogers 2007; Sidebottom et al. 2017). This is intended to disperse crime away from the building and create a more secure private space. While this may eliminate crime, it also limits the amount of pedestrian access and reduces the potential public space to be used by the community. Rogers (2007) touches on this relationship through his study of alley gating, stating that creating a physical boundary between the social space of the community and the public space available to those outside of the community will reduce potential dangers and increase perceptions of safety. However, there are still concerns that gating alleys will merely cause crime to move to adjacent areas rather than disappear.

Above: Figure 2.15 Gated Alley. The gate creates a space for private, pedestrian use only. (photo by Paul Davis 2008)

Below: Figure 2.16 Windows securty shutters. These security measure can be opened or closed by the resident (photo by Lynne Hand, 2005)

2.8 Summary

In summary, urban alleys have been a crucial role of cities for centuries (Beasley 1996; Borchert 1980). Whether it is social, economic, or environmental benefits, the alley has a role to play in the public and private domain of urban landscape. Knowing the history of these alleys also helps us understand the current condition of alleys in our cities today. Alleys that are being neglected are often seen as areas of blight in cities, which can increase crime and other adverse effects on people. While there are many advocates for a purely functional alley for vehicles and maintenance, there are programs and cities that have begun to use them to their full potential. With that, there are many obstacles with using alleys. One of the most prominent is the negative perception of alleys that the American society has built up over the past few centuries. Scholars such as Herzog, Martin, and Van Rijswijk have explored both physical and psychological elements and factors in alleys that may affect perception of alleys. Herzog and Smith (2001) highlight specific elements but not in conjunction with other elements. The impact of these elements can sway either positively or negatively depending on context and in conjunction with other factors. Multiple sources refine the factors of the environment down to a few recurring elements. One such element is mystery in a variety of spaces. The presence of mystery typically makes a more preferred environment, but at the same time induces thoughts of potential danger which, depending on many other factors such as vegetation, time of day,

and individual personality traits, can be a positive or negative factor (Herzog and Miller 1998; Nasar and Jones 1997; van Rijswijk, Rooks, and Haans 2016). Another well-established factor is the idea of prospect, which is the ability to see possible future events occurring. Being able to observe and analyze surroundings is important to establishing a sense of safety. While the unique combination of many factors, either physical or mental, influences human behavior and perceptions, physical elements have yet to be studied cohesively and within a controlled environment. Having a controlled environment is important to this study which is why virtual environments are being explored for this study.

The methods used by precedent studies are also useful for designing this study. Since virtual reality is becoming a more popular tool to explore human psychology, it is instrumental for achieving the purposes of this study. Many other studies of perception use photographs or actual sites to record their findings. For the context of this study, virtual reality is a balance between immersing the participants within the environment and reducing the potential dangers of urban alleys in reality. It is much more efficient to manipulate virtual environments, because the reality of these alley spaces would be difficult to alter at the desired levels. The information from this review will be useful for creating a controlled and safe environment for the experimental segment of this study.

3

Methodology

3.1 Research Design

The design of this study is meant to identify physical aspects of the environment that affect perceptions of safety the most and to use that information to determine a design framework to improve safety perceptions in urban alleys. To achieve this, independent variables are identified through the literature review as well as previous information of alleyway design studies regarding safety perception. All this information is used as preceding analysis of alleyway design and how to approach measuring perceptions of safety. To measure perceptions and find which physical elements have the strongest effect, the survey method is used to gather information with virtual reality by using physical elements of an alley as virtual stimuli in this psychological experiment. Once the most significant variables are identified, a design framework uses the information from the questionnaire responses. This framework can be applied either directly to urban alley environments or can be applied to existing organizations, designers, and guidelines as a reference to safety design.

3.2. Variable Selection

There are many environmental factors to consider in examining human behavior. Based on observations and studies of alleys, there are physical elements that are more frequently obeserved to have impact on behavior. The following physical elements are selected because they have been observed to cause behavioral changes in alley environments and in other urban environments, such as streetscapes, that are similar to alleys. The physical elements described are the visual stimuli that serve as the independent variables for this experiment.

- Building Conditions refer to the general quality and upkeep of the adjacent buildings of an urban alley. Elements such as worn materials, abundant graffiti, and broken windows all indicate a lack of upkeep and potential space for danger (Hassen & Kaufman 2016; Weber & Heuberger 2008; Jiang et al. 2018).

- Street Cleanliness is the general upkeep and quality of the ground plane and transition space of urban alleys. Trash and other refuse that litters the ground along alleys is a clear indicator of misuse and poor maintenance. (Hassen & Kaufman 2016; Weber & Heuberger 2008).

- Vegetation is divided into two subcategories: canopy and planted vegetation. The first category, canopy, refers to trees and other vegetation that creates a green overhead plane. Trees increase enclosure and shade, but do not reduce the prospect of the space and can increase sociability of urban spaces. (Holtan et al. 2015; Kuo & Sullivan 2001; Herzog et al. 2000; Herzog

et al. 1982; Coles et al. 2013). The second subcategory is planted vegetation, which refers to smaller scale plantings that are either in planting areas or in pots and maintained by local residents. While this greenery can also improve social capital, it can also create more concealment and mystery if applied too much (Kuo & Sullivan 2001; Herzog et al. 2000; Herzog et al. 1982; Coles et al. 2013).

- Lighting comes from two sources: natural (sunlight) and lighting fixtures. The sun provides light during the day while artificial light provides safety and visual connections during the night. Different levels of luminosity have been studied to have various impacts on people in urban contexts. Lights that are too bright can be off-putting to activity, while too low lighting generates fear and concealment (Nasar & Jones 1997; Blobaum & Hunecke 2005; Hassen & Kaufman 2016; Boyce 2000; Rijswijk & Haans 2018).

- Complexity of private structure refers to the idea of overstimulation which can cause discomfort and stress, especially in urban spaces. Too much visual input such as signage and bright, eye-catching visuals can quickly overwhelm the eyes and cause stress (Ewing & Handy 2009; Herzog et al. 1982; Martin 2002; Ittleson 1978).

- Security measures are divided into two subcategories for this study: Gates/ fences, and window/door security shutters and barring. Alley gating is a common practice that creates semi-private space for the adjacent buildings. Gating alleys is a preventative measure that comes at the cost of complete access (Sidebottom et al. 2017).

- Security Windows/Door Shutters are another security solution that “hardens” the potential targets of crime in hopes of preventing it. While crime rates are typically reduced by these measures, the shutters remove the “eyes on the street” ability of neighbors and can reduce social interactions between community members (Cozens & Davies 2013).

- Alley Length is the physical length required to move through the space between buildings. It can also create a greater sense of enclosure since alleys typically have only two main entry/exit points. People feel less comfortable in enclosed spaces if the exit points are too far away (Herzog & Flynn-Smith 2001).

- Alley Width is the physical space set between the abutting buildings. This can vary widely depending on various contexts. The width can affect the sense of enclosure but can also imply various uses of a space. A wide alley is able to accommodate more activity either negative or positive (Herzog & Miller 1998).

- Building Height is divided into high and low density. Taller buildings create more shade in alleyways and create a greater sense of enclosure (Martin 2001; Herzog et al. 2000; Siksna 1997).

- Human presence is a necessary variable to consider. If people are present in alleyways, they could either improve security since there are more people to observe activity and activate the space themselves, or they can negate the sense of security depending on the situation if the subject is alone with one other person in the alley, no one else is around to observe the potential danger (Platt 2012; Schlund et al. 2017; Seymour et al. 2009).

3.2.1 Variable Selection

This experimental study uses human subjects to record decisions and perceptions within selected sites. Subjects are 24 people who volunteered to participate including college students and faculty from Kansas State University. All subjects experience multiple virtual reality environments based on the physical elements from literature. The model urban alley for creating a virtual environment is selected randomly to represent a typical urban alley. The selection of alleys is based on the presence of the previously identified physical elements. This site provides a base layout for the interactive virtual environments (IRVs). Virtual reality is used for two reasons. Firstly, it is safer to avoid potential environmental hazards and for convenience of the participants. Secondly, it allows for greater control over outside variables that might alter the data being collected.

This study does not intend to create a generalized design through virtual reality but rather to create a typical alley that is common to cities in the United States. This typical alley helps create multiple variations of the alley and act as the level 1 measurement of each variable. The independent variables being used are based on elements of alley environments found in other studies to have effects on human perception and safety from various sources. Using these independent variables as visual stimuli and accompanying survey questions, the dependent variable is the subjects' perceptions of safety.

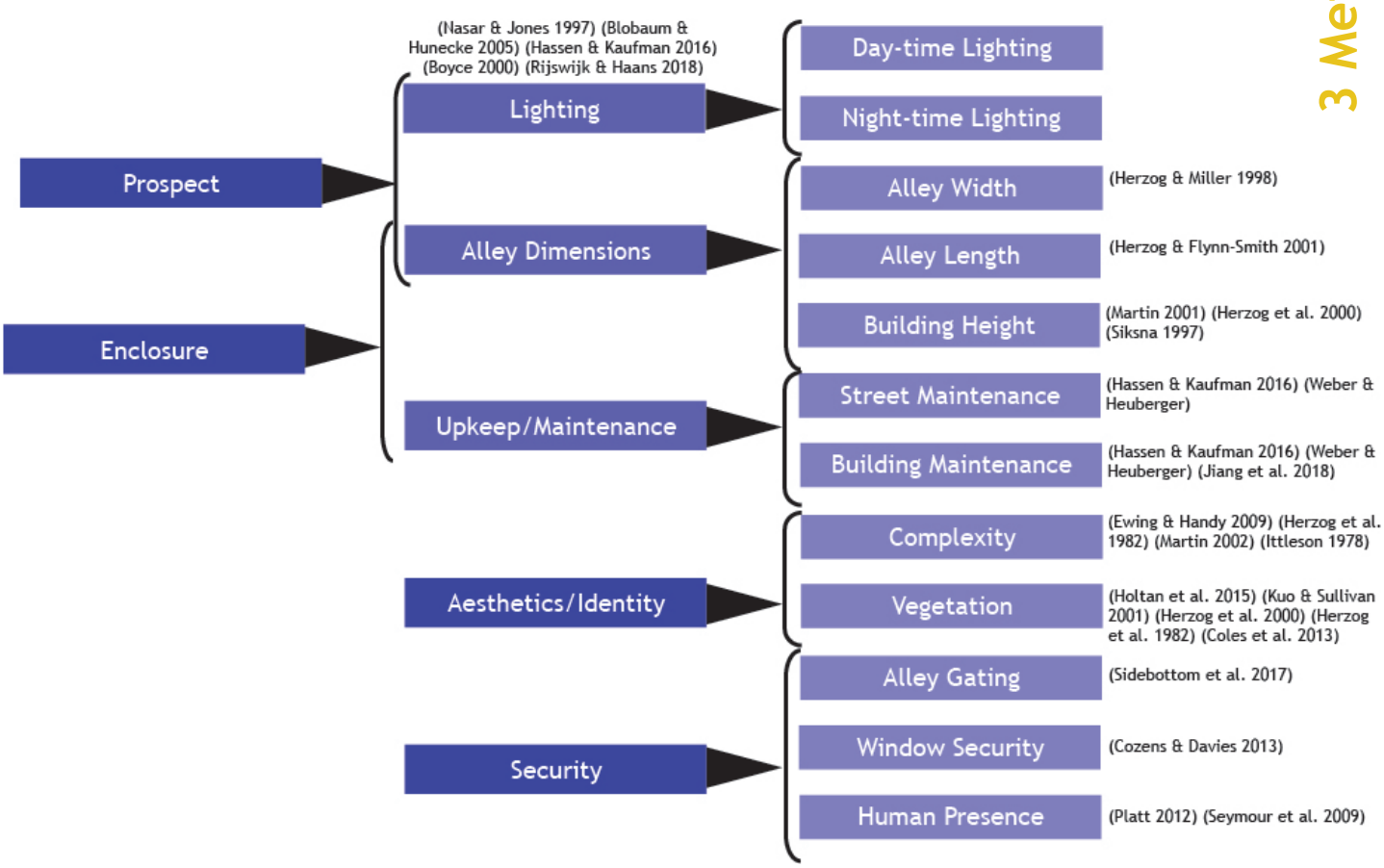


Figure 3.1 Categories and variable chart. Topics found in literature and the variables selected for the study.

All the variables in this study can be put into four general categories that are recurring themes and elements in past studies and literature. Figure 3.1 shows how each variable fits into these categories and their major preceding sources. Prospect and Enclosure specifically are used in many preference and perception studies related to urban areas and urban alleyways (Herzog and Smith 2001, Herzog and Miller 1998, Nasar and Jones 1997). Aesthetics and Identity is mainly derived from Hassen and Kaufman's study identifying the main goals of alleyway programs. Security is brought up in multiple studies (Cozens and Davies 2013, Sidebottoms et al. 2017). Use of security measures is often debated and it is important to identify what people think of their application.

Each of the variables has two levels of observation: Level 1 and Level 2. The following descriptions define how each variable level is represented in the virtual environments. Level 1 is typically the normal presence of a variable in an urban alley. Level 2 is typically the increased presence of its level 1 counterpart. A variable with a level 1 “no presence” is then present in level 2. A variable with a level 1 “normal presence” has an “increased presence” in level 2.

- Width: The two levels of alley width are defined as “narrow” (level one) and “wide” (level two). The “narrow” alley has fifteen feet of path between the abutting buildings. The “wide” alley is extended to thirty feet.

- Length: The two levels of alley length are defined as “short” (level 1) and “long” (level two). The “short alley has a length of one hundred and fifty (150) feet from one street connection of the alley to the other. The “long” alley is extended to three hundred (300) feet.

- Trash/Street Maintenance: Trash and street maintenance are combined since they both are dedicated to the ground plane of the alley. The two levels are defined as “maintained” (level one) and “unmaintained” (level two). The “maintained” alley has trash presented in small,

organized amounts and with a normal quality street of brick pavers. The "unmaintained" alley has large amounts of trash that are unorganized and encroach on the main path through the alley. The street also has multiple water puddles to indicate disrepair and neglect to the material of the street.

- Building Maintenance: This variable observes the presence of graffiti and broken windows, and dirty building materials, all of which are often indicators of crime and neglect. The two levels are defined as "maintained" (level one) and "unmaintained" (level two). The "maintained" alley has no broken windows, and clean building facades. The "unmaintained" alley has multiple broken windows and has a large amount of graffiti and worn materials on the building facades.

- Signage: The signage variable uses multiple business neon signs, parking signs, and other various signage. The two levels of this independent variable are defined as "no signage" (level one) and "presence of signage" (level two). The presence of a large amount of signage is expected to have negative effects of perception due to overstimulation.

- Building Height: The two levels of building height are defined as "tall" (level one) and "short" (level two). The "tall" alley has abutting buildings

that are four stories tall (~40-50 feet). The “short” alley is reduced to two stories (~20 feet).

- Alley Gating: The two levels of alley gating are defined as “no gates” (level 1) and “presence of gates” (level 2). The “presence of gates” alley has three chain-link fences with gate access: one at either exit to the street and one that restricts access to a small alcove. Subjects are notified that for the purpose of the study they should assume that they have access to all gates in the alley.

- Window Security: The two levels of window security are defined as “no window security” (level one) and “presence of window security” (level two). The “presence of window security” alley uses metal security shutters and iron bar installments.

- Vegetation: The two levels of vegetation are defined as “no vegetation” (level one) and “presence of vegetation” (level two). The “presence of vegetation” alley has both trees and smaller vegetation such as grass and shrubs.

