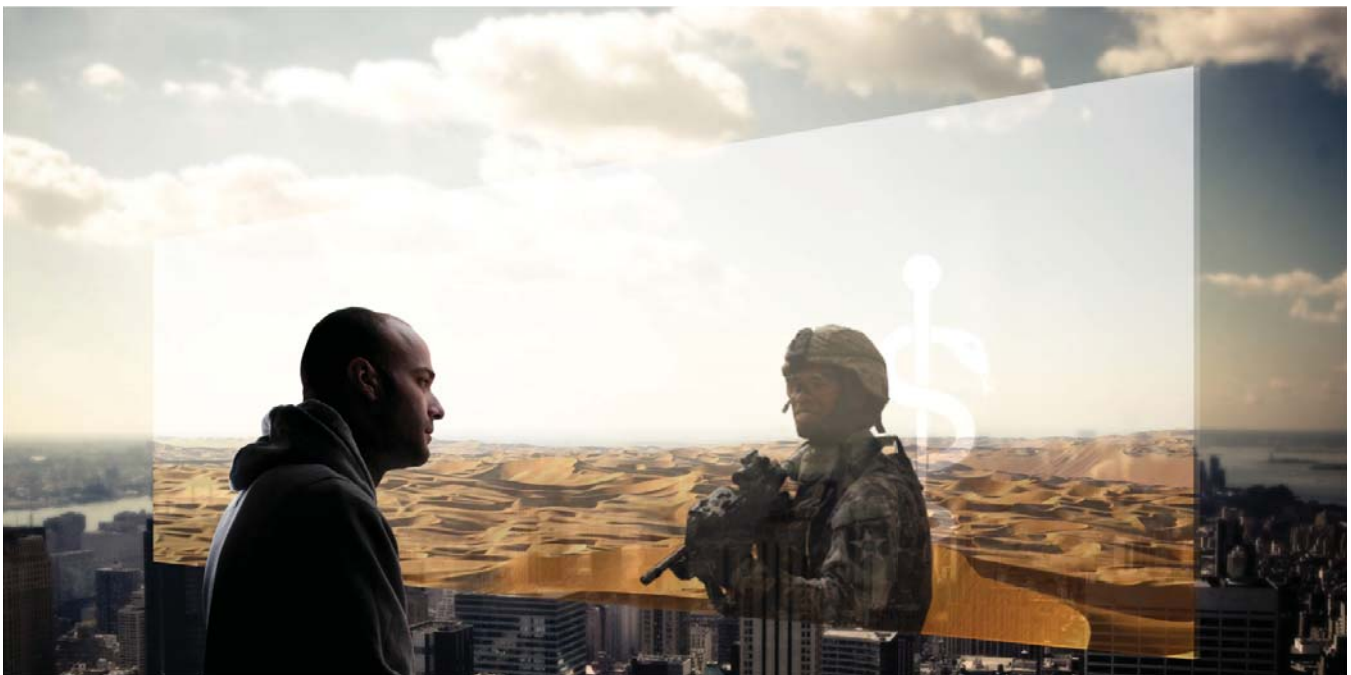


POSTTRAUMATIC UNDERSTANDING

THE CONNECTIONS BETWEEN POSTTRAUMATIC STRESS AND ENVIRONMENTAL DESIGN



Rev. 12 September 2014

The taste of the apple... lies in the contact of the fruit with the palate, not in the fruit itself; in a similar way... poetry lies in the meeting of the poem and the reader, not in the lines of symbols printed on the pages of a book. What is essential is the aesthetic act, the thrill, the almost physical emotion that comes with each reading.

- Jorge Luis Borges

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IDEAS+BUILDINGS THAT HONOR THE BROADER GOALS OF SOCIETY
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To U.S. service men and women, who make great sacrifices.

Thank you.

ABSTRACT

Memories of a traumatic event are processed and stored uniquely in the mind, disassociated from all other memories. Stimuli reminiscent of a person's trauma can trigger a unique response in a person suffering from PTSD, however, psychotherapeutic treatments can facilitate restoring the mind to health. This research hypothesizes a correlation between principles of sensory processing and principles of environmental design to improve efficacy of cognitive-behavioral treatment for veterans with PTSD.

