The Design and Testing of a Student Prototyped Homeless Shelter

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ABSTRACT

On any given night in 2015, over 500,000 people were homeless and 31% of them slept in unsheltered locations. Given the seriousness of this situation, the purpose of this research study was to test a student prototyped, portable shelter with six men who were homeless. Qualitative interview questions were developed by the research team. Six, open-ended questions for baseline interviews and 11 open-ended questions were used after the men slept in the shelter for two nights. The men ranged in age from 25 to 56 years and had been homeless for 1–5 years. Two of the men were African American and four were Caucasian. Several themes emerged from the data collected: dignity, safety, security, control, privacy, and portability. While the research team thought that carrying the shelter on your back was a novel idea, none of the men liked this design feature. The majority of men carried backpacks and stated that individuals who are homeless would not carry the shelter, rather they would hide it. Dignity also became an issue, as these men did not want to advertise their homeless condition by carrying the shelter. Safety and security from the "law," "animals," and "other homeless" people were other concerns. All of the men liked the privacy and control the shelter provided as it allowed them to eat, sleep, and talk on their cell phone when they wanted to. Giving these men a voice and allowing them to actively sleep in the prototype gave the research team a better understanding of design suggestions needed for portable homeless shelters.

Introduction

He pushes his shopping cart along the crowded streets of the city. Everything he owns is in that cart. It's dark and getting late, so he lays down on the concrete ledge of a planter with his torn, down coat and sleeping bag. This will do … …..this will do (personal observation, December, 2015).

The observation above, along with volunteering for "To Our House," an organization that houses homeless men during the winter months, inspired my interest in the homeless condition. Through these experiences, I witnessed numerous men who had nowhere to sleep. To address this problem, I had interior design students in sophomore studio divided into groups to design and prototype portable homeless shelters as part of their class requirements. One group's design met much of the criteria found in the student-generated information gathering: it was portable (Howard, 1990; Lurie & Wodiczko, 1988), easy to set up, low in cost (Alter, 2008), and weatherproof (Walburger, 2006; Young, 2010). Once the class project was complete, I approached this student group and asked if they would be interested in further reiteration of the design and testing of the prototype on the homeless. The group agreed to the challenge. In this paper, we present an exploratory study where the group of students designed, built, and tested their portable shelter on a sample of homeless men to address the growing needs of the unsheltered. It is important to note that this paper does not include the teaching, learning, or pedagogical approaches to the class project. Rather, the focus is on the design and testing of the shelter generated by the student team.

The Plight of the Homeless

It is five degrees and 1am in the nation's capital. A homeless man under a blanket is found frozen to

Even though prototypes of portable, homeless shelters exist, as noted above, documentation on what the homeless think about these prototypes is slim.

death (Keyes, 2014b). In the richest country on earth, this is not uncommon as the United States has one of the highest homeless rates among developed nations, and each year, 700 people die from hypothermia (Agans et al., 2011; Keyes, 2014a; Shapiro, 2012). Recently, two people froze to death just two miles away from the White House (Keyes, 2014a). While more than 700,000 total beds in emergency shelters (ES), safe havens, and transitional housing exist, there are a number of reasons why some homeless choose to live on the streets (Henry, Shivji, deSousa, & Cohen, 2015; National Alliance to End Homelessness, 2015). A fear of contracting parasites or a disease; incompatibility with work hours; danger of rape, assault, or theft; inaccessible accommodations for the disabled; an invasive check-in procedure; drug addictions; mental illness; crowding; noise; and a lack of privacy and control are all reasons why some homeless do not seek shelters (Hartman, 2013; Miller, 2013; Neale & Stevenson, 2013; Pable, 2012; Shapiro, 2012; Shay, n.d.). But, the number one reason is the lack of available beds (National Alliance to End Homelessness, 2015; Shay, n.d.). In fact, in 2014, the total homeless population exceeded the number of beds by 153,544 (National Alliance to End Homelessness, 2015; The National Law Center on Homelessness & Poverty, 2014). Everyone deserves a place to call home, even if it is temporary (Zhang, Phillips, Balikian, Venkataramanan, & Morales, 2014).

Designers have experimented with basic-shelter needs for the homeless since the 1980s (Alter, 2008; Lurie & Wodiczko, 1988), and the challenges are great: (1) the housing must be moveable, (2) the materials must resist the elements, (3) the shelter needs to be cost effective (Alter, 2008), and (4) the home should preserve dignity and privacy (Pable, 2012). Based on these needs, a number of prototypes of temporary shelters have been designed (Howard, 1990; Lurie & Wodiczko, 1988; Walburger, 2006; Young, 2010), but only Lurie and Wodiczko (1988) attempted participatory design by discussing their solution with the homeless.

Participatory design is an approach where stakeholders are involved in the design process to ensure that the product, service, building, etc. meet client needs and are usable (Krikac & Ryan, 2014). With participatory design (also termed codesign), individuals who have a vested interest in the problem have a voice. Instead of designing *for*, there has been a shift to designing *with* (Krikac & Ryan, 2014; Sanders, 2002; Wang, Vaux, & Xu, 2014). Even though prototypes of portable, homeless shelters exist, as noted above, documentation on what the homeless think about these prototypes is slim. The current model provides designed prototypes without feedback from the homeless. As noted by Pable (2015, p. 247),

> *In the case of creating built environments to accommodate the homeless, a deep understanding of the lived experience of being homeless is critical to crafting an effective design response....As designers, we cannot casually observe or just gather information about the homeless, we have to listen to their stories and need their feedback.*

Literature Review

In this section of the paper, an overview of how many individuals are homeless, the problems with homeless shelters, and homeless shelter design are discussed. What is important about the literature below is that people "opt" out of the system and intentionally live on the streets (Wallerstein, 2014, p. 22), reiterating the need for portable shelter designs.