- Lighting: The two levels of lighting are defined as “day-time lighting” and “night-time lighting”. The “day-time” alley has lights installed but primarily uses sunlight. The “night-time” uses light installations above doorways and on buildings to create low level light throughout the space in a night setting.

- Human presence: The two levels of human presence are defined as “no presence” and “one human present”. The “one human present” alley only has one male moving through the space. This was decided due to the assumption that subjects will consider a male presence more critically and a one-on-one interaction more negatively. The presence of multiple people would increase the surveillance of the alley and alter the controlled environment.

3.2.2 Other Factors

Physical elements of the environment are by no means the most important or the most influential. While this study seeks to understand the impact of physical elements, there are other factors at play in all environments that can determine initial perceptions and behavior. Individual preferences and experiences could cause different perspectives on alleys and urban space in general. A person who lives in a rural community may have a much different perspective than someone who has lived for years in a city with hundreds of alleys. Others still may have had different experiences regarding alleys directly.

Perspectives may also be affected by various contexts surrounding alleys. This could be due to varying cultures as discussed previously or it could vary by building use and neighborhood connections to the alley. Beasely's report on Galveston (1996) shows that alleys have a wide variety of uses through an even wider variety of people, and each one could have a different story to tell about the same alley.

Perception does not only apply to sight but extends to our other senses. One most prominent in alleys is the smell/odor. Since many alleys are used primarily as a place to store garbage and vehicles, foul smells are often very prominent in alleyways. While all these factors are important to consider, this study singles out the physical elements and visual perception of space.

3.3 Virtual Reality Alley Environment

Multiple alley features were reviewed and selected to serve as a typical alley for developing the virtual reality environments (see Figure 3.2). This typical alley is approximately one hundred and fifty (150) feet in length and sixteen (16) feet in width. This site is not replicated from an individual alleyway in virtual reality but serve as a basis of dimensions and present elements that is used as a reference for a controlled environment that can easily showcase each variable.

Virtual reality is used to provide a more controlled environment to collect data. VR has also been proven to be able to provide a realistic sense of presence in research (A.W. de Kort et al. 2003), allowing for it to replace real environments in case those environments are difficult to work in or are potentially dangerous. In this case, there are many outside factors such as travel times, potential hazards, equipment availability, and number of subjects, that prevent this study from using a real environment for what it aims to observe.

Figure 3.2. A model alley for creating a virtual environmet. This is one of many alleys observed as a precedent to develop the virtual reality environments.

Figure 3.3 Typical alley virtual environment. This environment is both the 'typical alley' and represents "level 1" for each variable.

Using the alley in Kansas City, MO as a reference, a base model for the alley variants was created using both 3d modeling and the Unreal Engine 4 (see Figure 3.3). The model encompasses an approximately 150-foot-long alley surrounded by medium height buildings (4 stories) of various uses (i.e. loading dock, windows, building access). This alley is meant to keep outside factors controlled so each variable in question of this study can be easily identified and observed by subjects during the experiment. This typical alley also serves as the level 1 measurement of each variable being observed in the perception experiment.

Each variable selected for the experiment has two levels of study; the level 1 of the variable which is represented in the "typical alley", and the level 2 of the variable which is represented in a separate environment (See Figure 3.4). For example, level 1 for the vegetation variable is represented in the first environment with an absence of any vegetation. The second level of the variable (Figure 3.9) shows a similar environment with the presence of vegetation. For the variable "lighting" the level 1 represents "daytime lighting" while the level 2 represents "night-time lighting" (see Figure 3.10). Independent variables that are measurements of the space itself, the level 1 represents the typical dimension for that measurement. The level 1 measurement for width is fifteen (15) feet while the level 2 measurement is thirty (30) feet (See figure 3.5). The level 1 measurement for length is one-hundred fifty (150) feet and the level 2 measurement is two-hundred fifty (250) feet. The building height variable is measured at a typical height of 4 stories for level 1 and is reduced to 2 stories for level 2. For some independent variables, the typical alley shows a "typical presence" of that element, rather than a complete absence of it. For example, figure 3.6 shows the environment that represents level 2 for the trash/path maintenance variable. This environment has an increased presence of trash and a lack of maintenance while the level 1 environment shows reduced and organized trash and minimal damage to the path.

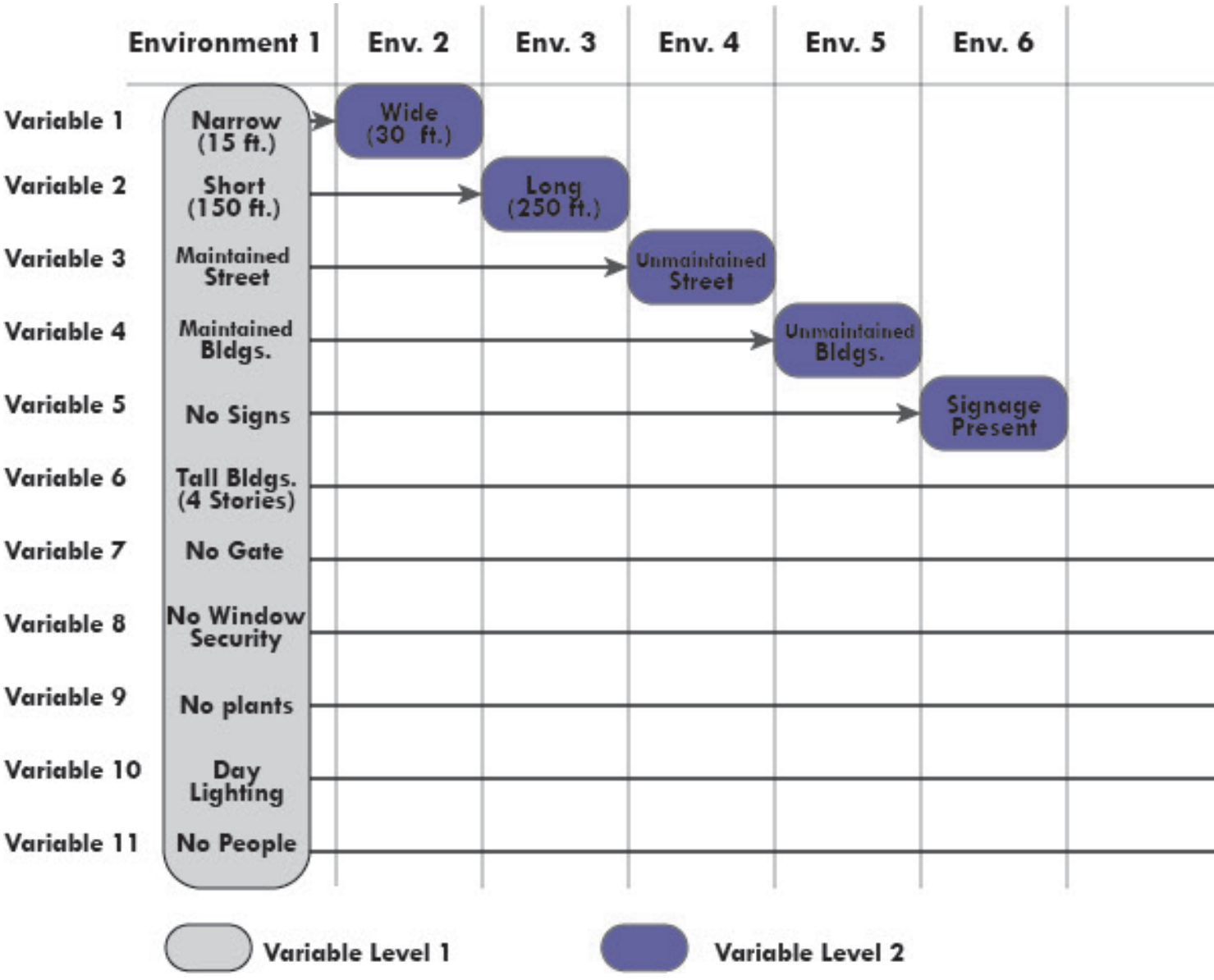


Figure 3.4 Virtual environment and variable sequence. The first environment encompasses all independent variables as the level 1 measurement. Each subsequent environment represents level 2 of each independent variable.

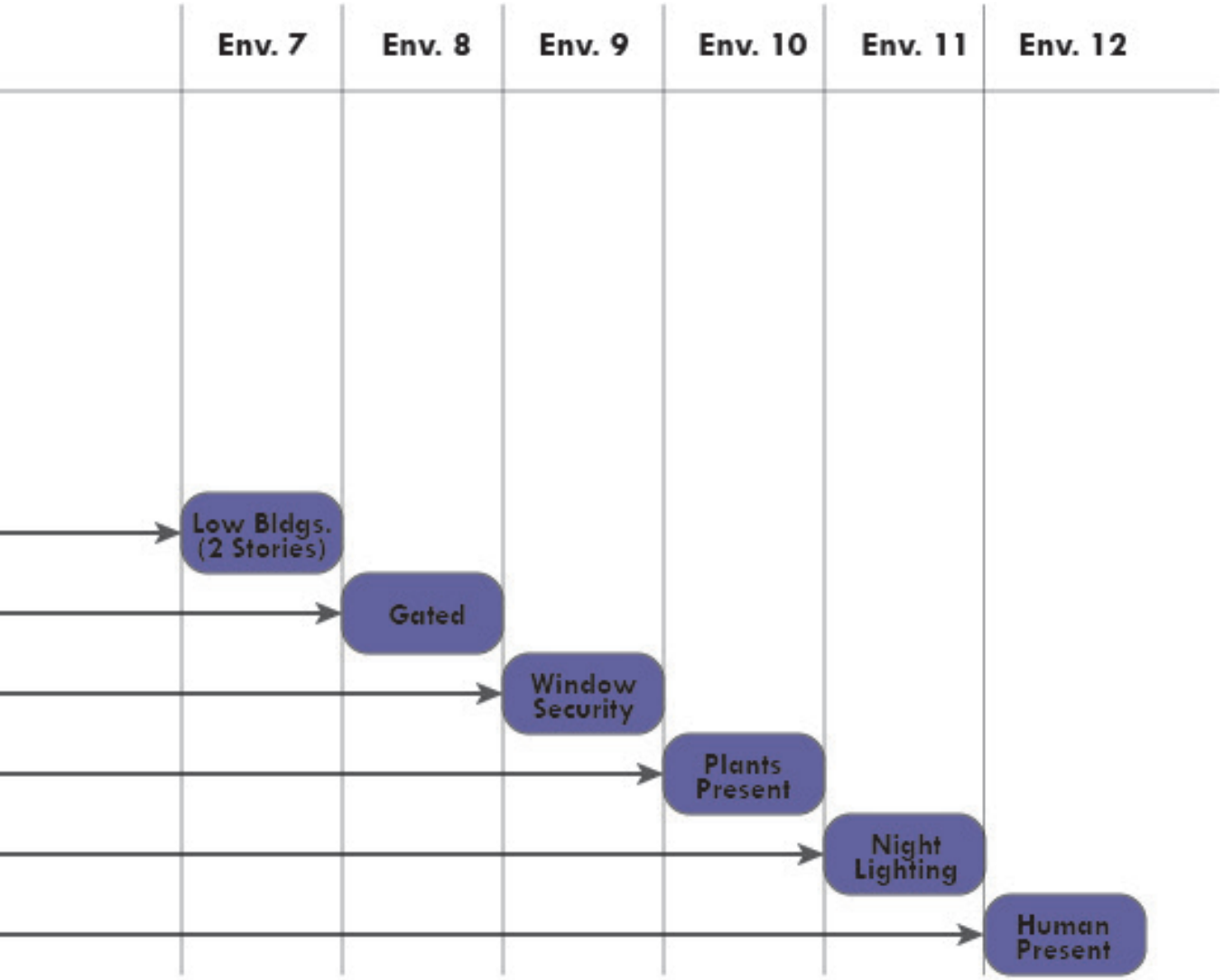

Env. 7
Env. 8
Env. 9
Env. 10
Env. 11
Env. 12
Low Bldgs. (2 Stories)
Gated
Window Security
Plants Present
Night Lighting
Human Present

Figure. 3.5. Wide Alley. Alley Width variable level 2 (30 ft.).

Figure. 3.6. Unmaintained Street. Trash/Path Maintenance variable level 2.

Figure. 3.7. Unmaintained buildings. Building Maintenance variable level 2 (unmaintained building facades).

Figure. 3.8. Low buildings. Building Height variable level 2 (2 stories).

Figure. 3.9. Vegetation present. Vegetation variable level 2 (trees and plants present).

Figure. 3.10. Night time lighting. Lighting variable level 2.

3.5 Study Subject

The study subjects are students and faculty volunteers from Kansas State University. Volunteers were asked to sign up for a session ahead of time or could do a "walk-in" session within allotted times set by the researcher. Volunteers were taken from all backgrounds academically and culturally. Each subject completed a two-part survey and participated in the virtual reality segment of the study. Each session lasted for approximately twenty minutes.

The sample consists of 24 subjects (13 men, 11 women). Ages ranged from 18 to 56 with a mean age of 27.2 years. A majority of subjects (70.8%) are between the ages of 18 and 24. A majority of volunteers were students of architecture and design but volunteers also came from other disciplines or were not affiliated with a college. Volunteers were recruited through word-of-mouth, social media, or by advertisement posted through email or flyers on the college campus. Volunteers could sign up using an online schedule for a thirty minute session or could communicate directly with the researcher.

3.6 Survey Procedure and Implementation

The first half of the survey is a written questionnaire. With this portion of the study, subjects express their opinions of urban alleys and any experience they have had involving alleys. This information is used to gather initial data for analysis of how alleys are perceived along with typical elements of alleys. Identifying elements that would affect safety either negatively or positively allows deeper consideration when creating design decisions. Some portions require subjects to respond with a one to five rating, while other portions require they fill checkboxes or with written answers. All subjects' responses were documented and general notes about each session were recorded. For each environment, each element is rated by the subject's answers to the questionnaire (see Appendix 1). All questions of the oral portion of the survey use a 5-point Likert Scale to indicate subjects' sense of safety from "very unsafe" (1) to "very safe" (5) (Jiang et al. 2018).

3.6.1 Survey Design

The survey questionnaire is used as the primary data collection because this study is looking at individual perceptions and preferences on environmental factors. Many studies use a written survey questionnaires along with visual factors such as photographs or real environments to collect similar data. Herzog and Flynn-Smith (1998) use a survey to record preferences between various photographs of alleyways to find preferences on mystery and enclosure. Blobaum and Hunecke (2005) conducted a field experiment on a German university and used two questionnaires to record subjects' safety and anxiety in various campus scenes. Questionnaires are effective at gathering the desired information at the time of the actual event like walking through an alley or viewing photos.

The survey questionnaire of this study is divided into two modules, a written survey and an oral survey. This survey is divided so that participants can share two points of data, their initial thoughts of the environments before the experiment, and their thoughts and perceptions during the experiment. The initial gathering of their original thoughts is important for understanding how the general public currently feels about alleyways and any experiences that may have led to its current state. The second module takes precedent from the studies mentioned above by gathering data as the experiment is unfolding and the subject's reactive perceptions can be recorded.

The development of this survey comes from an initial pilot study conducted in December of 2019. Six subjects participated in a visual preference survey, precedented by Herzog and Smith's (2001) study on preference and perceived danger (Herzog and Smith, 2001). Subjects observed a series of photographs of alleyways. The photographs were organized into a sequence starting from a photograph of an alley with no design or physical changes (trash present, poor building and street conditions, etc.). The subsequent photographs were altered by one of the selected variables per photograph that were thought to improve the quality of the space.