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PREFACE

It is a personal interest of mine to study the many ways in which people interact with their surroundings. I pursue this interest with the intention that a better understanding will yield a more insightful design process and a more successful solution for a given problem. The quote on the cover of this document, by Jorge Luis Borges, establishes a baseline understanding for the explorations taken in this study, which serves two main purposes:

1. The “first step” of a larger investigation into the connections between posttraumatic stress and environmental design.
2. A case study in design research methodology and design approach.

This work is done in part with the Innovation Incubator program at Perkins+Will, which has provided resources for this project as well as an audience with whom to discuss my findings. It is with great gratitude that I submit this document.

INTRODUCTION

The Need for a Posttraumatic Understanding

Focusing on Veterans

Because an individual’s life experience is the filter through which they see the world, there comes an inherent difficulty with the task of designing for the general public. Because of this, I have focused on active and veteran US military, a demographic with the deeply engrained commonality of training and combat experience. With a better understanding of the contributing factors to posttraumatic stress, we can increase our capacity to design in

a way that is both sympathetic to this altered state and conducive to healing.

This document provides a basic overview of how the human brain processes environmental stimuli, stores and recalls memories, and how these processes are impacted when a trauma occurs. There will be a focus on the techniques military-trained personnel use to assess their surroundings and survive in conflict. Traumas experienced while practicing these techniques are one of the most common sources of posttraumatic stress in veterans. Interestingly, variations of the surveillance techniques used by military-trained personnel can often be seen in untrained civilians exhibiting hypervigilant PTSD symptoms.

This project will focus on posttraumatic stress (PTS) in veterans; however, veterans are not the only demographic affected by this condition.

An estimated 7.8% of Americans will experience posttraumatic stress disorder (PTSD) at some point in their lives. This represents a small portion of those who have experienced at least one traumatic event: 60.7% of men and 51.2% of women (Nebraska Department of Veterans’ Affairs, 2007). The most common traumatic events experienced by individuals not in war zones include rape, childhood neglect, childhood physical abuse, and being threatened with a weapon. Individuals suffering from posttraumatic stress and posttraumatic stress disorder, regardless of the specific details of their traumatic event, often exhibit similar behaviors and symptoms. I believe the design considerations outlined herein would benefit all sufferers equally.

This document will identify information of merit and the next steps to be taken, should additional resources become available. The principles of

With a better understanding of the contributing factors to posttraumatic stress, we can increase our capacity to design in a way that is both sympathetic to this altered state and conducive to healing.

human-centered design will be the focus of this study. According to Environmental Gerontologist Esther Semsei Greenhouse, “Human-centered design is based on the physical and psychological needs of the human user, enabling the user to function at the highest level possible... human-centered design is not a design style, but a process for designing and developing buildings, products, and communities that is grounded in information about the people who will be using them...” (Greenhouse, 2012).

It is a personal belief of mine that the current architectural dialogue over-emphasizes the visual. However, in order to achieve relevance, and because posttraumatic stress is complex and multifactorial, the extent of this study will be limited to visual contributing factors. The intentional omission of other factors, such as tactile, acoustical, and olfactory sensations will allow for meaningful attention to be paid to visual cues.

01. STIMULI AND MEMORY

Before we can design to accommodate PTS, we must first understand how the human brain processes stimuli and forms and recalls memories. Upon this, we can add the unique functions of the treatable posttraumatic stress disorder.

The Formation of Memories

Under normal conditions, sensory organs send information to a part of the brain that functions as a gatekeeper that assesses incoming information for emotional significance. After assessing, information is sent to undergo higher-order thinking. Once this has occurred, the information is stored in short-term and long-term memory. On a fundamental level, this is referred to as a “learning event.”

Information that has undergone the process of higher-order thinking is stored as what we will call an “associated” memory. These memories have a known relationship to other memories.

The Formation of Memories Under High Stress

Just as in normal conditions, sensory organs transmit information to the brain’s gatekeeper. During a high-stress event, the situation is identified as problematic, prompting the bypass of higher-order thinking and direct activation of the autonomic nervous system (ANS). The ANS is capable of activating two emergency pathways, the sympathetic and parasympathetic nervous systems.