Demographics of Homelessness

While the homeless rate is difficult to determine, more than 500,000 people were homeless one night in January, 2014 (Henry et al., 2015; National Alliance to End Homelessness, 2015), and an estimated 3.5 million people may experience homelessness in a given year (Henry et al., 2015; National Coalition for the Homeless, 2009). The majority of homeless use some type of shelter (including missions, churches, shelter buildings, hotels, motels), but 31% of the

homeless population live on the streets or in "other places not meant for human habitation" (National Alliance to End Homelessness, 2015). Fortunately, the number of unsheltered homeless individuals has declined by approximately 11%, yet the face of homelessness has changed. While most homeless are still individuals, families and children have entered the landscape (Hoag, 2013; National Alliance to End Homelessness, 2015). Among individuals who are homeless, most are male (Toro, Hobden, Durham, Oko-Riebau, & Bokszczanin, 2014; Wasserman & Clair, 2010). This is especially true for the street homeless. Relatively few women and children live on the streets due to the availability of formal services.

In order to help, emergency and transitional shelters—along with permanent supportive housing and re-housing programs—provide sleeping facilities for people experiencing homelessness (National Alliance to End Homelessness, 2015). Emergency and transitional shelters (e.g., missions, churches, hotels, and motels) do not follow the same procedures when it comes to access. Some are first come-first serve, where the individual leaves for the day to return to claim a bed, while others offer a bed for a specified period of time. Even greater restrictive access occurs at shelters (typically churches) that provide housing only during extreme cold (Henry et al., 2015; National Alliance to End Homelessness, 2015). While the number of permanent supportive housing options and ES' has increased by 59% and 18%, respectively, there is still a shortage of beds. From 2007 to 2014, the total homeless population exceeded the number of beds by 150,000–200,000 each year (National Alliance to End Homelessness, 2015). The system has the capacity to house 73% of all people who are homeless, but "geographic and population mismatches" occur, preventing many individuals from obtaining a bed (National Alliance to End Homelessness, 2015, p. 55; The National Law Center on Homelessness & Poverty, 2014). With 31% of homeless individuals living on the streets and a lack of available beds in homeless shelters, there is a clear need for other viable housing solutions for the unsheltered.

Problems with Homeless Shelters

Even though the majority of individuals who are homeless seek ES help, many choose to live on the streets due to perceived absence of dignity experienced at some shelters (Finley, 2003; Hoffman & Coffey, 2008; Miller & Keys, 2001; Pable, 2012). Dignity is defined as a sense of self- or inner worth (Miller & Keys, 2001, p. 332), and some homeless shelters have a number of features that can lower self-esteem. Miller and Keys (2001) conducted qualitative interviews with 24 homeless men and women who received services at a nonprofit organization called Inspiration Café. Receiving care, support, encouragement, personalized service, resources for self-sufficiency, opportunities in the community, a sense of belonging, and being treated like a human being were cited most frequently as a way to be treated with dignity. Experiences and conditions that violated dignity included being treated like a child or animal, having no individual identity, being ignored or yelled at by staff, arbitrary and excessive rules, unfair treatment, poor services, a lack of resources for basic needs, and a negative physical setting.

Hoffman and Coffey (2008) found similar results in their transcribed interviews with more than 500 homeless individuals living in ES' in Portland, Oregon. A total of 44% of the respondents stated disrespect from staff interactions. Many participants noted they were treated like children, a number, or trash. Thus, dignity, individual identity, and humanization were absent from many of the shelters, causing some to opt out of the system and live on the streets (p. 213).

Another problem associated with homeless shelters is regulations that can lead to institutionalization (DeWard & Moe, 2010; Hoffman & Coffey, 2008; Miller & Keys, 2001; Mulder, 2004; Wallerstein, 2014). Institutionalization is defined as regimented rules that can "erode" the individual's "self-concepts" (Mulder, 2004, p. 140), and Goffman (1961) suggests that total institutions (an isolated system whose primary purpose is to control individual's lives) are based on a system of hierarchy and power (DeWard

& Moe, 2010). In a study of a faith-based homeless shelter in a Midwestern city, Mulder found a system of rigid policies, including set bed times, phone calls approved by administration, no hats and jewelry, no arguing, and mandatory gospel and religious services. Programs that focused on self-sufficiency actually left individuals dependent on a regimented lifestyle, with few individual choices and "indoctrinated" in Christian rhetoric. Many programs at shelters force the homeless to abide by rules in an attempt to manage resident behavior, and if rules are broken, the individual is no longer deemed "worthy" of services (DeWard & Moe, 2010; Wallerstein, 2014, p. 21). Check-in procedures requiring a search of the individual's belongings, along with strict rules on times, limit independence. For instance, check-in might be 5:00 p.m. with a 5:00 a.m. checkout, and if you leave, someone else may get your bed. Many of these rules are not conducive to the working homeless and originated with addiction behaviors (Hartman, 2013). The "excessive" rules, moral judgments, and lack of respect and dignity drive many homeless to the streets (Hoffman & Coffey, 2008; Wallerstein, 2014, p. 22), thus exacerbating the number of unsheltered homeless and the need to identify other solutions.

Homeless Shelter Design

Not much has been written about the testing of portable shelters on the homeless. The instructor and student team searched Google, Google Scholar, and databases available through our university (e.g., Art Source, Article First, Arts/Architecture Databases, and SocIndex) and found one study, Lurie and Wodiczko (1988), where the authors received feedback on the design of their portable shelter from individuals who were homeless. Instead, we found a number of patents on portable shelter design ideas (Howard, 1990; Walburger, 2006); portable shelter designs such as the "urban caterpillar" (Young, 2010), "cardboard origami" (Peters, 2013), "hobo haven" (TrendHunter Art & Design, 2016), "wearable dwelling" (Varagur, 2016), and paperboard disaster shelter (Samuels, 2015); and information on the tiny house movement (DeNicola, 2015;

Federico-O'Murchu, 2014; Ketler, 2014). While the tiny house movement has gained momentum, and occasional quotes from homeless residents occur, a participatory design approach where the homeless provide feedback on the design is lacking.