In the pilot study, subjects rated each photograph on a 7-point Likert scale. This scale was reduced to five for convenience of available choices in the oral survey. It was found that the continuous improvement of the space saw the ratings stagnated after multiple photographs were observed. To improve this, and to identify the effects of the independent variables individually, the continuity between each variable photograph was removed. Finally, the use of photographs did not give the sense of presence required for capturing realistic perceptions of alleyways. Through this observation, the option of virtual reality became part of the experiment.

Through this study the questions and methods of gathering data were refined to gather the necessary data. The two modules of this study both contribute to the two questions of this study. The first is an analysis of the factors present in comparison to each other (what physical elements of an urban alley affect human perception the most?) and the second is to feed into the design decisions that come from the results of this study.

The survey is designed to acquire both prepared and reactionary perceptions of urban alleys. The first module is important to identify outside factors that may need to be considered such as gender, age, and past experiences, while the second module is important to identify perceptions as they happen (See figure 3.11). Combining these two perceptions gives a more holistic view of how urban alleys are viewed. The combination of this information is used to inform the design framework that is the overall goal of this study.

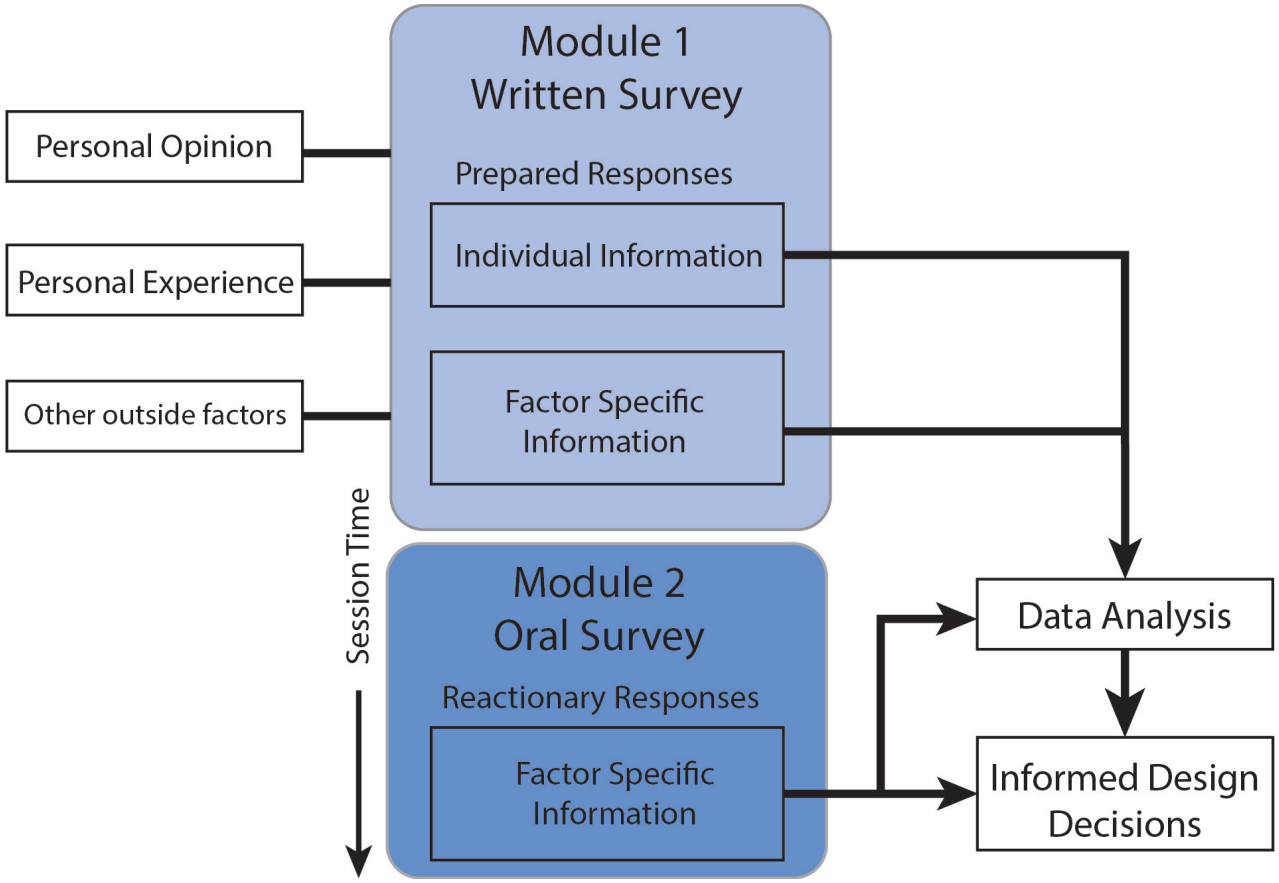


Figure 3.11 Survey design layout

4

Results

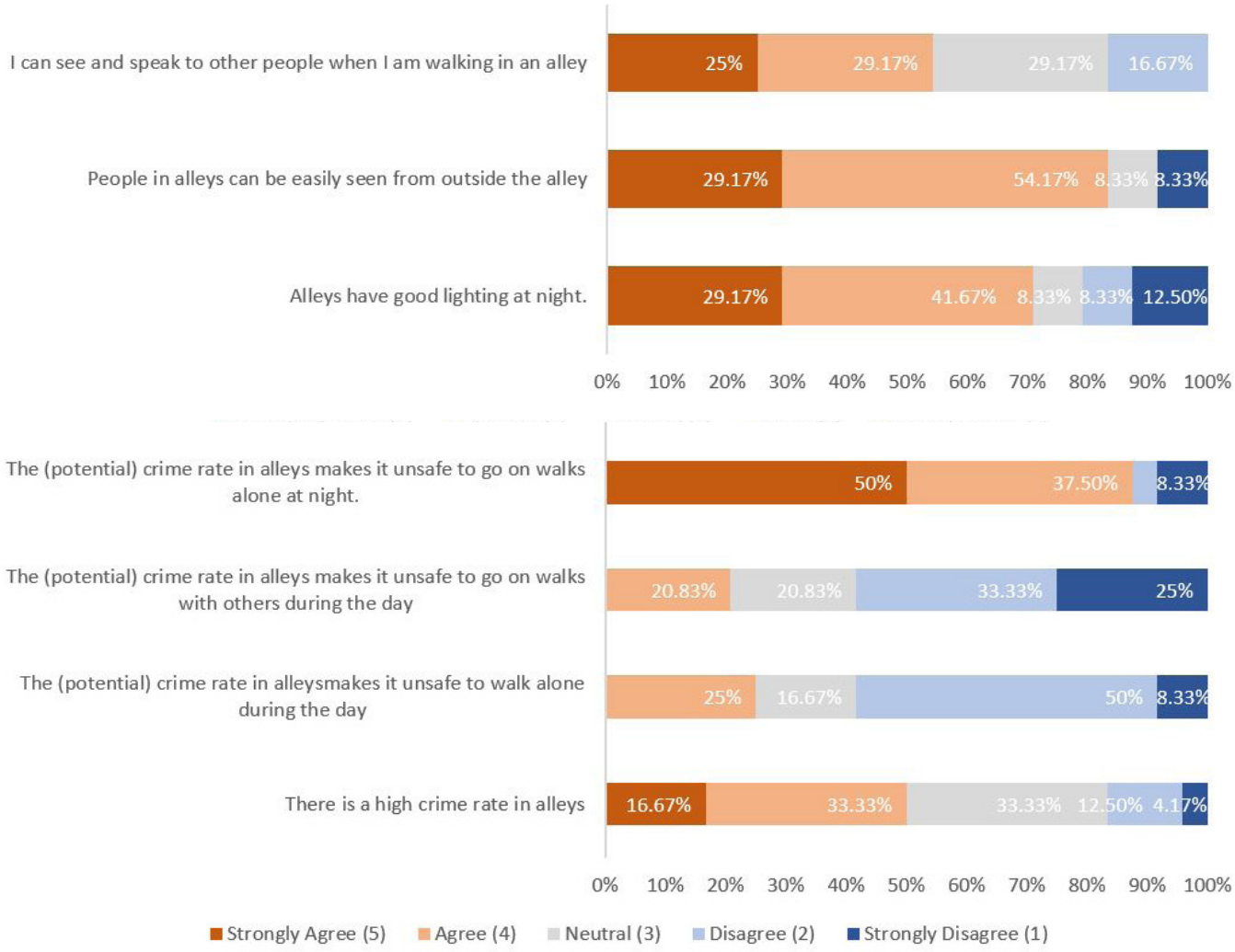
4.1 Descriptive Statistics

The results of this study are divided by the first and second modules. For each module, the data collected is compiled into descriptive statistics, showing the mean scores and percentages of all responses for each of the Likert-Scale questions. Level 2 of all variables is recorded by the mean scores and is used as the dependent variable “perceived safety”. The study has 24 participants complete both modules of the study. Every subject has some prior knowledge and experience of urban alleys before the study.

4.1.1 Module 1: Written Survey Questionnaire

The rating for the overall safety of urban alleys is 58.33% negative (a 2.53 rating on a 5-point Likert Scale). This is before any exposure to the virtual environments. Participants also identify their preliminary impressions about urban alleys and their qualities. Figure 4.1 shows subjects’ responses to statements regarding crime and safety in alleys. Fifty percent of all subjects believe that there are high crime rates in urban alleys, compared to sixteen percent who disagree (Thirty three percent are neutral). Eighty-one percent of subjects disagree with the statement that people can be easily seen in alleys. Most subjects (59%) disagree that crime rates effect walkability during the day, but many (63.7%) agree with the statement that crime rates effect walkability at night. These responses show that there is a concern for crime but mostly during the night when there is lower visibility and less people to observe any criminal activity. These responses also suggest that subjects think about prospect, the ability to see and predict your environments, when walking through urban alleys.

Figure 4.1 Overall crime and safety perception about urban alleys (Module 1)



In module one of the survey, subjects are also asked to identify physical elements they perceive as negative (Figure 4.2). Uncleanliness is the highest rated negative factor with 91.3 percent of subjects identifying it. Other highly identified negative factors are Building Conditions (82.6%) and Human Presence (65.2%). Subjects are also asked to identify positive factors (Figure 4.3). Ninety-five-point seven percent of subjects identify lighting as a positive factor, followed by Cleanliness of streets and buildings (both at 87%). These were identified before being exposed to the virtual environments, which indicate the subjects' preliminary expectations and preferences for the study.

Figure 4.2 Negative Elements in Urban Alleys

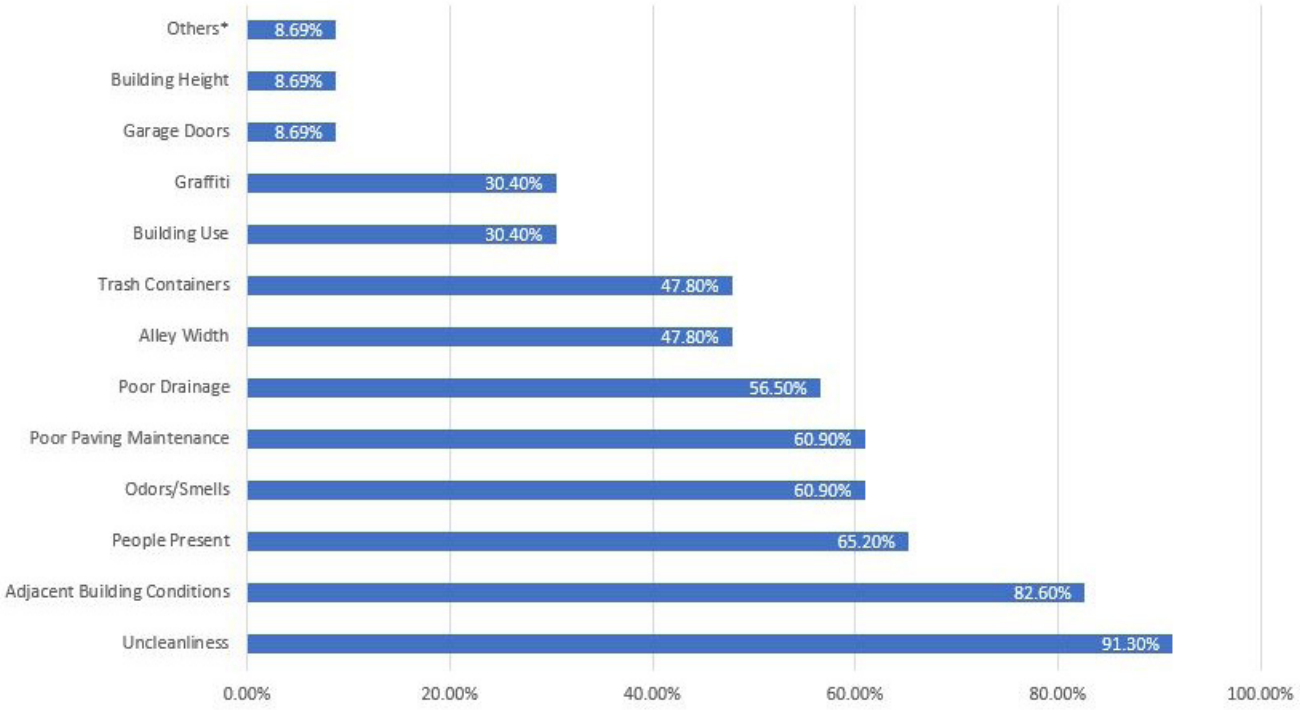
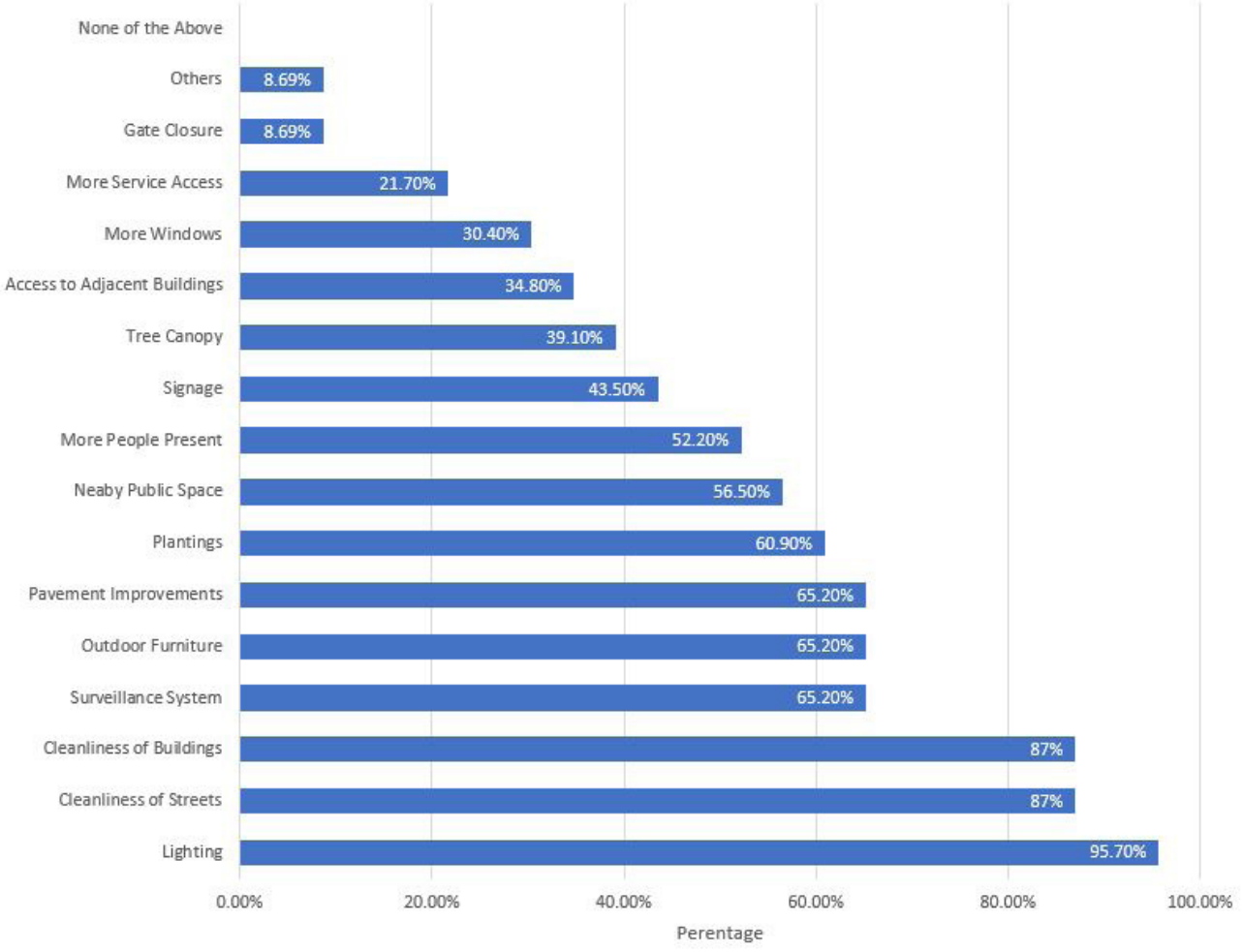