The sympathetic nervous system (SNS) initiates the “fight or flight” response, expending all physiological and social resources in order to survive. In a situation where the gatekeeper determines neither fight nor flight is

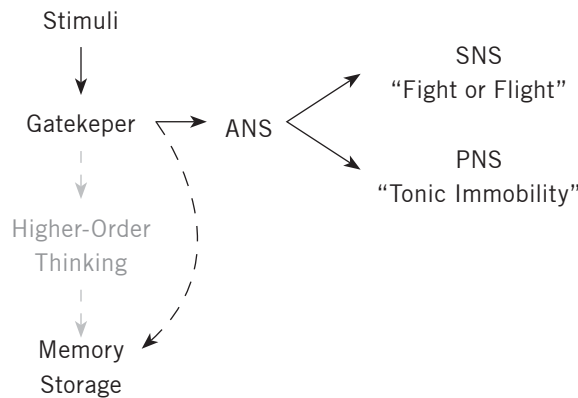


Figure 1.1

During a traumatic event, the brain’s gatekeeper bypasses higher-order thinking and directly activates the autonomic nervous system, resulting in the “fight or flight” or “tonic immobility” response. Memories from this event are likely fragmented and non-verbal.

possible, the parasympathetic nervous system (PNS) is activated and a sensation known as tonic immobility occurs. When the PNS is activated, the brain has determined the best chance of survival is to simply submit to the conditions and wait. In this state a person is immobile, able to observe without feeling fear or pain, and time is perceived as moving more slowly.

When the ANS is activated, information bypasses higher-order thinking, and is unable to be stored among “associated” memories. Regardless, information from this learning event is important and must be kept in order to protect against the reoccurrence of a similar event. We can refer to these memories as “disassociated,” which are often fragmented and mostly nonverbal.

Disassociated memories are a survival tool; they remain accessible at the forefront of the mind and are easily triggered by sensations associated with the trauma. Triggers can vary widely; they may be visual or physical sensations, a feeling of movement, or even body position. A trigger may have any relationship to the trauma or the trauma’s context.

Because they are often nonverbal, a person experiencing post-traumatic stress may not be able to verbalize or even identify their trigger, its relationship to trauma, or even that they are experiencing stress associated with a trauma.

Posttraumatic Stress Disorder

Thus far we have been discussing Post Traumatic Stress, which are normal reactions to an abnormal situation. Expanding upon this baseline, we will now consider the concept of post-traumatic stress disorder, PTSD. Reactions to a stressful event vary in severity and longevity from person to person; and a psychologist is tasked with assessing if the symptoms are severe enough to be classified as a psychiatric disorder. PTSD is marked by biological changes as well as psychological symptoms following the experience or witnessing of a life-threatening event, such as military combat.

In the broadest sense, a trauma is a learning event that affects one’s perception of their world and their perceived ability to function within it.

Categories of psychological symptoms of PTSD:

1. Re-experiencing Symptoms

Reliving the trauma in some way such as becoming upset when confronted with a traumatic reminder or thinking about the trauma when you are trying to do something else.

2. Avoidance and Numbing Symptoms

Staying away from places or people that remind you of the trauma, isolating from other people, or feeling numb.

3. Arousal Symptoms

Feeling on guard, irritable, or startling easily.

A complete description of the American Psychiatric Association's DSM-5 Criteria for PTSD may be viewed on the United States Department of Veterans Affairs website.

Although anxiety disorders, including PTSD, are prevalent amongst Americans, it remains an atypical condition. About 30 percent of the men and women who have spent time in war zones experience PTSD. An additional 20 to 25 percent have had partial PTSD at some point in their lives. Of veterans, according to the US Department of Veterans' Affairs, PTSD occurs in:

- +/- 11% of Afghanistan War Veterans
- +/- 20% of Iraq War Veterans
- +/- 10% of Gulf War Veterans
- +/- 30% of Vietnam War Veterans

Because these statistics include so many, we must try to understand what causes PTSD and how we can help them achieve a permanent solution.

Let's refer to one's environment as their "context", which includes both

physical and social conditions. When a person, veteran or otherwise, is experiencing PTSD symptoms, their brain is over interpreting real-time stimuli; they are associating that with the context of their trauma, which only exists as a memory. The person experiencing the symptom is often aware of falseness of their reaction, although unable to prevent it. The following represents current practices to help address this psychological condition.