Lurie and Wodiczko (1988) designed a homeless vehicle inspired by a grocery shopping cart that could be used as a shelter and transportation for belongings. As noted by the authors, "the working model was discussed with scavengers and passers-by" on the streets of New York City (p. 62). Suggestions such as larger wheels and other changes to increase maneuvering over curbs, steps, and potholes and an emergency escape system in case of fire or attack were categorized into mobility and safety concerns, yet the authors never provided information on a sample size or if the scavengers slept in the shelter. Moreover, the data was collected more than 25 years ago.

In 2012, Pable altered one bedroom in a homeless shelter to increase resident sense of internal control through design changes that enhanced privacy, reduced crowding, increased personalization, and engagement. Blackout roller shades for window treatments and a lockable door, for example, were added features to increase privacy. One single mother (Jazmen) and her two girls stayed in the altered room for six weeks, while another single mother (Marilyn) and her two boys stayed in an unaltered room for twelve weeks. The most important changes to the room emphasized privacy, support of activities, storage capabilities, and comfort. A locking Dutch door and privacy curtains around each bunk bed not only increased privacy but provided Jazmen with a sense of empowerment and control. Visual organization through more storage also improved the spaciousness and decreased perceived crowding. Jazmen and her family used the altered room for three more hours per day than the unaltered bedroom. A quantitative test for internal control showed that Jazmen's score increased by 10% in the altered room. This finding is important as it suggests that the physical environment could be a factor in "building internal control which may lead to

a person taking control of their circumstances...." (p. 33).

In a continuation of the research above, Pable and Fishburne (2014) interviewed 22 individuals who were mothers living in shelters along with case workers and shelter directors at four southeast U.S. shelters. Data from these interviews were coded for themes, and eight psychological constructs for what shelter bedrooms may signify were identified: security/fear, organization/peace, control/empowerment, discipline/reward, self-esteem/identity, stress, acknowledgement by others, and creativity/play. Bedrooms in homeless shelters that do not have locking doors, for example, can increase resident stress and fear but instill discipline and adherence to rules. While the research by Pable (2012) and Pable and Fishburne (2014) does provide some design guidelines that could be considered for portable shelters (security/fear, control, and organization), only Lurie and Wodiczko (1988) have received feedback on their design from individuals living on the streets.

The literature above reveals that 31% of the homeless are sleeping on the streets (National Alliance to End Homelessness, 2015) and that, often, these same individuals shun homeless shelters due to their rules and lack of dignity, privacy, and control (Hartman, 2013; Miller, 2013; Neale & Stevenson, 2013; Pable, 2012; Shapiro, 2012; Shay, n.d.). These statistics point to the need for portable shelters, yet little research exists on the testing of prototypes of portable shelters on those who use them: the homeless. In this exploratory study, we examined a student-generated prototype of a portable shelter on a sample of homeless men.

Design Process

During the spring semester, interior design students enrolled in Sophomore Studio II designed and built portable homeless shelters in teams of 3–4. Using the design process, students completed information gathering on a variety of topics related to the design problem: factors leading to homelessness, problems encountered by the homeless, demographics of the homeless, local weather conditions, and material possibilities as well as strategies related to ventilation, heating, cooling, moisture resistance of materials, historical use of temporary shelters (e.g., teepees, igloos), and previous portable design solutions for the homeless. Upon completion of the information gathering, students brainstormed on concept and design ideas and built their final solution to full scale. Students were encouraged to use found materials for the prototype in order to keep costs down and the project sustainable. Once the class project was completed, each team displayed and used its shelter outside in front of the student center for two hours as an opportunity to draw awareness to homelessness and raise funds for a local homeless shelter.

One project in particular caught my attention and met many of the criteria needed for portable shelters based on the information gathering. For this design (termed Prototype One), the student team used hula-hoops, a brown tarp, duct tape, and interior fabric (see Figure 1). The brown tarp, through student information gathering, insulated, was moisture resistant, lightweight, versatile (The Advantages of Tarp Camping, 2013), and offered privacy (Pable, 2012; Pable & Fishburne, 2014). The basis of the design revolved around the inspiration of a cocoon in order to develop a protective refuge (see Figure 1), which this student team felt was critical in creating a place of safety (Pable, 2012). The round shape provided less surface area, resistance to wind, prevented rain and snow collecting on the roof, and allowed body heat to flow around the space evenly. Other key components discovered through student research were portability, ease in set up, low cost, and protection from the elements (Alter, 2008; Lurie & Wodiczko, 1988).

I approached this student team and asked if they would be interested in further development of the prototype. From this point onward, we followed Oygur and McCoy's (2011) user-centered integrated design process (IDP). The IDP involves four steps: user involvement, knowledge generation, integration, and assessment of design features (see Figure 2). First, the student team continued with passive information

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Figure 1. Original concept board for Prototype One created by four undergraduate students for the class project in Sophomore Studio II. Prototype One consisted of a found brown tarp, hula-hoops, and interior fabric. The four students slept in Prototype One during the summer for two nights each.
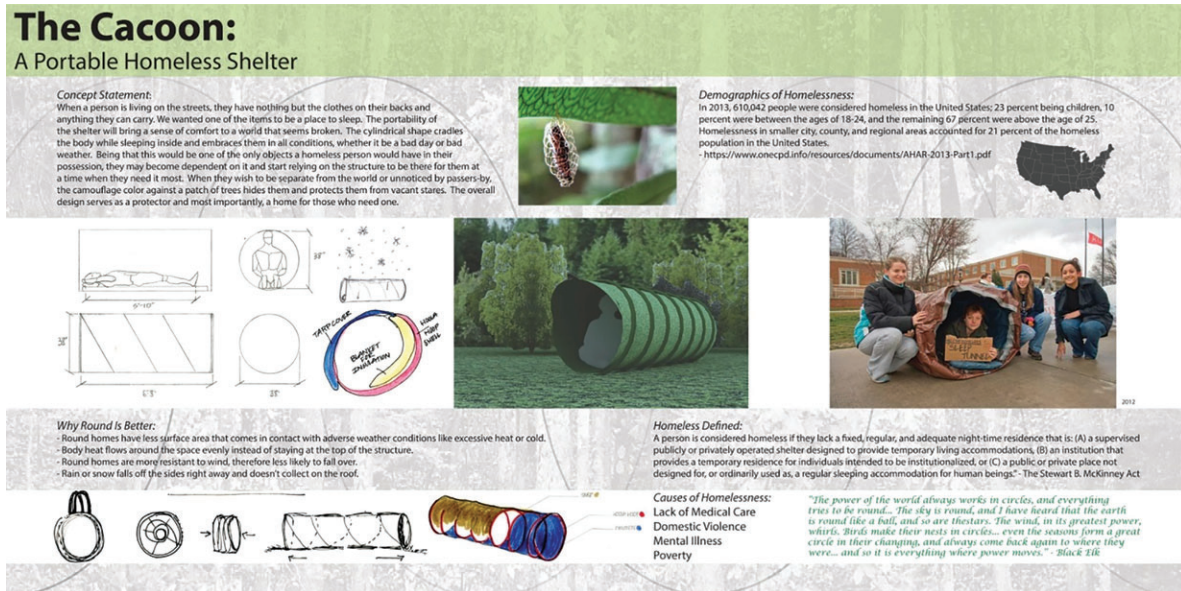