Figure 4.3 Positive Elements in Urban Alleys



4.1.2 Module 2: Oral Survey Questionnaire

In module two, subjects use a 5-point Likert scale to answer questions about the safety of each virtual environment and their willingness to utilize the space in different circumstances. The questions given during the second module ask subjects about their general perception of safety in each environment. Subjects are also asked to rate their willingness to walk through each environment based on different circumstances: alone or with a group of people, and alone or with a group on a regular basis (considering if they lived near the space and were constantly in contact with the space). The general safety ratings has a mean score of at 3.67 on a scale from one to five. This mean also serves as the level 1 mean for each of the variables as the mean for a "typical urban alley". Compared to the initial safety rating in module 1 (2.46/5), subjects rate the VR environment higher (3.67/5). Walking alone in a typical alley averages at 3.71/5 (Figure 5.5), in comparison to a rating of 4.45/5 for walking with a group of people (Figure 5.6). This indicates that safety perceptions increase with familiarity of the space and repeated visits. If subjects worked or lived near a typical alley, the mean for safety ratings is 3.92/5 (See Figure 4.7). In a familiar environment with a group, the typical alley ratings has a mean of 4.21/5 (See Figure 5.8). This indicates the expected results that the subjects would feel safer in more familiar areas and with familiar people in the space.

The variable with the highest mean rating across all five questions in the VR experiment is the alley with vegetation present (level 2). This is in comparison to the preliminary module, where only 39.1% of subjects identify tree canopies as a positive factor in urban alleys and other plantings at 65.2%. The other highest rated variable is low building height (level 2) with a mean safety rating of 4.00 on a scale from 1 to 5.