PTSD Treatments

The changes that take place within a person's brain after a trauma may be semi-permanent and capable of existing for an indefinite period of time if not treated. However, recent developments in psychotherapy and pharmaceutical treatments give us reason to hope that what has been done, may be overcome.

Psychotherapy

The goal of most psychotherapy treatment plans is to combat PTSD with a 2-step process:

1. Identify the traumatic event(s) and trigger(s).
2. Confront maladaptive behaviors and re-associate the traumatic memories in context with one's present, predictably safe, situation.

Psychotherapy can take many forms, but for the purpose of this discussion, identifying these two fundamental steps will allow us to begin hypothesizing a direction we should take in designing to accommodate this psychological condition.

Pharmaceutical Treatments

Pharmaceutical treatments, also referred to as psychotropic medication, are often used to lessen certain

symptoms of PTSD by disturbing particular functions within the brain. All have side effects and none are capable of relieving all the symptoms. Although most people prefer psychotherapy to medications, the two are often used in tandem, to help reduce re-experiencing and arousal symptoms in order to proceed with psychotherapy.

Pharmaceutical treatments fail to address the root cause of PTSD, and therefore, cannot be viewed as a comprehensive solution.

Substance Use Disorder

In an attempt to alleviate PTSD symptoms, some veterans become entangled in addictive behaviors with alcohol, tobacco, or drugs. Relief, if achieved at all, will be temporary and ultimately result in symptoms more severe than before. Problematic continued use of a substance may be qualified as substance use disorder (SUD). Among veterans diagnosed with PTSD, more than 20% are also diagnosed with SUD. Of all veterans with SUD, approximately 30% are also diagnosed with PTSD. One in 10 veterans of Iraq and Afghanistan wars has SUD.

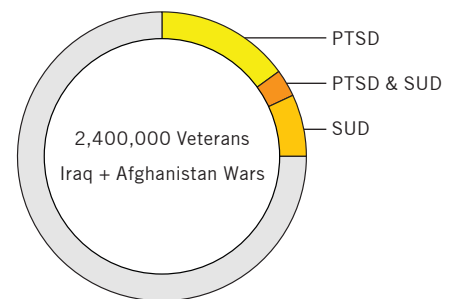


Figure 1.2 Of the 2.4 million veterans of the Iraq and Afghanistan wars, approximately 1 in 4 are diagnosed with posttraumatic stress disorder, substance use disorder, or both.

Source: Iraq and Afghanistan Veterans of America and US Department of Veterans Affairs

02. MILITARY AND POSTTRAUMATIC STRESS

This study, thus far, has been general; it will now shift to examining psychological factors associated with military service and explore the potential these have in being considered while designing to accommodate PTS in veterans.

USMC Military Operations & Urban Terrain (MOUT)

The US Armed Forces are the best in the world, largely due to the extensive training every soldier completes. Often taking years, training reprograms individuals to remain alert in dangerous situations and react effectively in combat. Soldiers train to the specific type of battlefield they anticipate; this study focuses on the United States Marine Corp., specifically Military Operations & Urban Terrain (MOUT) with the guidance of veteran Corporal / E-4 Clinton McMahan. MOUT training encompasses indoor and outdoor urban warfare, such as fighting within a fortified city or building. Studying how to assess dangers and survive in this type of environment was chosen because it is spatially most similar to the built environment a soldier will experience upon returning to civilian life. This chapter discusses practical application of MOUT techniques and their psychological implications.

Working in a Team

The USMC trains and operates in teams; the most basic of which is a Fire Team, and consists of four soldiers. Within a Fire Team, one soldier is designated as the leader and the other three are typically complementary equipped, such as a machine gun, rifle, and support.



Figure 2.1

The urban battlefield shares many qualities to the spaces veterans inhabit upon their return home, increasing the potential to trigger PTSD symptoms and code-switching behaviors.

Larger groups, such as a Squad or Platoon, are comprised of multiples of this Fire Team module and often include an additional soldier designated the Squad Leader or Platoon Leader. There is a very clear hierarchy within this organization, which helps with direction under stress.