gathering about the user (i.e., user involvement) and material usage. Next, we decided that each student on the team would sleep in Prototype One for two nights (one night of rain) each to determine its viability. Recall that student teams had only used their shelters outside for two hours, and we felt that additional testing was needed. This was an important part of the IDP process, which can include designer self-assessment and experience prototyping/user testing where designers, clients, and stakeholders use the prototype themselves rather than watching in an inactive mode (Buchenau & Suri, 2000; Oygur & McCoy, 2011). Having the student team use its prototype for a longer period of time was critical because, as noted by Buchenau and Suri (2000) and Martin (2014), they could see and feel their design concept, get immediate feedback on an idea (Konkel, 2014; Martin, 2014), gain an appreciation for human scale and spatial constraints (Buchenau & Suri, 2000; Konkel, 2014), and quickly reject or confirm design ideas (Buchenau & Suri, 2000; Cahill, 2001; Konkel, 2014; Martin, 2014; Schneiderman, 2014). Students kept reflective

notes and identified the following problems: the shelter was too hot and lacked ventilation, the shelter was too large and cumbersome to carry, and the shelter was too heavy, yet it was waterproof. Based on these issues, another iteration was designed.

For the next idea (termed Prototype Two), the students used fish-tape wire, netting fabric, and a light-weight, water-proof fabric lined with a warm, interior fabric (see Figures 3–5). Other features included: (1) the shelter was reduced in size from a 38″ to 30″ diameter to increase portability (Alter, 2008; Lurie & Wodiczko, 1988), (2) fish-tape wire was used to make the structure lightweight and easier to carry, (3) back-pack straps were sewn onto the structure to increase portability (Alter, 2008; Lurie & Wodiczko, 1988) (see Figure 3), (4) a netting fabric was used at the back and front to increase ventilation and privacy (Pable, 2012; Pable & Fishburne, 2014) (see Figures 4 and 5), and (5) a pocket was included inside to store personal belongings. These design revisions were based on the experience

I experienced Prototype Two for one night during the summer, at a temperature of 47 degrees, to ensure that the design changes made were conducive for testing on the homeless.

Figure 2. User-Centered Integrated Design Process (modified from Oygur & McCoy, 2011) User involvement can include active involvement (users participate in the design process/codesign) or passive involvement through research, information gathering, or evidence-based design. Assessment of design features can include user testing (experience prototyping), simulation, critique, user feedback, and designer self-assessment.
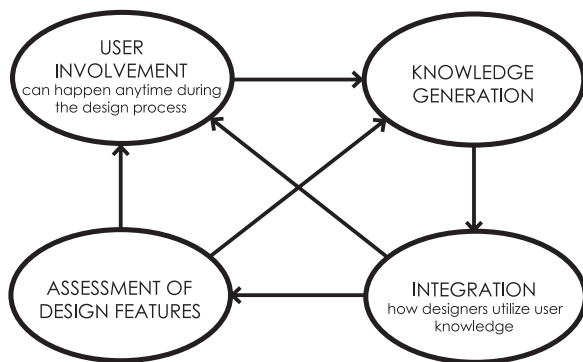
prototyping and the IDP process where knowledge generated from testing leads to new design outcomes (Oygur & McCoy, 2011). I experienced Prototype Two for one night during the summer, at a temperature of 47 degrees, to ensure that the design changes made were conducive for testing on the homeless. This testing allowed me to also use and feel the design concept in an active mode (Buchenau & Suri, 2000; Cahill, 2001; Konkel, 2014; Martin, 2014), and I found the shelter warm, comfortable, and cozy. We believed Prototype Two was ready for testing with the homeless (a critical part of participatory design and the IDP process).

Methods

In order to determine if our designer self-assessment and revisions made to the prototype were successful, we needed feedback from the intended users. In this next section, we describe the testing that occurred on the sample of homeless men.

Sample

Two rescue missions in a southern state were chosen to participate in this study. Mission One, located in a mid-sized city in the southwestern portion of the state, provides comprehensive care to those in crisis and is a Christ-centered organization that houses men, women, and families. The mission sleeps on average 250 men, women, and children. Mission Two, located in a smaller city in the northern part of the state, is a Christ-centered community supporting the chronic homeless in finding sustainable housing. This mission does not provide sleeping facilities. Having been in contact with these shelters previously, I emailed each mission director to determine if they would be willing to identify men who would sleep in Prototype Two. Three men from Mission One and three men from Mission Two were identified by the staff. The following criteria were used: individuals had to be homeless, older than 18, and male. They could not demonstrate addiction behaviors, mental illness, or cognitive impairment as observed by the mission staff. Men were chosen because the majority of individuals who sleep in unsheltered locations are middle-aged males (Toro et al., 2014; Wasserman & Clair, 2010). It should be noted that a small sample size was used for this study, and the limitations and challenges of working with the homeless will be addressed later in the paper.