Figure 4.4 Safety Ratings for Virtual Environments

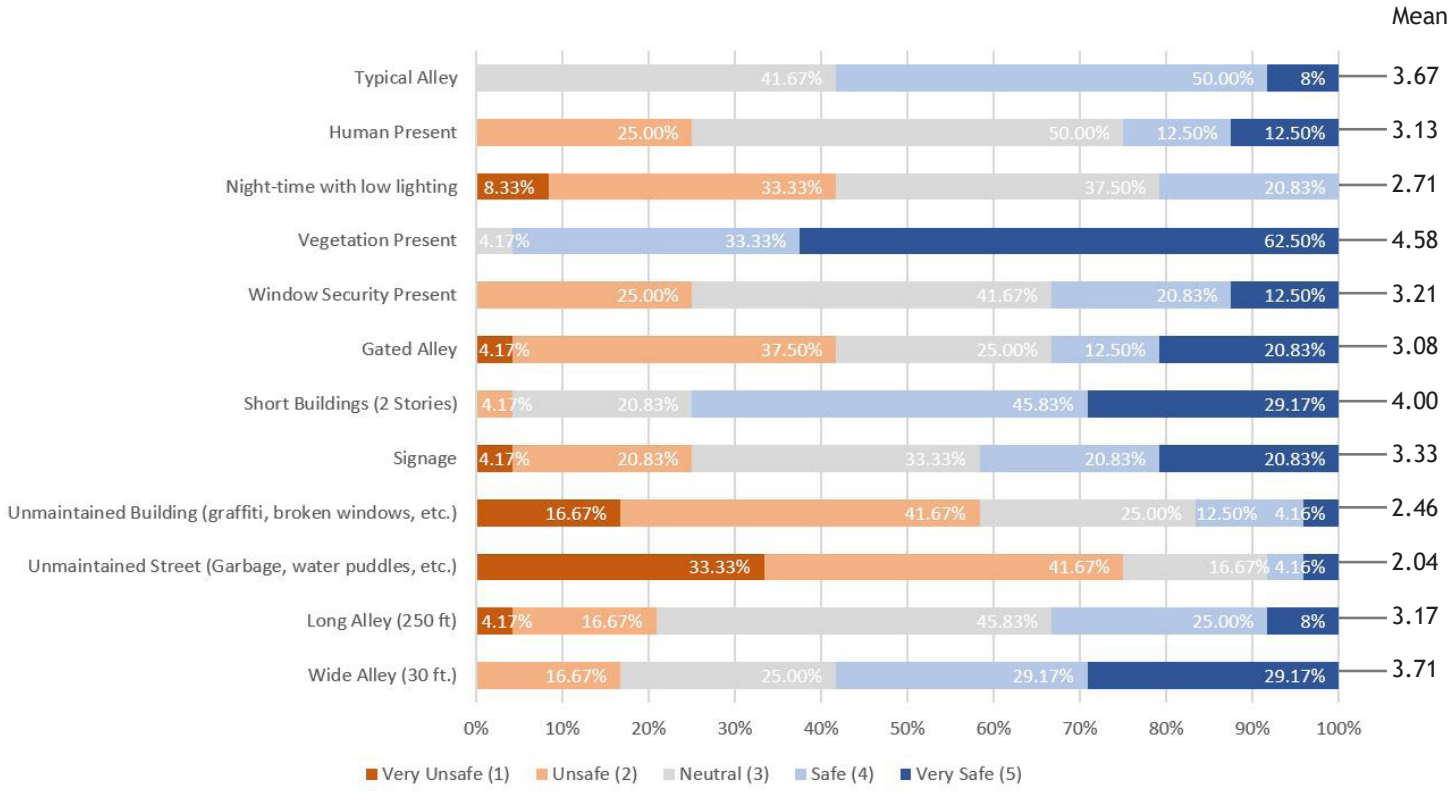


Figure 4.5 Willingness to Walk Alone in the Virtual Alley

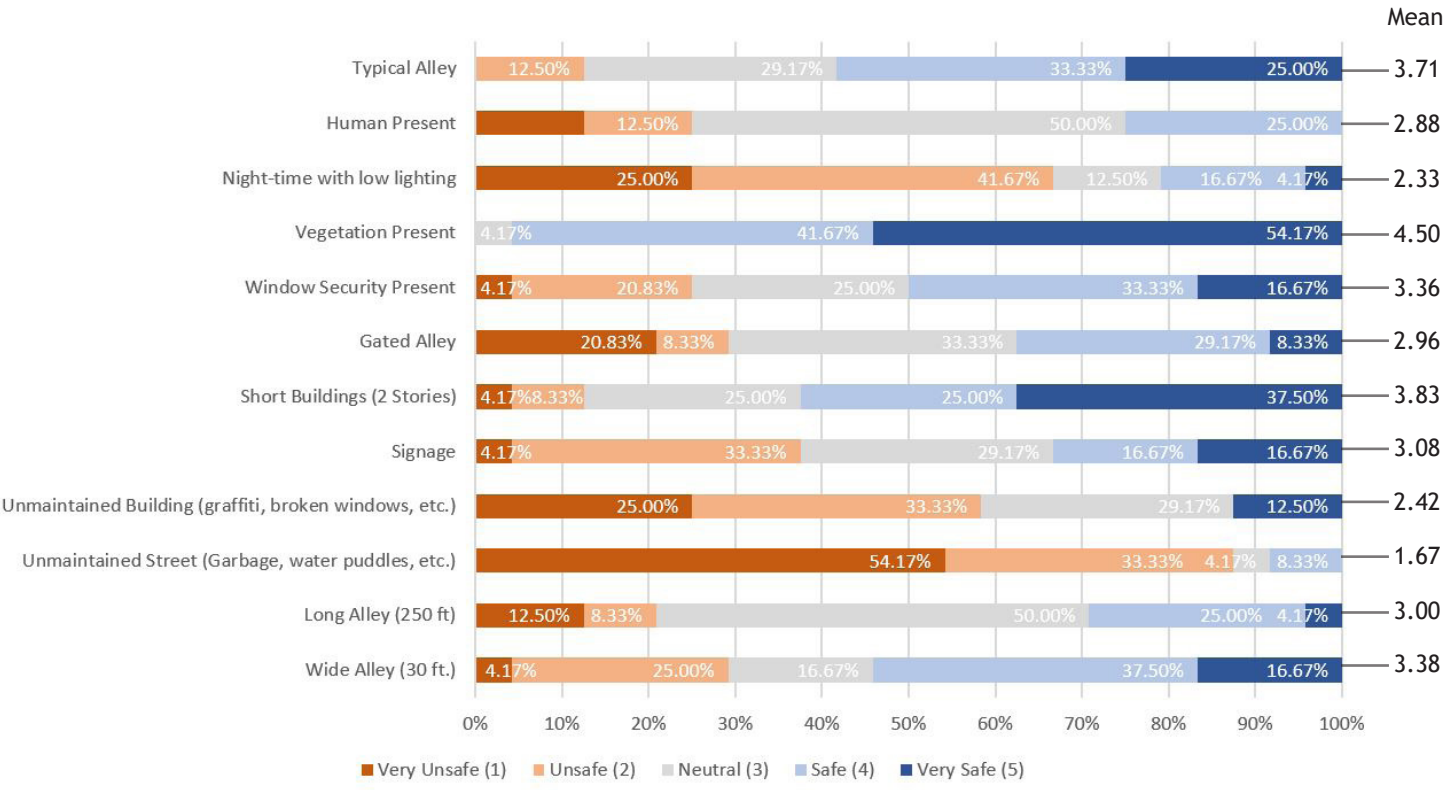


Figure 4.6 Willingness to Walk with others in the Virtual Alley

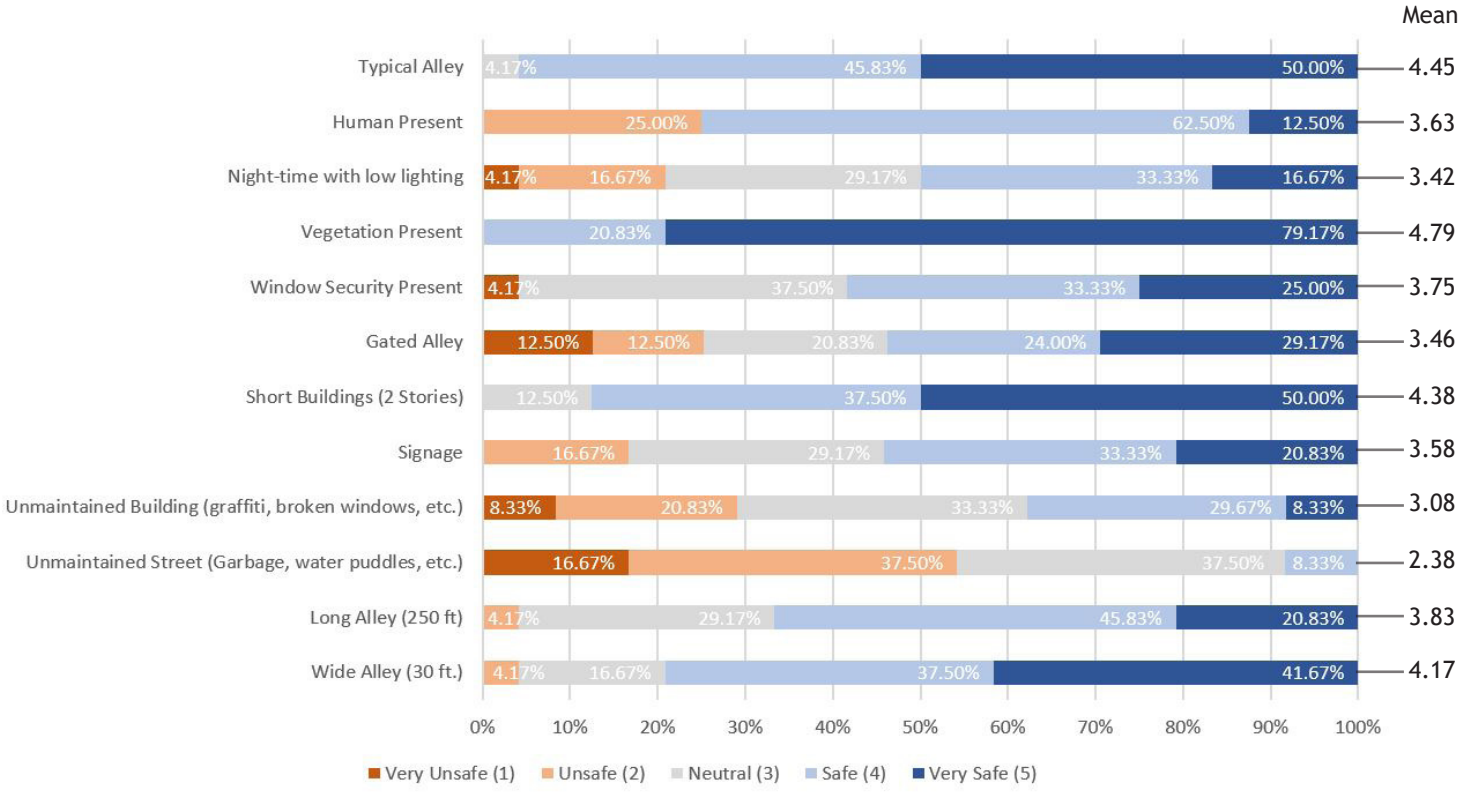


Figure 4.7 Willingness to Walk Alone in Virtual Alley Near Home or Work

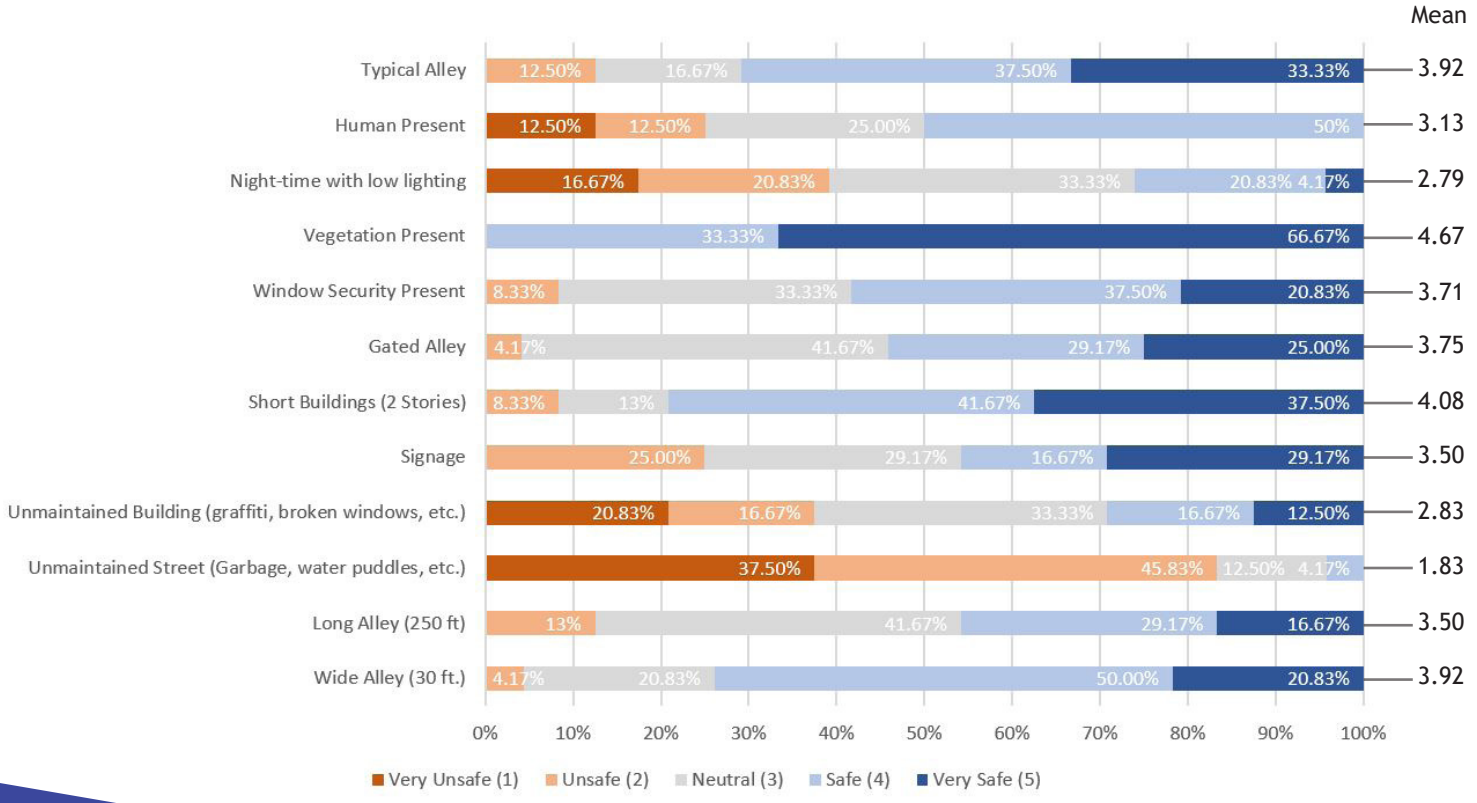
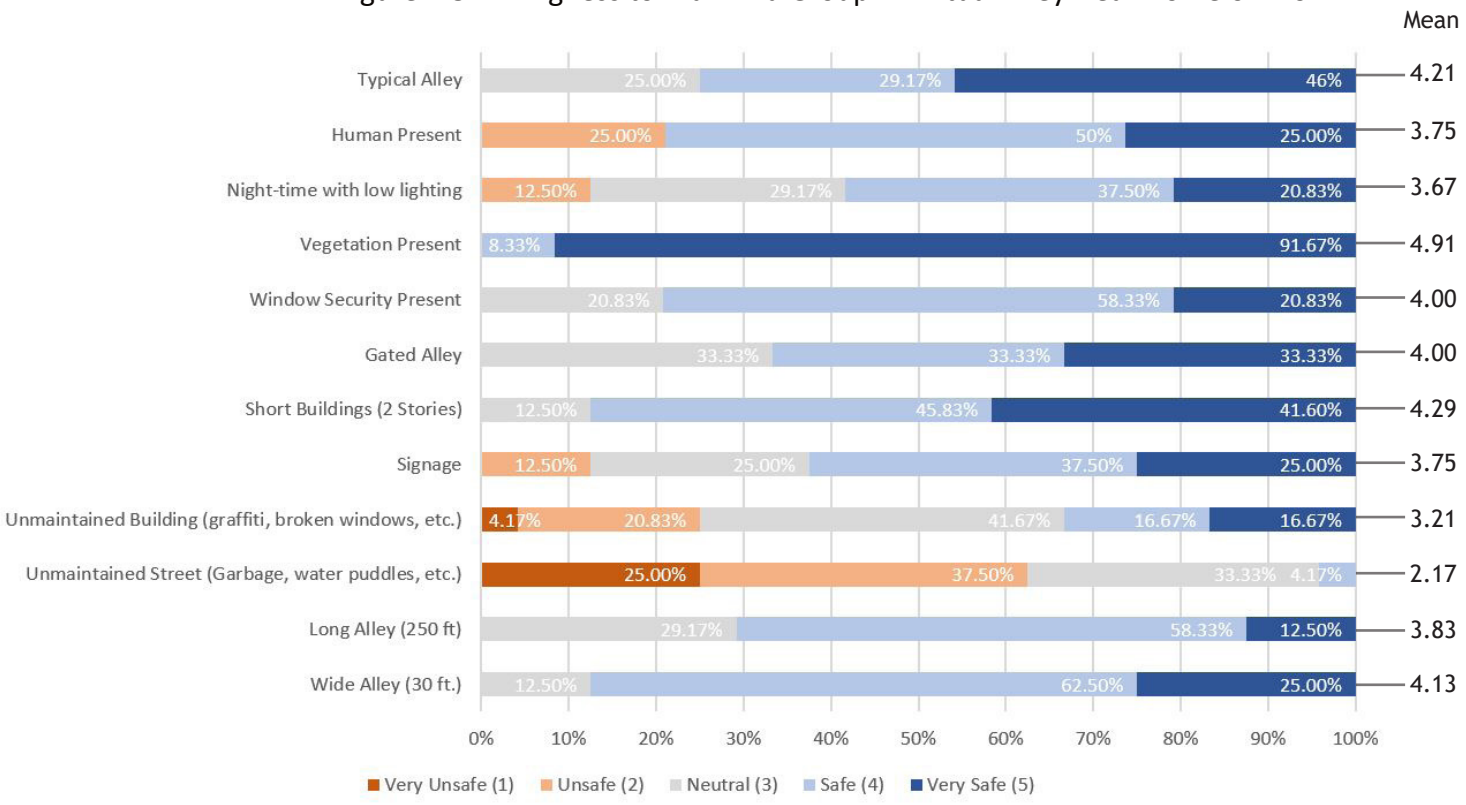
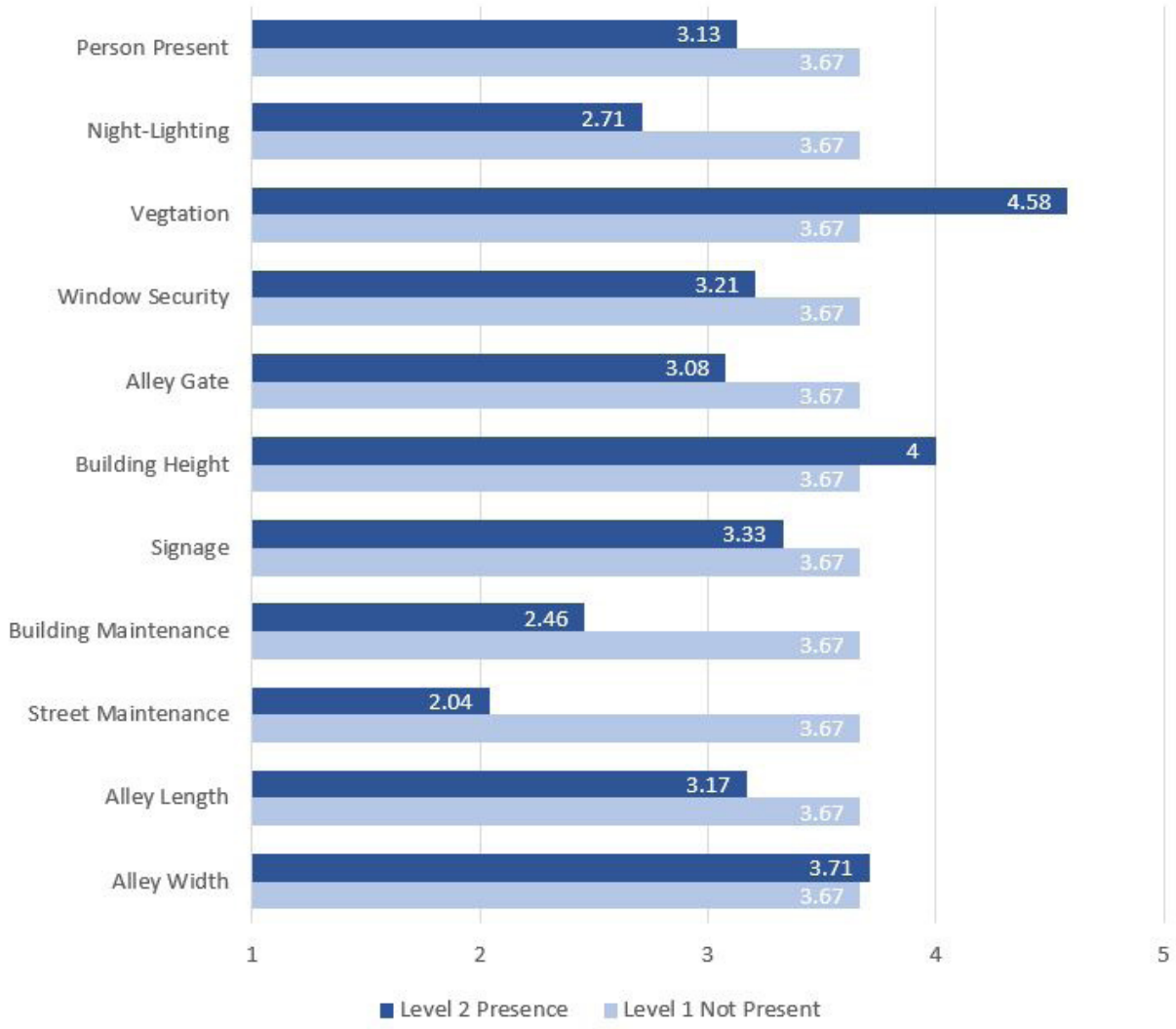


Figure 4.8 Willingness to Walk in a Group in Virtual Alley Near Home or Work



The lowest rated variable is by far the unmaintained street environment. This is consistent with the first module where 91% of subjects identify uncleanliness as a negative factor. The variable "building maintenance" also has one of the lowest safety ratings (2.42/5), despite having one of the widest range of ratings (see figure 5.4). This disparity comes from differing opinions of graffiti present. Many subjects note that the graffiti imply constant criminal activity, while other subjects believe that graffiti is the sign of culture and artistic expression. This sort of disparity is also seen in the presence of alley gating and window security. Some subjects feel safer knowing that the security measures are in place, while others think that its presence implies that the area is a bad neighborhood. These responses are preceded by Cozens and Davies study (2013) where it is determined that hard security measures like fences and gates create a negative effect on the social connections of the area.

Figure 4.9 Mean differences in safety situated between non presence and presence of variables



Each variable have two levels of measurement. Figure 5.9 shows safety ratings for both levels of each variable. The "typical alley" environment serves as the level one measurement for each variable. From the paired sample t-test using SPSS, it is reported that mean difference from seven elements were statistically significant. Street maintenance ($p<.000$), building maintenance ($p<.000$), vegetation ($p<.000$), lighting ($p<.000$), alley length ($p=.024$), building height ($p=.035$), and window security ($p=.031$) are all significant ($p<.05$). Street Maintenance (unmaintained), Building maintenance (unmaintained), and Lighting (night-time) have the widest negative mean differences between level 1 presence to level 2 presence.

Figure 4.10 Paired Samples T-Test Results

				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Width: Level 1 - Level 2	-0.416	0.93	0.19	-0.43	0.34	-0.223	24	0.825
Length: Level 1 - Level 2	0.5	1.04	0.21	0.07	0.93	2.402	24	0.024
Street Maintenance: Level 1 - Level 2	1.62	1.07	0.21	1.18	2.07	7.573	24	0.000
Building Maintenance: Level 1 - Level 2	1.21	1.15	0.23	0.73	1.68	5.236	24	0.000
Signage: Level 1 - Level 2	0.33	1.11	0.22	-0.12	0.79	1.508	24	0.145
Building Height: Level 1 - Level 2	-0.33	0.75	0.15	-0.64	-0.026	-2.236	24	0.035
Alley Gating: Level 1 - Level 2	0.58	1.44	0.29	-0.011	1.18	2.024	24	0.054
Window Security: Level 1 - Level 2	0.46	1	0.2	0.046	0.87	2.294	24	0.031
Vegetation: Level 1 - Level 2	-0.92	0.64	0.13	-1.18	-0.65	-7.16	24	0.000
Lighting: Level 1 - Level 2	0.96	1.02	0.2	0.54	1.38	4.699	24	0.000
Human Presence: Level 1 - Level 2	0.39	0.86	0.29	-0.27	1.05	1.375	8	0.206

This experiment is meant to answer the question: “What physical elements affect human perceptions of safety in urban alleys?” The most important outcome of these results is the significant impacts of vegetation, lighting, and maintenance (street and building) on the perceptions of safety. It was expected that lighting (especially at night), maintenance, and varying degrees of enclosure (height, width, length) would be some of the most important, focusing on concepts like prospect and identity. Another important observation to consider is the differences in perceptions before and during exposure to the VR environments. Subjects had a more negative perception of urban alleys before the experiment but improved once they were inside a “typical alley”. This reinforces the idea that while the space itself may not seem unsafe, negative experiences and other associations create an inherent negative identity of urban alleys. With the most important elements identified, a framework can be used to generate a guide towards safer design in urban alleys.

4.2 Design Framework

To improve safety perceptions of urban alleys, a design framework is needed. A framework is a guiding structure that organizes information to produce more effective decisions in design. The results from the virtual reality experiment and from past literature and projects in urban alley design will be used to build this framework. This can apply to either an individual design project for an urban alley or can be applied to an existing project that spans multiple alleyways. Figure 4.11 shows the flow of this framework and the process towards designing urban alleys. By using this process people will perceive them as safe areas for better access and activity in their communities.

The first step is to create overarching goals to be achieved through design. Other alley programs have various goals. Chicago's Green Alley Program aims to improve stormwater infrastructure and have cleaner, greener environments. The Integrated Alley Handbook for Seattle, Washington set its goals as improving quality of space, improving the health and image of the city, and creating safer environments. The goal of this study is to improve safety perceptions, so the design framework will have the goal of safety in addition to whatever individual goals that a design project or program already has.