Marines are conditioned to work seamlessly together, with fluidity necessitated by the complexity of the urban battlefield. A single person, regardless of training, can effectively monitor only a portion of their surroundings; because of this, soldiers operate in a way that divides the battlefield into small, more manageable pieces that each

soldier can effectively scan. As a team, they can continuously monitor their environment in its entirety, which is often spatially complex.

Through extensive practice, members learn to intuitively cover what their teammates are not, executing a highly sophisticated series of movements based on their practice and on-the-go reactions to the opposition. The worst scenario a Marine can experience in a combat situation is to be alone.

The bond between members of a Fire Team is immense; teammates exchange the trust and responsibility of protecting one another's lives. This relationship sets a potentially troublesome precedent relative

to leaving active duty. Within the comprehensive training required to reach this level of trust and competency, there grows a strong distinction between those you trust to do no harm, and those you trust to protect.

The Stress of Camouflaged Dangers

Unfortunately, not all dangers are as obvious as someone firing a gun or threatening with a knife. Hollywood-style shootouts are commonly associated with deployment, but the truth is our soldiers rarely engage in that type of battle. More often, threats faced are encountered while maintaining security in a mostly safe neighborhood. This is where a soldier may encounter a booby trap. Many of these are improvised explosive devices, commonly referred to as an IED.

A common example of an IED is a remote-controlled explosive hidden in plain sight, such as within one of many curb-side garbage bags awaiting pickup. Combatants often go to great lengths to hide an IED, such as burying an IED under the pavement, in the middle of a road. The devices may be triggered remotely by a watching combatant or automatically by an integrated sensor. The only way to detect these deadly buried explosives is to spot the slight discoloration of the pavement where the device was buried; it's not hard to imagine the difficulty of such a task, given the dust and countless distractions soldiers encounter.

These dangers are not just limited to the outdoors. Something as subtle as a matte-finish trip wire strung across a doorway leading from one dimly lit room to another could detonate an explosive. The creativity of an enemy can be astounding; repurposed hardware, such as laser garage door sensors, have been converted into IED

detonators; meaning the detonator for an explosive could literally be invisible to the human eye.

After years of active duty, it can become no less strange for a soldier to look for the subtle signs of a lurking IED on patrol than it is for a civilian to look both ways before crossing a street. This altered state of awareness transcends merely looking for hazards, it is all-encompassing. A strange sound, a particular smell, or an expression on another person's face could be the fraction-of-a-second early warning needed to survive. At any time, in the blink of an eye, a situation can become a fight for one's life. With this understanding, it is no surprise that some men and women who have served struggle to adapt upon their return to civilian life.

Chronic Stress

As is obvious, active members of the US Armed Forces are frequently in situations where they are likely to experience a traumatic event. The frequent experience of this context can lead to a condition called chronic stress, in which an individual's brain is constantly coping with the stresses of a hypothetical event.

Because the brain is continuously using its coping mechanisms in anticipation of an event, when one occurs, it is less likely the individual will have enough resources available to cope with the actual event. Chronic stress is not exclusive to members of the military, but it is likely prevalent among deployed members of the military and correlated to the rate of PTSD among veterans.

03. HUMAN-CENTERED DESIGN

Professor of Architecture, Roger S. Ulrich and Colleagues from Chalmers University of Technology and Sahlgrenska University Hospital recently performed a study using a psychiatric hospital, Ostra Hospital in Gothenburg, Sweden, that opened in 2006. Ostra Hospital's design includes many architectural features likely to diminish stress and aggression. The study compared statistics of aggressive incident rate to that of two similar facilities in the same region. The study finds the rate of aggressive incidents at Ostra to be significantly lower (Ulrich, 2013). Based on studies such as this, we know that design has the potential to have a positive effect on the occupants' physical and mental health.

Understanding the Problem

Before proceeding, it is important to acknowledge that PTSD is a mental disorder. Edward Vega, clinical psychologist at the Atlanta Veterans Affairs Medical Center, argues that the only effective treatment for PTSD is psychotherapy and that the built environment can neither cause nor cure this condition (Vega, 2013).

However, like pharmaceuticals, a well-designed environment has the potential to aid the caregiver in administering psychotherapy, yielding a more expedient recovery from PTSD. This project is focused on designing for military veterans overcoming posttraumatic stress.