Instrument

Six open-ended questions were designed for a baseline interview, and eleven open-ended questions were developed for after participants had slept in Prototype Two for two nights. The questions were based on the literature review and the experience prototyping (see Table 1). The questions were reviewed by several faculty members and the Institutional Review Board (IRB) to ensure content validity.

Procedure

The research team (student team and instructor) met with the six men at their respective missions. At this time, the purpose of the study was further

The following criteria were used: individuals had to be homeless, older than 18, and male. They could not demonstrate addiction behaviors, mental illness, or cognitive impairment as observed by the mission staff.

Figure 3. Prototype Two used for testing on the six men. Prototype Two is smaller in size and utilizes light-weight material. Straps are included so that individuals can carry the shelter similar to a backpack. Netting added to the front and back of Prototype Two provides natural ventilation and increases privacy. A small pocket provides storage and increased control for personal items.

Figure 4. Another view of Prototype Two used for testing, which illustrates the opening. The inside was lined with orange and red material to increase warmth. The instructor slept in Prototype Two for one night and found the shelter to be comfortable and warm.

explained, and each participant signed a consent form. At Mission One, the research team conducted a baseline interview in the dining room with the three men, which lasted 1.5 hours. At Mission Two, the three men completed the baseline interview in the Director's office with the research team, which took 1 hour (see Table 1). All members of the student group and myself took notes during the interview sessions to increase the reliability of the findings.

Upon completion of the baseline interview, each subject slept in Prototype Two for two nights each (approximately 8 hours each). The men from Mission One slept in the backyard of the homeless shelter. At Mission Two, participants were not as willing to sleep in the shelter. One man refused, and the other two slept in Prototype Two at a tent camp for the homeless. The subjects returned Prototype Two to their respective missions, and we conducted interviews again to determine the effectiveness of the design (see Table 1). At Mission One, two men were present for the interview on the effectiveness of design, while one man provided written comments about his use of Prototype Two. This interview lasted

While we thought carrying Prototype Two on your back (mobility of the shelter) was an important design feature, none of the men in our sample agreed.

Figure 5. Prototype Two used for testing was lighter in weight and could be carried on the back for ease in portability.
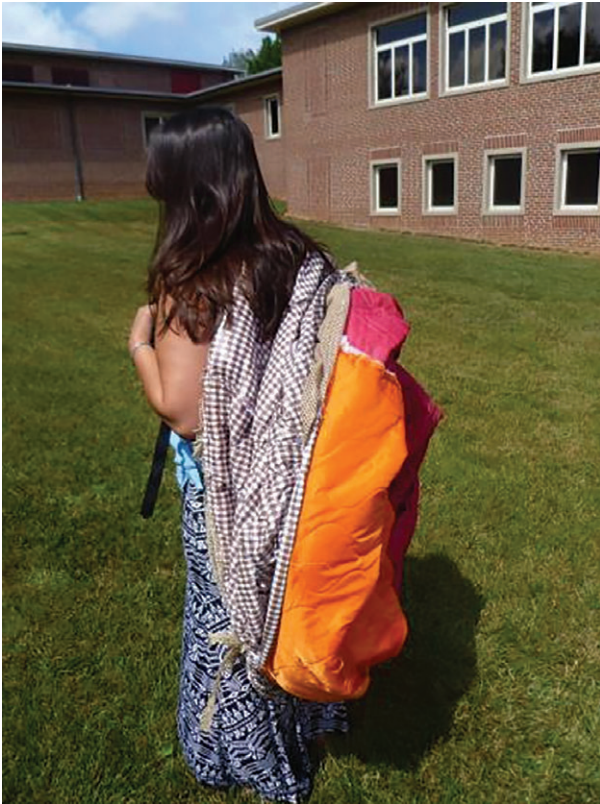
2 hours. At Mission Two, one man was present for the 45-minute effectiveness of design interview. The other two men did not show up.

Data Analysis

Due to the exploratory and qualitative nature of this study, we used content analysis to analyze the data generated (i.e., written notes taken during the interview sessions). The students and I read through the answers from the interview questions three times to determine common themes. The results and discussion have been combined based on these themes.

Results and Discussion

The men we interviewed ranged in age from 25 to 56 years old and had been homeless for 1–5 years. Two of the men were African American, and the other four were Caucasian. The names of all participants have been changed to protect their identities.

Mobility, Dignity, and Size

While we thought carrying Prototype Two on your back (mobility of the shelter) was an important design feature, none of the men in our sample agreed. As noted by Dave, "We cannot leave belongings in Mission One. We have to take items with us." Ron, Rick, and Dave all had backpacks. Ron said, "Most people who are homeless have their whole life with them. Eighty percent will not carry a shelter around with them. They will hide it. They have other items to carry." Josh also had a backpack and left larger items at a friend's house. Josh, who could have benefited most from using Prototype Two (Josh slept in a field or in a friend's house), would not sleep in it. According to the Mission Two Director, he was embarrassed.

Carrying Prototype Two on the streets could call attention to the individual and advertise that the person was homeless. Hoffman and Coffey (2008); Pable (2012), and Wallerstein (2014) all discuss the importance of maintaining self-respect among the homeless. The backpack straps, which allowed individuals to carry the shelter on their backs, are a design feature that needs to change, particularly because the majority of our participants used backpacks and wanted to maintain a sense of pride. Rick suggested carrying Prototype Two on your shoulder like a purse so it "would not hit the trees," but all of the other men agreed: most people would not carry it. Rather, they would hide it because they have other items to carry and do not want to publicize their homeless condition.