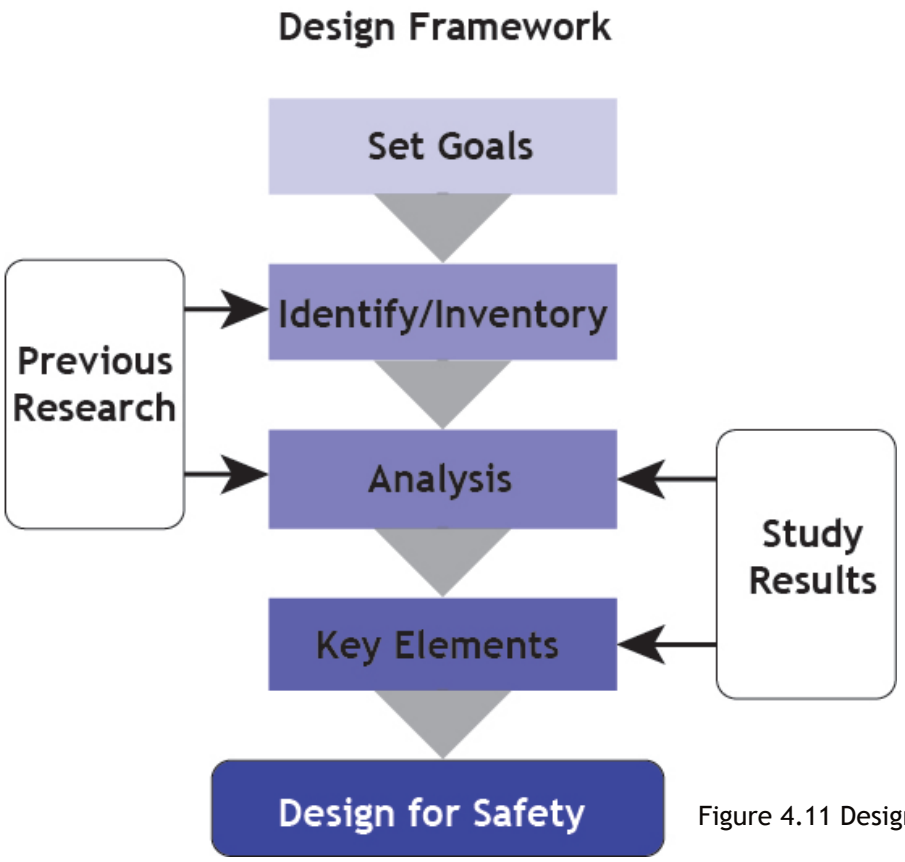


Figure 4.11 Design Framework Low Chart

Since the objective of this study is to improve the perception and activity of alleys, the next step of this study is to identify what kind of alley is being used. To begin with the process of creating safer perceptions, an alley needs to have its characteristics identified and classified. Types of alleys were determined previously in this study based on Seattle's *Integrated Alley Handbook* and will also be applied to this process for categorizing alleys and identifying their characteristics. This section includes identifying dimensions and physical characteristics of alleys. The results of the experiment in this study help determine what issues and opportunities are present in these characteristics. Identification of all safety issues or opportunities in the space is based on this study and previous research. Each alley has the primary role of maintenance and utility access, but many alleys will differ based on the surrounding context and inventory found in the previous step.

High Density: These alleys will require more changes compared to lower density environments to feel safer due to the high degree of enclosure. The higher density of buildings also indicates that more people will be using the space. Activity in these spaces should take advantage on the potential to increase surveillance on the space from outside the alley. High density projects should also focus on controlling light and shade at all times of the day, rather than just at night. (Figure 4.12)

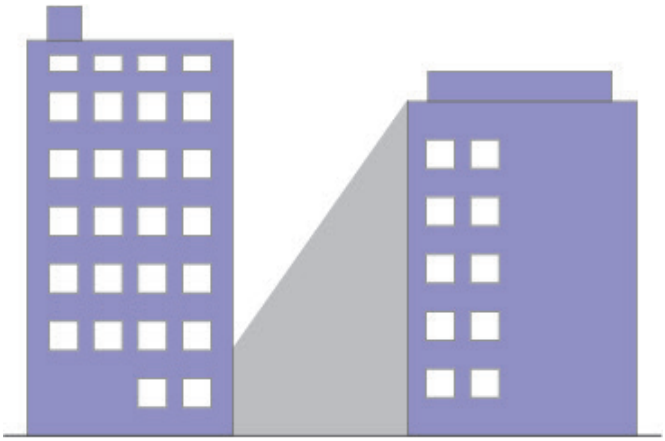


Figure 4.12 High Density Alley. These alleys are more shaded and have a high level of enclosure.

Low Density: Alleys in lower density areas were observed to feel safer due to the lesser degree of enclosure. This element should be key in attracting people and activity into the space. Adding vegetation such as trees will give more identity to the space while also adding an acceptable amount of enclosure. The lower density implies that less people may be using the space at any time, so increasing surveillance of the space is highly recommended if these sites are selected for use. (Figure 4.13)

Figure 4.13 Low Density Alley. These alleys have less shade and are more open.

Narrow Alleys: These spaces can be seen as either very personal and inviting, or highly enclosed and dangerous. To promote safety in these alleys, some of the most important factors to consider are lighting and keeping the narrow path clear of obstacles and debris. If the space is too full of activity and objects, whether it be trash and refuse or planters and seating, it can overwhelm the narrow space and cause discomfort even before entering the space. (Figure 4.14)

Figure 4.14 Narrow Alley. These alleys can provide access but little space for activity.

Wide Alleys: People typically felt safer in a wider alley since there is more room for surveillance and more space to move around. For these alleys, safety can be promoted by balancing parking with pedestrian activity. Wider alleys begin to feel like regular streets and tend to give the impression that pedestrians should not be in the space. (Figure 4.15)

Figure 4.15 Wide Alley. These alleys can provide more access for vehicles and social activity.

When addressing individual elements, there are some issues that are harder to modify than others. Figure 4.16 divides each element observed in this study into degrees of modification. For example, one of the biggest contributors to negative perceptions is the cleanliness and maintenance of the space. This can be addressed either locally by individuals who can easily clean the space on a regular basis. It can also be addressed through changing policies regarding how trash is handled within the space. Trash and cleaning services can visit more often, or trash can be better regulated in the space to reduce poor cleanliness practices. Other issues may need to be addressed by improving codes and policy through the city government or through other community organizations.

Some modifications are easy to implement and require no system to be upheld. Practices like cleaning or maintaining potted plants in the urban alley can quickly change its identity. Other modifications may be possible but may require the proper authority to implement. Installments lights or signage on adjacent buildings and property may require approval by property owners. For most alleys, there is little restriction on what can be altered so long as the existing necessary functions of the space remain (i.e. powerlines, utilities, maintenance vehicle access). These measures may not be altered by all community members and may require professional services to implement. There are some elements in this study that are more difficult or even impossible to modify. Since urban alleys are primarily service areas and secondary access, practicality is important to consider when selecting elements to modify. Using easier, more cost effective,

or more effective ways of improving the safety of urban alleys will contribute towards favoring urban alleys as potential active spaces.

Maintenance is one of easiest and most important elements to consider. Because of its ability to alter perceptions in urban alleys, each alley project should have a goal of general cleanliness and organization. This is an easily altered element if an alley is unclean. Volunteers and community members can clean an alleyway of trash but maintaining cleanliness consistently and over extended periods of time may fall to city regulations. Implementing small amounts of vegetation is also a highly recommended modification to urban alleys since vegetation is one of the highest rated elements from this study. Small plants are also easily accessible and can be maintained by locals or by public employees. Signage such as private property or parking restriction signs can be installed to deter any negative activity and is easily available.

Larger installments like lighting, gates, and other security measures may require approval of property owners or other stakeholders. Since lighting is one of the more significant elements from this study and past studies, it is another highly recommended alteration if lighting is identified as an issue. Alley gating and window security were not shown to have a significant effect on safety perceptions, but developers may still want to implement security measures. These modifications will require approval if the alley is privately owned and must ensure that the space can still fulfill any maintenance or utility services. Lighting

is the more significant element and, although it may be harder to implement, it can greatly increase the safety of an alley.

Although some elements can greatly affect perceptions of safety, they are also hard to modify in a practical manner. Specifically, dimensions of the alley are found to have some effect on perceptions, but modifying these dimensions implies the modification of the surrounding buildings. It is not practical to alter the buildings to improve a space in service to those buildings. Instead, to "alter" dimensions in a project would be to select alleys with the desired dimensions. This study finds that lower building heights can affect perceptions, so it may be recommended to switch to an alley surrounded by lower buildings to achieve the desired space. Another element that has a major effect on safety perceptions is vegetation, specifically trees present in the space. This element has one of the largest effects on perceptions but can be difficult to implement for several reasons. First, the presence of trees in urban alleys is much like that of street trees which can be difficult to maintain and can cause damage to infrastructure and foundations. Adding trees into urban alleys may prove difficult unless there is enough open space and light. Tree canopies are also higher maintenance to keep trimmed and away from powerlines. Despite its significant effect on safety perceptions, unless there are already trees present, it is largely impractical to introduce large vegetation like trees into urban alleys.

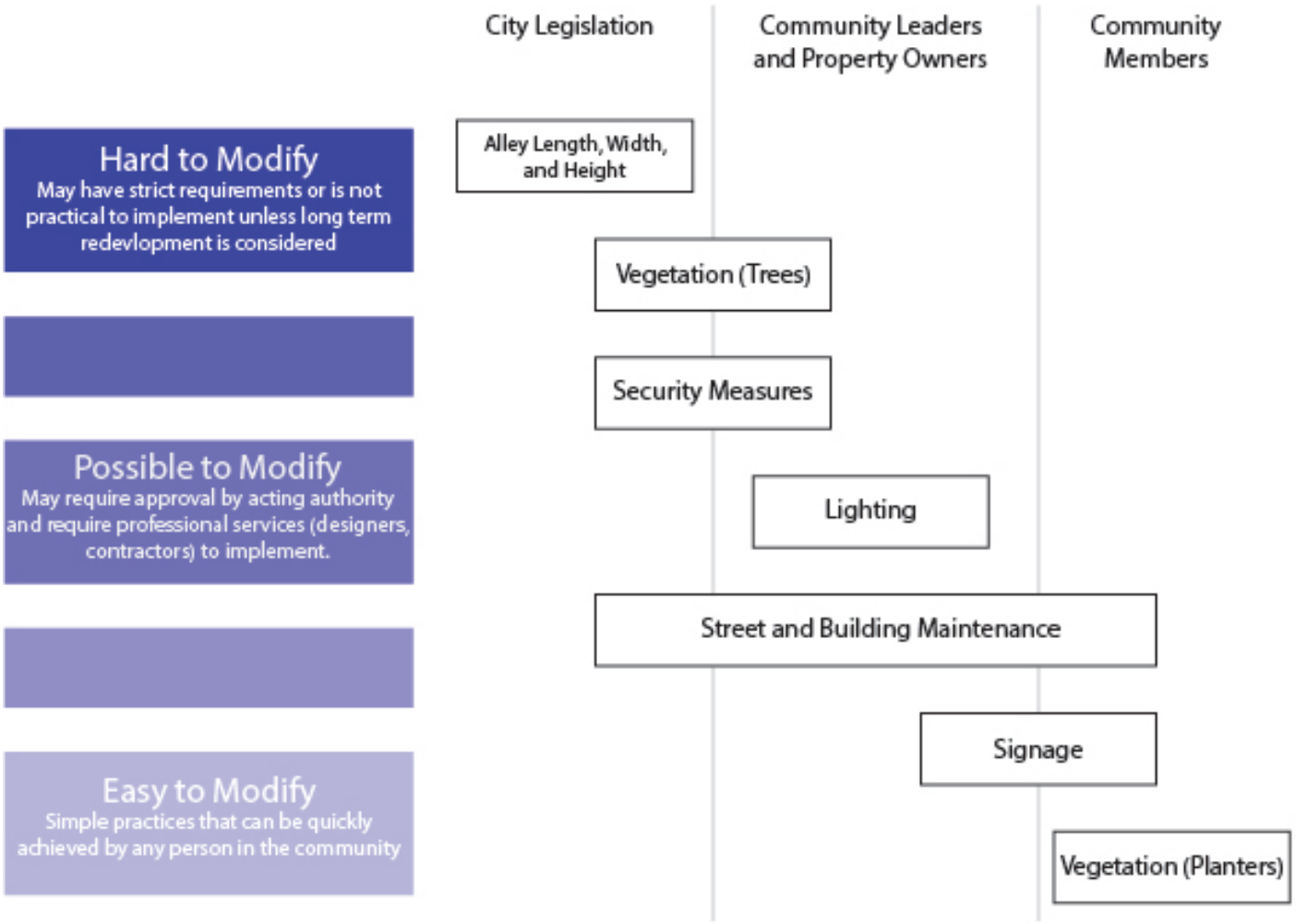


Figure 4.16. Modification chart. Some of the selected elements are diffiult to alter and there are various parties that can be involved in the process.

4.3 Practices to Promote

Promoting safe design is an important factor to consider when designing in urban environments. Urban alleys especially need be easily identifiable as a place where people can safely move through. The site selection is the first step towards ensuring the site feels safe. Altering the right elements based on the results found in this study is the next step towards making alleys feel and look safer for more community activity. This next section of the guideline takes the findings from the oral survey and virtual reality experiment to identify which elements are worth improving, removing, or changing to create safer urban alleys.

Promotion of practices can include a wide range of actions performed by different people at varying scales. Some might include policy changes for an entire city while some may be more focused to a specific site. Others may include interaction with residents or community organizations to better promote safety. A key framework will be established as an overarching guide for all urban alleys, but each alley will need different levels of care and assessment. Each element identified in the review and in the virtual reality session will also be addressed individually.

Through the results of the VR sessions and with the general feedback from the subjects about their initial perception, a framework that is applicable to all alleys can be created. Alleys should always still be able to accommodate for at least one maintenance vehicle. Not only do most cities require this detail, but it also helps prevent obstruction of passage for pedestrians. This is be less of a limitation for alleys with wider areas between buildings but will be a constant limitation for any alley since they are an important part of the city's street and maintenance system (See Appendix A).

Another critical factor for alleys is lighting. Many studies and organizations already acknowledge the importance of lighting to be able to see the space at night and prevent concealment of potential crime. This study finds that lighting is just as important to safety during the day. Alleys that are shaded are still considered less safe than alleys with natural lighting. Ensuring that the urban alley in question has lighting at all times will create a safer and walkable path.

In addition to maintenance access, alleys need to uphold the services they provide to the adjacent buildings, including trash disposal and building access (parking, loading docks, etc.). If an urban alley is redesigned, it must maintain the services that it provided to the adjacent buildings. What this guide focuses on is the organization and upkeep of these services so that people feel safer to move through the alley even with these typically unsightly/uninviting services present. Trash receptacles such as trash cans and dumpsters should be organized and limited to designated areas to prevent excess trash within the alley. Disorganized and dirty alleys were perceived as the least safe alleys through this study. Through city planning, communication with disposal services in cities, and through community organization, alleys can be kept clean and provide its usual services in addition to promoting walkability and safety.

Design Considerations

Once a site is properly analyzed the issues and opportunities can be addressed. The guidelines in this section are tied directly to past literature and the results of the VR experiment. The elements found in the study to be the most positive or negative influences can all be applied through the following concepts: walkability, lighting, safety and security, and enclosure. For each of these concepts, there are some significant positive and negative influences based on the results (Figure 4.17).