If executed thoughtfully, this approach could become a common design consideration for many typologies. It is the goal for our veterans to return home from deployment, and with

help from tools like the GI Bill, are able to fully reintegrate into society. What a message it would send to our servicemen and women, while they are risking their lives for our freedom, buildings and cities are being designed for their return. Even the fully able stand to benefit from these accommodations; the design intent explained herein would not only benefit veterans, but all citizens.

Cognitive Congeniality

In his 1996 paper, *Adapting the Environment Instead of Oneself*, David Kirsh introduces a concept based on the human pursuit of a higher return on investment of our physical and mental resources (Kirsh, 1996); the premise is that a person can only improve their efficiency in one of three ways:

1. Adapt to the environment
2. Migrate to a new environment
3. Adapt the environment itself

If we examine these three strategies as they relate to a person experiencing PTS, the first two are eliminated as clearly poor avenues. PTSD is itself a failure to adapt to one's environment and migrating to a location with no triggers is impossible, leaving only the third option: to optimize their surroundings for the given task of healing.

It is important to acknowledge the concept that physical and mental efforts are both expenditures of the same energy. If a space can contribute to lessening the burden of healing from a psychological wound, it also frees up resources for the body to use elsewhere, possibly by the immune system or other cognitive processes.

In his paper, Kirsh coins the term *cognitive congeniality*, which he defines as a measure of how cognitively hospitable an environment may be.

We can see clearly that a task such as psychotherapy, which involves great mental resources, could benefit from a space of high cognitive congeniality, but we could also argue that any activity could benefit from a space of this intent.

A building's purpose is to serve as the backdrop for activities, not the activity itself. When we're wounded, we go to the hospital not because being inside the hospital heals us, but because that is where we receive treatment from caregivers and their well-accommodated tools.

Take for example a person ailing from the flu, seeking a diagnosis and treatment plan. On the premise that cognitive and physical expenditures consume the same basic energy, we could argue they would benefit from well-designed signage directing them from the parking lot to their doctor's office. Not expending energy on the emotional stress of losing their way has left more resources available to increase their capacity to heal.

04. RESEARCH METHODS

Review of Existing Literature

References include works on related topics design theories, PTSD, PTSD treatments, and cognitive processes of perception, processing, and reactions to environmental stimuli. These references establishes a reference point for where this research can contribute to a larger conversation about how environment can positively impact human occupants.

Interviews

The knowledge required to successfully consider this complex topic reaches far beyond what any individual can hope to obtain. Aspects of this work have been discussed with experts in the field of psychology, military techniques, human factors engineering, healthcare, architectural design, and others.

Corporal Clinton McMahan, USMC

Among other deployments, Cpl. McMahan spent 2005-2007 in urban warfare in East Africa and Southwest Asia. At the time of this study, he is living in Atlanta and is studying Game Art & Design at the Art Institute of Atlanta, where he has developed a thorough understanding of the role environment plays in the psyche of occupants.

With the generous support of Safety Wolf, a recreational indoor Close Quarters Battle (CQB) combat facility, Clint provided an overview of the ways in which the USMC works in teams, assesses their surroundings, prioritizes threats, and attends to detail. And he didn't just share this by lecturing, he explained in person with the safety afforded by using paintballs instead of bullets.



Figure 4.1

Matthew Finn (left) and USMC veteran Clint McMahan (right) inside Safety Wolf Paintball Facility

Immersive Simulated Training (IST)

Over the course of two full days of hands-on immersive simulated training, Cpl. McMahan introduced concepts that should be considered by anyone designing with the mindset outlined herein.

An experiential description of this immersive simulated training can be found in Appendix A.

Techniques of the USMC Military Operations & Urban Terrain training are described in Appendix B.

05. DESIGN DIRECTION

If you can play a guitar and harmonica at the same time, like Bob Dylan or Neil Young, you're a genius. But make that extra bit of effort and strap some cymbals to your knees, suddenly people want to get the hell away from you.