In addition to mobility, size was another complaint. Dave stated that Prototype Two was "too bulky," and Ron and Tom said, "I believe the biggest flaw is its

Table 1. *Interview questions*

Baseline interview questions	
1. What is your daily routine? Describe a typical day.	Allowed us to better understand the homeless condition (Pable, 2015), which is key to participatory design (Oygur & McCoy, 2011; Pable, 2015; Wang et al., 2014).
2. During a typical day, do you carry all of your belongings with you? Please explain your answer.	Based on research conducted by Lurie and Wodiczko (1988), who suggest that mobility is an important feature of shelter design. Theft-related question which is a problem in homeless shelters (Hartman, 2013; Miller, 2013; Neale & Stevenson, 2013; Pable, 2012; Shapiro, 2012; Shay, n.d.).
3. Where do you typically sleep on a given night?	Questions 3 through 6 are precedent questions. It was important for us to understand the homeless experience of sleeping outside prior to giving Prototype Two. This allowed us to compare Prototype Two to existing shelters used by the homeless.
4. Have you ever slept outside? What do you use when you sleep outside to protect yourself from the elements (e.g., cold weather, rain, hot weather, etc.)?	
5. What problems have you encountered when sleeping outside?	
6. How often do you sleep outside?	
Interview questions (The men slept in the prototype for two nights for approximately 8 hours each night.)	
1. Before we gave you the shelter, where did you typically sleep?	Questions 1 through 7 provide comparison data between Prototype Two and existing shelters. Questions 4 and 5 are participatory design questions based on the IDP process where information collected from users leads to new design outcomes (Oygur & McCoy, 2011).
2. Can you describe what you used specifically to sleep with before we gave you the shelter (e.g., did you use a blanket, sleeping bag, tarps, etc.)?	
3. Tell us about the two nights you used the shelter (e.g., what where the weather conditions, where did you use the shelter, how much time did you spend in the shelter).	
4. What did you like about the shelter?	
5. What did you dislike about the shelter?	
6. How easy was the shelter to set up compared to what you used before?	
7. Did you find the shelter comfortable compared to what you used before? Why or why not?	
8. Did you feel too hot or cold when using the shelter? Please explain your answer.	Questions 7 and 8 allude to weather. Shelters must protect from the elements (Alter, 2008; Howard, 1990; Lurie & Wodiczko, 1988; Walburger, 2006; Young, 2010). Based on experience prototyping where students found Prototype 1 too hot.
9. Did you have enough privacy in the shelter or did you feel exposed? Please explain your answer.	Based on Pable (2012) and Pable and Fishburne (2014), which suggest the importance of privacy in homeless shelters. Based on experience prototyping as Prototype 1 lacked privacy.
10. Was the shelter easy to carry? Why or why not?	Based on experience prototyping when Prototype 1 was too heavy and cumbersome.
11. How important is it for you to have space for your personal items? Did the shelter provide for this?	Question related to control and security. Ability to store own items when and how you want to protect from theft (Hartman, 2013; Miller, 2013; Neale & Stevenson, 2013; Pable, 2012; Pable & Fishburne, 2014).
12. If you could make changes to the shelter, what would they be?	Participatory design, assessment of design features, and testing, which are a part of the IDP process. Having users participate in the design process (Oygur & McCoy, 2011; Pable, 2015).

These findings suggest that portable shelters should be designed to be easily hidden and that entrances should be secure.

size … it needs to be more lightweight and smaller." Rick said that Prototype Two was "too bulky and too big to carry." Ron suggested designing the shelter so it "would fold up to 4" X 4" X 14", be lighter so you could carry in your backpack." Rick mentioned that a "one-man tent is like a casket," and it shouldn't be too small. Based on these findings, portable shelters need to be smaller and fold up to a size that is manageable to carry or hide. Both of these features would increase a sense of dignity as the person who is homeless could carry the shelter in their backpack or easily conceal it in their sleeping spot.

Weather and Structure

Rick slept in Prototype Two in the rain when it was in the low 40s. He stayed in the shelter from 9:30 p.m. to 5:30 a.m. On the second night, it did not rain and was in the low 40s. On the night it rained, the shelter started to collapse in the center when it got wet. "The top wants to cave in, it is not long enough, and the back needs to be solid due to too much air circulation. I put rocks on the side to give it more support," stated Rick. Dave did not encounter rain on either night and slept in Prototype Two with shorts, a shirt, and socks with a temperature in the low 40s. He also wanted Prototype Two to be longer and thought there should be more control over the ventilation. "My head got cold in the wind," said Dave. Ron had slight rain on the first night and also had some collapsing in the center of Prototype Two. "As far as keeping you from the elements, the structure serves its purpose, but when the ends and center caved in it turned into nothing but an oversized sleeping bag." Tom noted, "The first night was rough. It was Friday, and it rained just enough to wet everything. I found I had to stake the tent down or it would accordion on me. The tent is hot inside, stifling with clothes on and it's almost unbearable. As the night progressed, it got cooled down to 63 and the ground was hard and cold." Rick, Dave, and Tom suggested using string to hold each side of the shelter up. Rick said, "The shelter needs a quilt or thick sleeping bag sewed on the bottom."

These findings point to the importance of weather considerations and structure of the shelter (Alter, 2008). Rick said, "The cold is a big problem when sleeping outside," and Sam said, "I stay at the cold weather shelter from November to March." While all of the men believed Prototype Two was easy to set up, the comments regarding temperature were quite different depending on the weather. The students conducted research on material considerations, and the instructor slept in Prototype Two for one night, finding it warm, but Prototype Two was never tested by the students or instructor in the rain or cold. Portable shelters must be able to withstand the weather conditions of the area and must be structurally sound.

Theft, Security, and Fear

Lurie and Wodiczko (1988) discuss how constant movement is a necessity for surviving the streets of New York City due to the authorities. Our sample, however, did not like the mobility feature of Prototype Two and stated that most homeless would hide the shelter rather than carry it. In other words, the need to continually move a portable shelter was not suggested by our participants. When individuals have a permanent sleeping location, security becomes a concern (Pable, 2012, 2015; Pable & Fishburne, 2014). In fact, theft has been noted as a problem in homeless shelters throughout the literature (Hartman, 2013; Miller, 2013; Neale & Stevenson, 2013; Pable, 2012; Shapiro, 2012; Shay, n.d.). Josh said, "people steal your stuff," which was why Rick suggested "painting the shelter camouflage to hide it." Dave said, "Other homeless people won't tell you about their spot. They are afraid you will rob or hurt them. You do not want people, the law, or other homeless people to find your spot." Rick reiterated this stating, "You do not want the law to find your shelter."