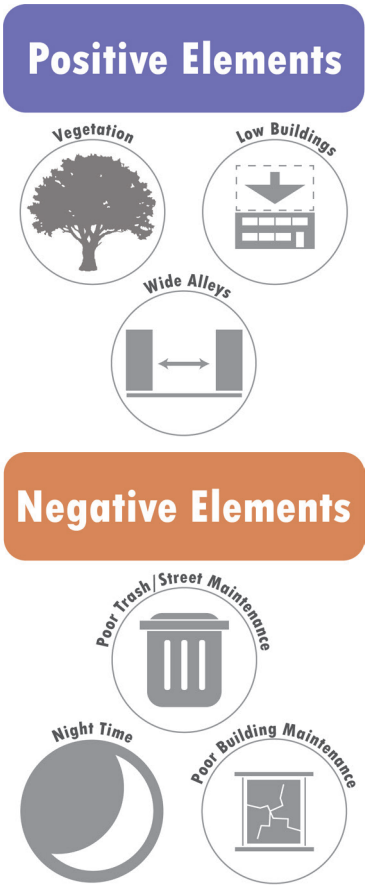


Figure 4.17 Influencing Elements. These elements are found to be the most influential factors towards perceptions and safety in this study.

Promoting Walkability: People should be able to walk freely without their path being obstructed. A good measure is to keep a path as straight as possible and to keep a width of 10 feet for both vehicle access and allow space for foot traffic. This can be achieved best by cleaning and repairing the existing materials. This can be addressed through consistent maintenance and wider alleys. While trash collection is necessary in many alleys, designating an area for it away from high activity areas and keeping trash areas well maintained will keep the walking space unobstructed and with less odor.

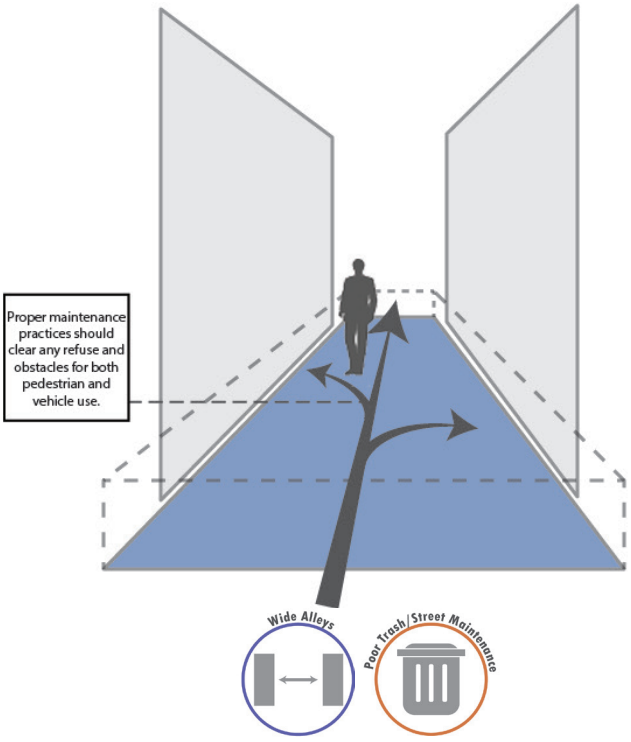


Figure 4.18 Walkability Diagram

More Lighting: Lighting makes a large difference in preference on different levels. Concealment of dangers and ability to see your surroundings (prospect) are the two main factors linking lighting to safety. Selecting alleys surrounded by lower buildings can reduce the amount of shadows being cast and have natural lighting as a key factor to promoting use. Having consistent lighting that illuminates the entire area is highly recommended for any alley. It is also important to avoid too much lighting at night to avoid light pollution. Light installations should be a minimum of 30 lux to ensure perceptions during the night are similar to daytime (Boyce 2000).

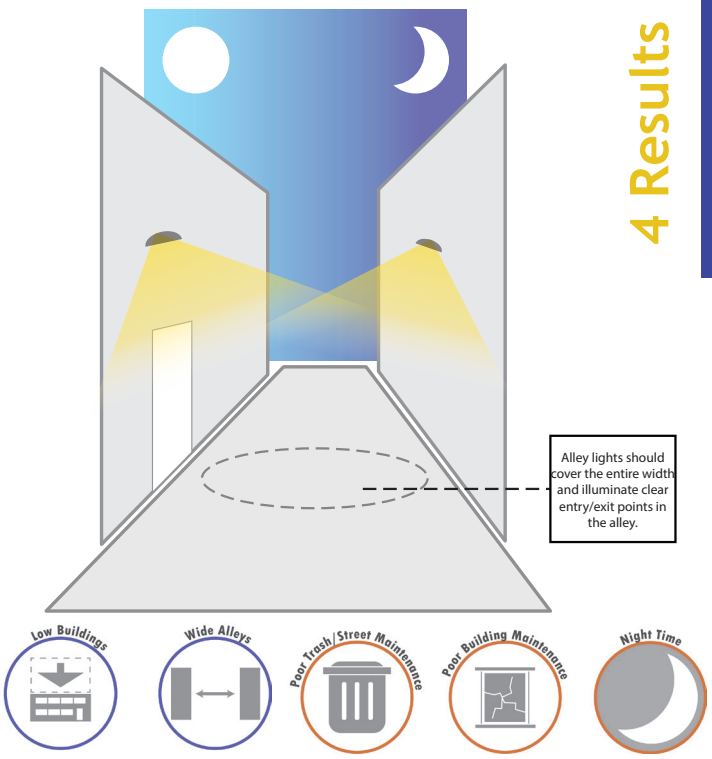


Figure 4.19 Lighting Diagram

Eyes on the Street: Security helps prevent crime but is often at the cost of sociability and walkability in the community (Cozens and Davies 2013). In this study, security measures such as window shutters and iron bars around windows gave an overall lower sense of safety. A greater sense of safety was found using signage and a greater sense of "presence" in the space. Alleys with more windows and a wider area can observed more easily from outside the alley. Proper maintenance of windows can also reduce the "broken window" effects and increase the "eyes on the street" effects with constant surveillance.

Figure 4.20 Eyes on the Street Diagram

Increased Greenery: Trees and vegetation can help reduce the feeling of enclosure and discomfort. Trees have a positive impact on safety perceptions so long as they do not block visuals through the space. Large trees may not be practical for many alleys, but small plantings such as flowers and shrubs can help both with visual preference and the removal of bad odors in alleys. Trees can be implemented if the alley allows enough space and can still perform its primary purposes. Shrubs and other vegetation should only be implemented if they do not increase the number of concealed spaces in the alley.

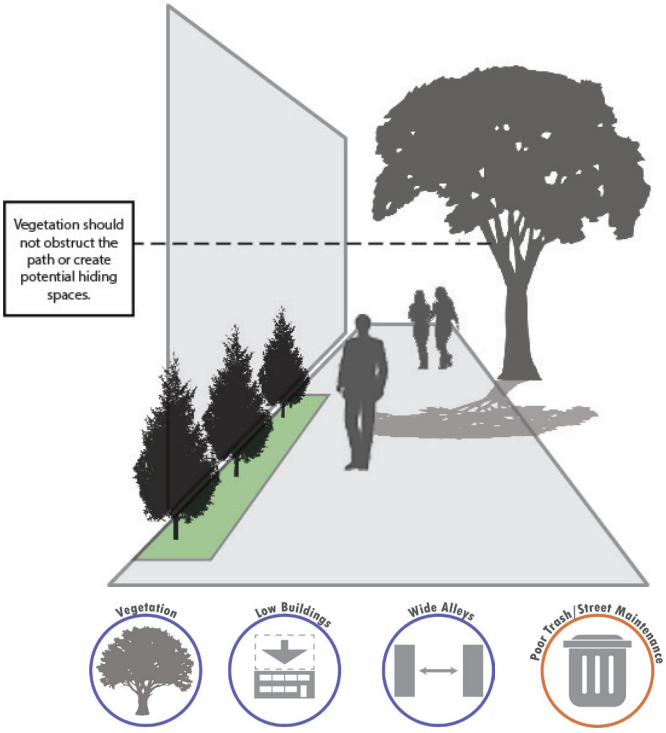


Figure 4.21 Increased Greenery Diagram

Altering the appropriate elements for each category will have the most effective results. However, analysis of the site (or sites) is the most reliable way to understand what the best options are for alteration. These guiding principles can be applied either to a single site or to a larger system. Programs already in service such as the Green Alley programs of Chicago and Los Angeles can evaluate their own designs based on these results and, if necessary, modify how they address some of the elements used in this study.

An example site was selected in downtown Kansas City to express some of the guiding principles used in this study. The site is located near popular nightlife districts and hubs like the Sprint Center. The alley is identified as a narrow (15 feet) commercial alleyway with low (1-2 story) adjacent buildings. Poor street maintenance and few streetlights are some of the most prominent issues. There is room in and around the alley for light and vegetation installations which could make people feel more comfortable in the space. Figure 4.21 shows a redesign of the alleyway that utilizes some of the principles of this study. This site has the potential to attract pedestrians to more commercial space and have safer connections to popular downtown areas.

Figure 4.22. Alley Redesign. A rendering of an urban alley utilizing some of the framework principles for safety.

4.4 Practices to Avoid

Negative perceptions can come from good intentions when considering safety measures. While some practices are used to prevent crime, they come at the cost of social activity. There are also practices that are effective at improving perceptions of safety but applying them too much could lead to worsening of perceptions. An example is the perception of human presence. While the implication of use in the space (signs, art, and some vehicles) can imply regular activation of the space, too much activity can overstimulate people in the space and create an “overcrowded” feeling in the alley.

Another potentially negative element is the use of security measures. The results of this study shows that security measures like fences and shutters can actually reduce the feeling of safety in urban alleys. The ‘fortress’ approach to security (i.e. using hard defenses such as gates, fences, barred windows, etc.) creates more definite security but comes at the cost of the implication that there is a high risk of crime occurring in that area. While this may be the case in some areas and the need for security is high, an effective, alternative way to promote “eyes on the street” through increasing surveillance among community members. Windows that look into the space (which are not closed by security shutters) increase the potential number of people that can see what is happening in the space at all times.

5

Conclusion

5.1 Key Findings

This study was meant to establish an understanding of safety perceptions and how to effectively improve it through the use of design and the environment. The survey questionnaire and VR experiment were both used as tools to gather data for analysis of perceptions and used for design decisions regarding safety. It was found that most people have a negative perception of alleys when not in that specific environment. However, when people are in the space, their perceptions of safety increase.

The primary question of this study is “What physical elements of an urban alley effect human perceptions of safety?”. This study finds that the elements most consistent in negative perceptions appears to be the presence of trash and obstacles on the path. It is also found that the element with the most positive perceptions is the presence of vegetation. Another factor that significantly improved perceptions is having lower building heights surrounding the alley.

These results are partially consistent with previous studies. Nasar and Jones (1997) report that vegetation has a positive effect towards mental health despite increasing lowering prospect in some instances. Some of the most prominent factors that affect safety are enclosure and prospect. Enclosure varies widely in its effects. Urban alleys that are wider and have lower buildings, two environments with a lower sense of enclosure, were typically seen as safer spaces.

On the other hand, higher enclosure that came from tree canopies and overhead signage often yielded higher safety ratings as well. This confirms that trees and vegetation can decrease stress in an environment and increase social capital (Holtan et. al 2015; Kaplan 1989), despite increasing enclosure and potentially increasing the degree of concealment in the space.

The other considerable factor is the presence of other people in the space. Expectedly, people are more willing to walk through urban alleys with a group of familiar people as opposed to walking through on their own. Many people stated that they felt safer when there was an “implied presence” of people in the space. This is most prominent in the data for the variable “complexity”. Signage, vehicles, and organized trash receptacles typically are identified as positive correlates to safety in the VR experiment of this study because thes can make the space ‘feel like it was used’. However, some may have opposite opinions about these factors because they feel that the “implied presence” is more negative. Many subjects noted that if people were in the space, they would definitely avoid the space entirely. Perceptions of human presence depend greatly on familiarity but also on implication of use. The t-test in this study shows that some changes to elements have more of an impact on safety perceptions than others. Those that have more significant impacts, such as vegetation and building maintenance ($p=<.01$), can be used to greater effect in design interventions than others.

5.2 Discussion

There are several limitations in this study. There are challenges with compiling all information and selecting independent variables since there are many different elements of the physical environment and various ways other factors affect the physical environment. For the plysical element selection, many of them such as lighting, dimensions, and vegetation had expected outcomes based on previous research. Other variables such as building maintenance and alley gates had much more controversial results than expected. Some subjects felt they were positive elements while others felt they were negative based on different reasonings. The design guidelines made from this data will be valuable for those wanting to improve safety in their communities or for promoting the use of urban alleys. The significant factors to consider are the presence of vegetation ($p<.000$), maintenance practices of both the street and the buildings ($p<.000$), lighting ($p<.000$), alley length ($p=.024$), height ($p=.035$), and window security ($p=.031$). Some of the variables with the widest range of perceptions are security, night lighting, and human presence.

Enclosure has different applications in this study, and subjects reacted differently to each one. Enclosure through the dimensions of the space (i.e. taller buildings, narrow alleys, longer alleys) had lower ratings as subjects felt more trapped and had less room to move. Enclosure created through elements

like signage and tree canopies were seen as safer spaces. While high canopies can create more enclosure, it does not prevent sightlines through the space. Numerous studies have also found that vegetation, in general, will create less stressful environments (Kuo and Sullivan 2001).

Maintenance of the space appears to be a major factor for safety perceptions. Trash and water that blocked the path were both major indicators of unsafe conditions. A number of comments from subjects is the that the smell of the alley would contribute to their decision of whether to walk through if there is an abundance of trash. While this study is unable to properly collect data on how odors contribute to safety perceptions, many subjects indicate that it would be the first thing they notice and would actively avoid when walking. Another interesting factor regarding maintenance is the general perceptions of graffiti. While some see it as an indicator of crime and felt uncomfortable, there are others that feel no danger at all and still others who enjoyed the graffiti as street art. Overall the safety rating is lower than the base alley, but it is interesting to see the wide range of opinions on a single element of the physical environment.

Other variables have a wide range of responses that influence design decisions. Gating alleys and other security measures also have mixed results stemming from different reasons. Gating is seen negatively when subjects are more concerned with enclosure and entrapment but is seen more positively when subjects consider the security of the adjacent buildings. Window shutters and bars on windows are typically seen as either excessive “fortress” methods of hardening the target buildings, but are seen by others as a clean, secure space with no criminal activity. Further analysis will be taken to determine what other factors should be considered in these results.

5.3 Limitations

As stated above, this study does not fully address the numerous other elements that may affect human perceptions and behavior in urban alleys. One of the most prominent limiting factors is the restriction of data collection on all senses (taste, feel, smell). Virtual reality is a remarkable tool for providing visual and auditory senses in a realistic way, but cannot extend the realistic environments to the other senses. The sense of smell especially is a large factor for some subjects regarding any trash present in the environments. Most subjects simply speculate about the smell which may have influenced their answers to the oral survey. There are some other technical issues that took away from the "presence" that VR can offer, but overall, subjects reacted to the environments as they would in a real urban alley.

This study also does not observe factors like materiality, public art, or specific alley programs. Material changes, such as pavement choices and building materials, may further indicate the quality of space similar to maintenance practices. Public art is also not observed in this study due to limitations of the software used, although it may be a sign of activity and culture in alleys. These factors were not included because their presence is not as frequently observed in urban alleys as the elements selected in this study, although this may be due to an error in the literature review.

The presence of people in and around these environments was a factor to observe based on the literature review but was difficult to implement in the environments without breaking the sense of realistic “presence” in the environments. With more training with the software and a longer time frame this factor could be further pursued. For this study, perceptions regarding other people within the space was limited to two of the oral survey questions (would you walk through here with a group of people?), and indication as an important factor in the first module. This method does not address the presence of people unknown to the subject or any other indications of movement or activity in the space. Another limiting factor to consider in this study is the small number of subjects. A small sample size of this study may result in the lack of statistical representation of the results. While the study still has only twenty-four subjects, having more data could have provided more significant conclusions.