- Rich Hall

Assembling an Orchestra

At the onset of this project I understood the limited nature of this study would preclude me fully engaging the other “musicians” needed to write a symphony. In an attempt to not oversimplify the problem, nor suggest this research is comprehensive, this section outlines principles I anticipate would be proven appropriate for creating space conducive to administering psychotherapy for PTSD.

I am confident none of the design considerations herein have the potential to be any less conducive of healing than standard practices, however, to maximize potential benefits, the right orchestra must be assembled and further research conducted before implementation.

The goal is to provide a setting in which patients and providers can most effectively perform psychotherapy, to achieve a permanent and comprehensive resolution.

Interdisciplinary Team

The knowledge required for designing as discussed herein far exceeds what can be expected of any individual. In the same collaborative nature that our current design practices include engineers, consultants, and end users in the design process, we must also involve experts of psychology, human factors engineering, and US military techniques. The individuals that have participated in this study are representative of such a group and the interdisciplinary nature of this pursuit.

Design Strategies

The built environment should not attempt to heal the sick. The goal is to provide a setting in which patients and providers can most effectively perform psychotherapy, to achieve a permanent and comprehensive resolution.

Given the opportunity to further this research, any design strategies developed should recognize the following principles:

1. PTSD symptoms may be triggered by any stimuli.
2. **Psychotherapy is a cognitively intensive process which consumes many systemic of resources.**

Intuitive Design

A built environment for healing can be accomplished by designing in a way that is, quite simply put, intuitive. This relates directly to Kirsh's concept of cognitive congeniality covered in section 03. *Human-Centered Design*.

With the help of Human Factors Engineer, Christopher Ryan, I was able to learn of many precedents for this approach in the field of user interface (UI) design, where special attention is given to interactions between man and machine, an inherently unintuitive process. Industry pioneer, Don Norman, recently published *Living with*

Complexity, in which he discusses the difficulty of integrating all forms of technology into our lives:

In attempting to reduce the frustrations caused by the complicated nature of much of today's technology, many solutions miss the point. It is no great trick to take a simple situation and devise a simple solution. The real problem is that we truly need to have complexity in our lives.

- Don Norman, 2011

We must acknowledge the complex nature of the task at hand and stay focused on the intent of a given project. All buildings must adhere to regulations, systems requirements, and budgetary and scheduling constraints. It is up to the design team to elevate considerations of the human experience to this same level and avoid it from becoming neglected.

Practical Application

In his 1988 book *The Psychology Of Everyday Things*, Donald Norman provides the shown example in *Figure 5.1, A row of swinging glass doors in a Boston hotel*. These doors do many things; they provide security when locked, confine mechanical zones, and one could argue they do so in a way that is transparent enough to avoid isolating the spaces on either side.

However, as Norman suggests, in achieving transparency the designer has inadvertently created a psychological barrier. Take a closer look and attempt to identify the handing of the swinging doors. When approaching, which side of the door should you push? Or should you pull?

This is just one of many relevant examples of a building component that can become distracting and easily a source of frustration. *Appendix B, USMC MOUT Key Concepts* explains attention to details, such as door



Figure 5.1

A row of swinging glass doors in a Boston hotel.

Image: Donald Norman

handing, our veterans practice in combat and training scenarios. A sensitivity to the likelihood that some of these techniques are carried over into their civilian lives is exactly why designers must also pay attention to these details.

The knowledge and understanding gained by this study's immersive simulated training serves as a foundation from which we can build an understanding of how our veterans perceive and react to the built environment. This would facilitate the design of environments that could more quickly be understood and "cleared" by a veteran. The result would not be a space capable of curing a psychological disorder, but instead, one that facilitates a more quick and accurate identification of the trigger of one's PTSD symptoms.

We cannot design an environment that frees a veteran of PTSD, but we can reduce the amount of stimuli for them to sort in finding the one(s) relevant to their situation.

Traumatic memories can be

non-verbal, and a trigger could be anything associated with a trauma; aiding a veteran in achieving clarity of their situation is one of the most consequential means of support we can aspire to provide.

How Design Can Help

The built environment may contribute to the healing of the psychological wounds of war in the following ways:

1. A reduction in the cognitive load of an environment moderates the energy required to process, orient and navigate within a space. This ultimately renders more of the body's resources available for therapeutic processes.
2. Reducing environmental complexity may also help prevent the patient from becoming distracted and lessens the probability of being unnecessarily exposed to one's trigger, as this would ideally occur in a controlled, deliberate and constructive manner.