These findings suggest that portable shelters should be designed to be easily hidden and that entrances should be secure. Lurie and Wodiczko (1988) even propose a lock or alarm system to protect personal items, and Pable and Fishburne (2014) discuss that unlocked doors can create fear and stress in homeless shelters. Newton (2008), as cited in Parsell (2012), "found that people feeling safe and secure contributed

to them developing emotional attachments of home," even in portable dwellings such as caravans (p. 162). Protection and safety are key features of any portable shelter.

Participants also suggested a zippered front so that food items could be stored. A surprising finding to us was the fear of animals. Sam stated that a raccoon at his campsite was a problem, and Rick said, "A zip front would prevent animals from entering while a solid back would eliminate wind." As designers, we anticipated that might provide problems with ventilation, but adaptability seems to be a key design trait to be considered.

Control and Privacy

One interesting finding was the amount of time subjects spent in Prototype Two. Dave went into the shelter at 7:30 p.m. This would be considered early, especially as data collection took place in the summer when it was still light out. Dave lived at Mission One, which had large rooms with bunk beds for sleeping. Noise was an issue (Hoffman & Coffey, 2008; Neale & Stevenson, 2013). Prototype Two gave participants more privacy, control, and quiet. In fact, all of the men liked the privacy of the shelter, which allowed some to get away from the crowded, group-sleeping quarters. Dave said, "I did not hear a thing, and I liked the privacy."

Neale and Stevenson (2013), in their study of the needs of homeless drug users, found that people who are homeless are exposed to a number of everyday problems such as noise and overcrowding. Much of a homeless person's life is on public display. Eating, sleeping, washing, arguments, intimacy, and drug use may all take place in the open. Their participants, along with ours, desired privacy and control.

Parsell (2012) states that people can only feel at home when they have a sense of autonomy, which is one reason why our sample liked the pocket, space for belongings, and solitude the shelter provided. Many of the men brought snacks into Prototype Two, and

the width allowed them to store their "stuff." We also found cigarette burns in Prototype Two after its initial use. These small design elements and physical traces may provide evidence of an increased sense of control, which has been cited as an important feature in homeless shelters (Pable, 2012; Pable & Fishburne, 2014; Parsell, 2012). Storing cell phone and snacks in pockets gave the men the ability to eat and talk on the phone when they wanted. Pockets for concealment allowed them to smoke, which was strictly prohibited in Mission One. Thus, control and privacy are other design features to include in portable shelters, and building internal control may give the individual more control to change their life circumstances (Pable, 2012).

Rules and Regulations

Mission One had clear set rules and regulations for staying overnight, which were noted by our sample. Ron stated that he had to make his bed correctly. Indeed, we found numerous posters hanging in the shelter that illustrated specific directions on bed making. We also observed firsthand the tension between residents and staff. Chapel time was mandatory at Mission One, as noted sarcastically by Dave. The Director at Mission One did not want Dave, Ron, or Rick to use blankets when sleeping in the shelter for fear of theft, but the subjects snuck them out. Dave noted, "when you are homeless, you will do whatever it takes to survive."

DeWard and Moe (2010) and Wallerstein (2014) discuss the strict adherence to rules and staff hierarchy found at many homeless shelters, which were also evident at Mission One. Dave, Ron, and Rick had days that revolved around the schedule of the shelter. They left at 7:00 a.m. and returned at 3:30 p.m. to ensure they had a bed for the night. These hours are clearly not conducive to individuals who work. Like Mulder (2004) and Deward and Moe (2010), we also found men with a regimented lifestyle forced to participate in rules they did not necessarily believe in. Prototype Two gave the men an opportunity to retreat from these rules by freedom of choice. The men could smoke, eat, talk on the phone, relax, be alone, and

exert their own identities without the interference of shelter staff.

Reflections

Using the IDP process, as discussed by Oygur and McCoy (2011), and experience prototyping for this project was beneficial as it gave us immediate feedback on the design (Martin, 2014). In the development of Prototype One, the students found the shelter cumbersome and heavy. Like Schneiderman (2014) and Konkel (2014), we discovered that building Prototype One to human scale gave us a better appreciation for spatial volume. This initial testing by the student group was important because it allowed us to quickly reject the design idea (Buchenau & Suri, 2000; Cahill, 2001; Konkel, 2014) of the hula-hoops, which were too large.

Reiteration of ideas is a key component of experience prototyping. Quickly building and testing Prototype One resulted in new ideas generated for Prototype Two. The size of Prototype One was 38″ in diameter and was reduced to 30″ for Prototype Two, and fish-tape wire was used instead of hula-hoops. Rapidly building a design solution created a way for us to test the initial design and make necessary changes, which has been identified as a benefit of prototyping by research previously cited. Another important feature of the students sleeping in Prototype One and the instructor sleeping in Prototype Two was that it gave us the ability to experience the situation of others with our own bodies (Thomas & McDonagh, 2013). Furthermore, self-assessment of the design features occurred via testing, a part of Oygur and McCoy's (2011) IDP. In other words, the research team gained awareness of what it was like to sleep outside. Thomas and McDonagh (2013) argue that too often designers jump to the design outcome prior to understanding the user. Sleeping in the prototypes sensitized us to sleeping outside and allowed us to make revisions to the original design.

Participatory design offers disempowered groups, such as children, the poor, older individuals, and the disabled, the opportunity to provide diverse knowledge and feedback that improves processes, services, products, and designs (Krikac & Ryan, 2014). For this study, we used both passive and active forms of participatory design under Oygur and McCoy's (2011) user involvement of the IDP. The student team conducted information gathering on the homeless prior to designing Prototype One and continued with research when examining material changes for Prototype Two and during the development of the interview questions. This passive form of user involvement was important as it gave students an understanding of the homeless condition during the analysis phases of design. But, as suggested by Pable (2015), designers cannot just gather information about the homeless, which was why testing Prototype Two on the homeless was so important.