Overall, this study is effective in the data collection sought by the researcher. The data was enough to create analysis of perceptions regarding the elements and to form a design guide for safety. Further research might include implementing this design framework into an urban site and recording perceptions of the application. It would also be interesting to expand this research and this method of questionnaire to communities that actively use urban alleys. This study focuses on general perceptions of alleys and looks to a random volunteer sample for information. Comparing that information to subjects that live in and use urban alleys consistently would yield further results and improve the design framework that came from this data.

5.4 Future Research

This study focuses on the analysis of human perceptions and using that information to develop a guideline for safety design. This information could be applied to the many organizations and other guides that address designing in alleyways. This can improve the effectiveness of each design regarding practical use and effective measures against crime and avoidance behavior. The application of this guide is directed towards alleys in urban environments, but there are some aspects that can be applied to walkability in cities, safety in neighborhoods, and alley design in more suburban environments.

There are many other aspects of the physical environment that were not observed in this study. The material type of buildings, pavements, and other elements in urban alleys may contribute to implied quality of maintenance, activity, and safety. While this study looked at maintenance of these materials such as the presence of graffiti, a similar element to observe would be art and decoration. There were small indications of the influence of art through subject observations and notes. Some subjects related the presence of graffiti to art and culture, which generated a division in opinions regarding building maintenance. Further exploring the physical presence of installed art could introduce more ways to implement community engagement and improve feelings of safety in urban alleys.

Future research could also identify which cities in the U.S. would be good locations to test the guiding framework in this study. Cities that lack public spaces and parks, could be good candidates for increased urban alley activity. Cities with high crime rates could also be good candidates for alley modification since this study focuses on safety and activation of public space.

Other research to consider would be to continue this study by further analyzing the elements in a factorial study. Analyzing combinations of the highest rated (vegetation, low buildings, wide alleys) and lowest rated (poor street and building maintenance, night time) could observe possible changes in perspective to individual elements (i.e. are trees still a positive factor in a poorly maintained alley?). The key findings of this study provide preliminary results and insights, and more importantly, help outline a more rigorous experimental design, promising a higher statistical power.

Since this study focuses on initial data collection and the design guideline, future research to pursue would be to directly compare this data to perceptions of the designs used in this guideline. This research will further analyze the effects of physical changes to the perceptions of the space. This method could also be applied to implementations of other alley programs to understand how communities feel about the safety of their local urban alleys. The survey questionnaire developed for this study is useful for analyzing both previous perceptions of safety and reactionary perceptions.

While this study focuses on human perception and behavior, it is linked to the field of landscape architecture by its goal to increase outdoor activity among urban communities and revitalizing the urban core of cities. The redesign of urban alleys can also tie into ongoing street designs to further connect communities and amenities. The framework resulting from this study can also be applied to either large scale alley plans and existing alley designs to further improve public spaces.

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Figures

Figure 2.7. Green alley design concept. National Association of City Transportation Officials, Author. Urban Street Design Guide. 2013. Print.

Figure 2.8 Art alley in kansas city. https://onthegrid.city/kansas-city/crossroads-district/art-alley

Figure 2.9 Los angeles green alley institution. The Trust for Public Land. Green alleys. 2018 [cited 2/6 2020]. Available from https://www.tpl.org/green-alleys.

Figure 2.10 Post alley in seattle washington. Brooke, I. 2015. Post alley.

Figure 2.11 Alley map - los angeles. https://geohub.lacity.org/datasets/alleys/data?geometry=-118.410%2C34.012%2C-118.149%2C34.061

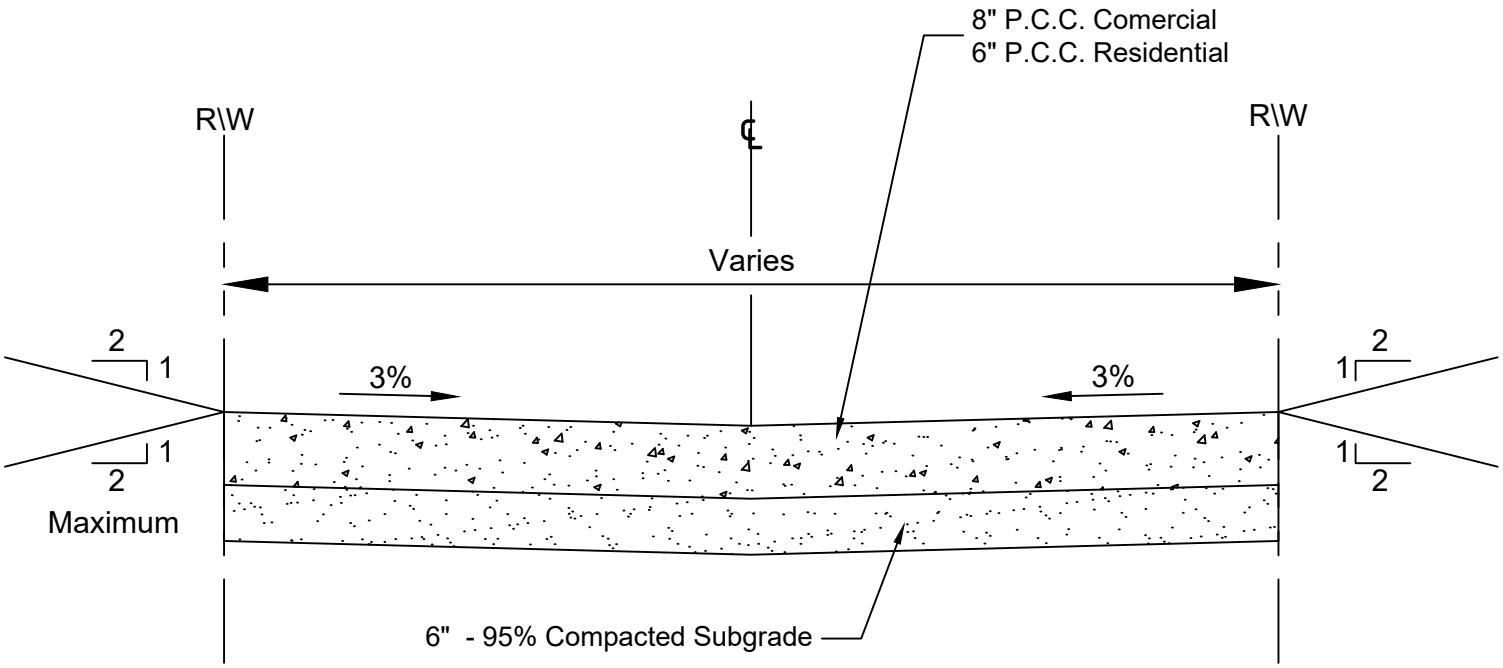
Figure 2.12 Alley map - Chicago. http://interactive.wbez.org/curiouscity/alleys/?_ga=2.256685837.727160777.1581311129-1746387081.1581311428

Figure 2.15 Gated alley. Davis, P. 2008. Gated alley.

Figure 2.16 Window security shutters. Hand, L. 2005. Blind shutters.

Appendices

Appendix A: Typical Alley Section



PORTLAND CEMENT CONRETE ALLEY SECTION

NOTES:

1. MIX design of P.C.C. shall be Per Section 2208.2
2. Transverse contraction joint shall be spaced at intervals equal to the width of alley. If the alley is 15 feet or greater in width, a lonqitudinal contraction joint shall be constructed at the ℄ of the alley.
3. Expansion joints shall be constructed at each end of the alley and at each abutting driveway.
4. Drainage structures may be required if determined by the City Engineer.
5. Where the alley intersects with a street, a driveway approach shall be constructed in accordance with the appropriate standard drawing.
6. Where needed, handicap ramps shall be constructed.

KANSAS CITY MISSOURI

ADOPTED

Director of Public Works Date

Entry No.

Kansas City, Missouri
Public Works Department
Engineering Division

TYPICAL ALLEY SECTION

STANDARD PLAN

AS-1

Appendix B: Survey Consent Form

Improving Perceptions of Safety in Urban Alleys

My name is Marcos Aleman, I am a graduate student with the department of Landscape Architecture and Regional & Community Planning here at Kansas State University. This survey is part of my Master's research, entitled "Improving Perceptions of Safety in Urban Alleys". This project aims to answer two research questions:

(1) What elements in an urban alley affect your sense of safety?

(2) How does changing elements of the alley improve its social and functional use?

This study will ask you to look at different virtual environments (VEs) by using a virtual reality (VR) headset. While observing these VEs, I will ask you to answer questions based on your personal experience with alleys and your experience with the VEs you look at. Your participation in this study will help us in creating safer environments and communities in settings like Kansas City. Participation in this study should take about 15-20 minutes to complete.

The events of your participation and your answers in the survey will be kept confidential. Your participation is completely voluntary, and you can choose to stop participating at any time without penalty. If you have any questions about this study, please contact me at maleman@ksu.edu or 913-575-1635.

Thank you for your participation!

Questions about the activity or the survey can be directed to:

Marcos Aleman, Graduate Student
Master of Landscape Architecture
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Terms of participation: I understand this project is research, and that my participation is voluntary. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which I may otherwise be entitled.

I verify that my signature below indicates that I have read and understand this consent form, and willingly agree to participate in this study under the terms described, and that my signature acknowledges that I have received a signed and dated copy of this consent form.

PARTICIPANT NAME:			
PARTICIPANT SIGNATURE:		**DATE:**	

Appendix C: Survey Questionnaire

MODULE 1: Survey Questionnaire on Safety Perception in Urban Alleys

Please fill out the following information about yourself.

1. Age: _____

2. Sex: Male ( ) / Female ( )

3. At K-State are you: Undergraduate Student / Graduate Student / Faculty and Staff

4. What college are you associated with? College of _____

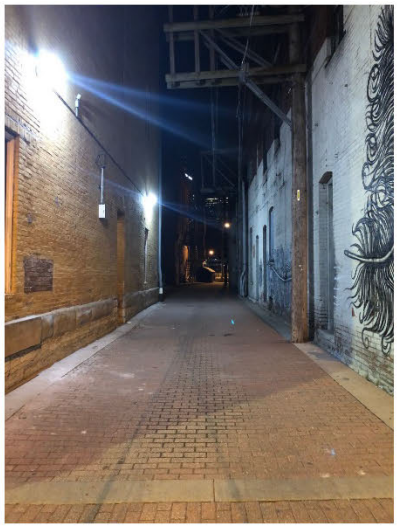
5. How safe do you think urban alleys are, in general?

Very Unsafe	Unsafe	Neutral	Safe	Very Safe
☐	☐	☐	☐	☐

WHAT IS AN **URBAN ALLEY**?

An urban alley is a narrow passage between two buildings in a dense city environment (e.g. Kansas City, Chicago, Los Angeles). An urban alley can be used for many reasons such as parking, trash collection, and back access into the surrounding buildings. The following images are all examples of an urban alley.

Examples:



6. Do you, or have you lived in a city/neighborhood with alleys? Yes No

7. Have you ever felt unsafe when you passed by or walked through an alley in a large city? Yes No

8. Have you ever been in, passed by, or walked through an alley in a city (e.g. Kansas City, Wichita, Chicago)? If so, please describe your experience.

8. The following questions are about your perceptions on crime safety in urban alleys. (on a scale from 1 to 5, where 1 is 'Strongly Disagree' and 5 is 'Strongly Agree')

Safety from crime in an urban alley	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
1) Alleys have good lighting at night.	☐	☐	☐	☐	☐
2) People in the alleys can be easily seen from outside the alley.	☐	☐	☐	☐	☐
3) I see and speak to other people when I am walking in alleys	☐	☐	☐	☐	☐
4) There is a high crime rate in alleys	☐	☐	☐	☐	☐
5) The (potential) crime rate in alleys makes it unsafe to go on walks alone during the day	☐	☐	☐	☐	☐
6) The (potential) crime rate in alleys makes it unsafe to go on walks with others during the day	☐	☐	☐	☐	☐
7) The (potential) crime rate in alleys makes it unsafe to go on walks alone at night.	☐	☐	☐	☐	☐
8) The (potential) crime rate in alleys makes it unsafe to go on walks with others at night.	☐	☐	☐	☐	☐

9. The following questions will ask your thoughts about negative factors and possible environmental changes for enhancing safety perceptions in urban alleys. What are the most important factors and changes to be considered? Check all that apply in BOTH columns.

The following questions ask your thoughts about negative factors and possible environmental changes for enhancing safety perception in urban alleys. What are the most important factors and changes to be considered? Please check all that apply.

(Check all that apply from **BOTH columns**.)

Negative factors: *related to safety in alleys*	***Positive* changes:** *new or improvements:*
❑ Adjacent buildings conditions (e.g. broken windows, dirty walls)	❑ Gate closure ❑ Signage ❑ Lighting
❑ Alley width (e.g. too narrow, too wide)	❑ Canopy (Trees overhead)
❑ Poor drainage (e.g. water puddles, mud)	❑ Surveillance system (cctv)
❑ Trash containers ❑ Garage doors	❑ Nearby public space (parks, plazas, etc.)
❑ Poor paving maintenance (e.g. potholes, cracks)	❑ Cleanliness of streets
❑ Uncleanliness (e.g. garbage, broken glass, dirt/debris)	❑ Cleanliness of buildings
❑ Building heights	❑ Plantings (potted plants, flowerbeds, etc.)
❑ Building use	❑ Outdoor Furniture (benches, tables, etc.)
❑ Odors /smells	❑ Pavement improvements (new/different pavement)
❑ Graffiti	❑ More windows on the adjacent buildings
❑ People present (e.g. strangers, homeless, other)	❑ Access to the adjacent buildings (Doors, etc.)
❑ Others:_____	❑ More service access
❑ None of the above	❑ More people present
	❑ Others:_____
	❑ None of the above

Appendix D: Oral Survey Script

MODULE 2: Oral Survey Session Using Virtual Reality (VR)

Script for Oral Survey

"For this next portion of the study you will use this virtual reality headset for about ten to fifteen minutes. During that time, you will be put into different virtual representations of an alley. Each environment is the same space but with a few adjustments. I will give you some time to observe your surroundings and then I will ask you some questions about the experience. I will let you know when it is time to move on to the next version of the environment. Please provide information to your comfort level and if you choose not to answer or have no answer, please respond with 'no answer'. A reminder that you can stop participating at any time for any reason without penalty. We can start whenever you are ready."

"For the following questions, I will ask you to give a rating on a scale from one to five for safety. A one rating is considered 'very unsafe' and a five rating is considered 'very safe'. A 3 rating will be considered 'neutral'. For others I will ask you about your likeliness to do something in this alley."

An example of a variant of the virtual reality environment

Questions for oral survey for each VR display

For each environment the following set of questions will be used.

Q1) On a scale from one to five, how safe do you think this alley is?

Q2) On a scale from one to five, how likely are you to walk through this alley alone?

Q3) On a scale from one to five, how likely are you to walk through this alley with other people?

Q4) On a scale from one to five, how likely are you to use this alley if you lived or worked in a building next to it?

Q5) On a scale from one to five, how likely are you to use this alley with other people if you lived or worked in a building next to it?

Appendix E: IRB Approval Letter

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Dr. Hyung Jin Kim
Landscape Architecture/Regional and Community Planning
1102 Seaton Hall

Proposal Number: 10038

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: 02/03/2020

RE: Proposal Entitled, "Improving Safety Perceptions of Urban Alleys"

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written – and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §46.101, paragraph b, category: 2, subsection: ii.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.