Testing Prototype Two on the sample of homeless men gave us immediate feedback from those who would actually use the shelter. This assessment of design features provided greater insight on the design problems that we never would have considered (see Figure 2 and Table 2). The backpack straps, which we thought was such an innovative idea, were immediately rejected by the men, suggesting that mobility was not an important feature. Issues with animals entering Prototype Two and concerns related to other homeless people or the law finding the shelter never occurred to us. Even though passive user involvement in the form of information gathering gave justification to design ideas such as the backpack straps for mobility (Alter, 2008; Lurie & Wodiczko, 1988), the pocket for storage and control (Pable, 2012; Pable & Fishburne, 2014; Parsell, 2012), and increased privacy (Pable, 2012), the actual testing on the homeless provided what Oygur and McCoy term, knowledge generation. This knowledge generation on design considerations is summarized in Table 2.

There are a number of limitations that occurred. Some might claim that we did not use the full process of participatory design. Prototype One was never tested on the homeless. Only the students slept in

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Table 2. *Design comments/suggestions for Prototype Two*

Summarized design comment	Negative versus positive	No. of Men	Theme
Center collapsed, caved in	Negative	4	Structural
Animals entering	Negative	3	Security
Had to be staked down with string or stakes for structural purposes	Negative	4	Structural
Not long enough	Negative	3	Size
Too big to carry, and homeless will not carry due to other items, such as backpacks, and embarrassment	Negative	3	Mobility/Size/Dignity
Needs thick sleeping bag or quilt on bottom	Negative	2	Weather
Paint it camouflage to hide it	Negative	1	Security/Theft
Front needs zipper and back needs to be closed for increased warmth	Negative	1	Weather/Security
Very easy to set up	Positive	2	Structural
Private	Positive	2	Privacy
No noise; did not hear a thing	Positive	1	Privacy
Space inside for belongings and snacks	Positive	2	Control
Pocket for cell phone	Positive	2	Control
Warm when it did not rain	Positive	2	Weather
Freedom from rules	Positive	2	Rules/Control

Note: Rick, Dave, Ron, and Tom slept in Prototype Two. Sam also slept in Prototype Two but did not show up for the second interview. Josh did not sleep in Prototype Two.

Prototype One. Pable (2015) argues that designers need to deeply understand the homeless condition and that designing "with" should occur. Designing "with" implies that our sample would have been more actively involved during the design process. While getting feedback from the homeless with regard to Prototype One might have been beneficial and would have more closely aligned with participatory design, it was difficult to find individuals for this study. We felt that the judiciaous use of our sample was imperative. Even after offering participants a gift card to their favorite restaurant, Josh, Ron, and Sam did not return for the second interview. Ron, however, provided us with written comments on his two nights sleeping in Prototype Two. Reliability of subjects is a problem when working with the homeless; thus, our sample size was small, and the findings cannot be generalized.

This study was exploratory, which provided both benefits and problems. Richards (2010) and Jackson (n.d.) state that exploratory research allows the researcher or companies to test product attributes, ideas, and design in a quick and efficient manner using small sample sizes. Clinical or empirical research can take years to complete, while exploratory studies allow researchers to gain immediate feedback on their product or design. This was certainly a benefit of our research study as Prototype Two was tested on the homeless and generated a series of helpful design suggestions (see Table 2). Furthermore, we provided the homeless, who have a vested interest in the problem of portable shelters, with a voice. However, exploratory research tends to use small sample sizes (Universal Teacher, 2016), and Jackson (n.d.) notes that definite conclusions cannot be drawn, thus limiting the results. Our study had six men participate in the initial interviews, and only four slept in the shelter. Furthermore, we tested men who had a place to sleep (Mission One and tent camps). To thoroughly understand the homeless condition, we should have tested Prototype Two on men who regularly sleep on the streets. This type of testing, however, is plagued with reliability

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issues. If we had given men on the streets our prototype, there is no guarantee it would have been returned.

The design ideas provided by the homeless men in our sample were enlightening, but changes to the design of Prototype Two have yet to occur. One student began experimenting with a car window shade because it folds to a small size, yet issues with weather and structure still plague the design. As shown in Table 2, the majority of the problems noted were structure and weather related. This is where the project could benefit from a variety of stakeholders such as engineers, architects, and industrial designers, which is a consideration for future designs (Krikac & Ryan, 2014; Oygur & McCoy, 2011; Vaux & Ryan, 2016; Wang et al., 2014). Prototype One was generated for a class, but Prototype Two was completed by the student team because they were interested in further design development, and it was not a class requirement. This group of students worked on the information gathering and design for Prototype Two during their free time, and building often occurred on weekends. The testing of Prototype Two happened over the summer when the students were not in school. Semester restraints and other class demands are a limitation of this study as further design reiterations are needed. We also did not audio-record the interviews, which may have improved the reliability of the results.

Future Directions and Conclusion

In this paper, we present the findings from the design, building, and testing of a portable shelter on a sample of homeless men. The pedagogy of the class project and the knowledge acquired by students was not measured. What the students learned from the studio and from the research project would be an area of pursuit for future studies.

Future research should also consider weather more closely along with a multidisciplinary approach. Our shelter was tested in one area of the country during early summer when the weather was not cold. How

the shelter would perform in the cold is not known at this time. Structure and weather issues could be better explored if the research team not only included interior designers but also involved engineers, product designers, and architects. Furthermore, the students who slept in Prototype One and the instructor who slept in Prototype Two were all females. Incorporating males into the design process might provide additional insight.

"The fact that people are compelled to live on the streets is unacceptable. But failing to recognize the reality of these people's situation or holding up the fact of their living on the streets as proof of their universal insanity is a morally and factually untenable position" (Lurie & Wodiczko, 1988, p. 54). In the richest country on earth, we still have individuals who do not have a home and who sleep rough. While ES' exist, too many people who are homeless refuse to participate in the system and deliberately choose to live on the street. Unfortunately, some will die from this choice. Portable shelters are a vital part of the homeless experience, and our research suggests that dignity, structure, size, safety, security, privacy, and control are important design considerations. Until everyone is housed, "Good design isn't about technologies and devices—it has a social heart and a role to play in meeting the needs of people facing impossible challenges" (Varagur, 2016).

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