The built environment can't solve PTSD on its own, but it can help. The cumulative effect of these design decisions stands to help the patient achieve their best mental state for psychotherapeutic healing.

06. NEXT STEPS

Partnerships

Perkins+Will's non-profit research organization, AREA, is currently seeking partnerships with external organizations specializing in the fields of psychology, cognitive-behavioral science and neuroscience. We are looking for motivated individuals who passionate about better understanding the many interactions between the built environment and human occupants. If you would like to discuss potential partnership, please contact:

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Physical Characteristics

Non-visual senses, such as olfactory, tactile, and acoustical sensations, must be incorporated to make this study comprehensive, to truly understand how perception interacts with the formation and recall of memories. Furthermore, the physical characteristics of our surroundings, such as visual complexity, intelligibility of sounds, and porosity of space, should be quantified and analyzed.

Expanded Applications

Based on the premise that psychotherapy for PTSD can be better facilitated within a space of certain physical characteristics, we can speculate that certain ethnic or social populations to benefit from inhabiting certain environments more than others.

By categorizing and quantifying physical characteristics of space, we could begin to consider the idea of matching individuals to facilities best suited for their predisposition. Over time, this could become highly feasible in regions where redundant facilities

serve large patient populations. This would be most appropriate for chronic conditions and long-term occupancy facilities, such as residential treatment facilities, orphanages, or correctional institutions.

Procession

It is important to acknowledge the cumulative experiences a person has while using a building. All spaces create a whole in the mind and are not learned as isolated incidents. This should be taken into consideration at the earliest stages of design, such as space programming, and be considered another tool of the clinical space eligible for qualitative analysis.

Expanded Sampling

This project incorporates the thoughts of a wide range of experts, but within each of these allied fields, few opinions are represented. With more time and resources, I would increase the sampling to include a deeper pool of participants. This would further validate original information generated for this research provided herein, in particular that by McMahan, making it serviceable to others pursuing research in this field.

MIL STD

The United States Military addresses many of the issues discussed in this project with a system of Defense Standards. These standards regulate the manufacturing processes, serviceability, and usability of items acquired and used by the U.S. Military; it establishes a consistency among user interface design, ensuring a high degree of intelligibility in combat situations. An investigation into these standards may provide design cues that the private sector could intentionally utilize to better accommodate veterans.

APPENDIX A

IMMERSIVE SIMULATED TRAINING

Regarding the topic of designing space conducive to healing the psychological wounds of war, I find myself interested and passionate, but admittedly removed from the situation. I've been blessed with a very comfortable life and haven't experienced anything remotely close to the trauma of warfare. Reading about and watching movies on the topic helped, but I still felt unable to comprehend the conditions I am trying to accommodate.

IST Day 1

May 24th, the first day of training, consisted of one-on-one lessons covering in detail a broad range of topics. As an individual, I practiced going through new spaces and identifying threats. With Clint's coaching, I was able to gain some, albeit limited, degree of competency in the tactics we covered using live (paintball) fire to identify and neutralize targets.

We concluded the first day of training with a live combat exercise. Clint, playing the part of an enemy combatant, armed to the teeth with the same paintball gun I was using, went and hid inside the building. My mission was to shoot him before he shot me. Not to spoil the ending of this story, but I don't recommend pitting yourself against a Marine. Seriously.

My rational mind knew I was safe. Clint and I were the only two people in the building, yielding nothing more than paintball guns; we were even following strict safety guidelines. There was absolutely no way I was going to get hurt, let alone killed, that afternoon.

But after a day of thinking about the nightmare of entering a building filled with enemy combatants, I came as close as a civilian could come to understanding the stresses of urban warfare. I was completely helpless to lower my racing pulse or quiet my panting breaths. At that time, I got a glimpse of what it must feel like



Figure A.1
Matthew Finn (left) and USMC veteran Clint McMahan (right) outside Safety Wolf Paintball Facility

to experience code-switching; I was associating my present context with the memories of another situation.

The section of Safety Wolf facility we were using for this exercise is a repurposed motel; Figure 4.1 shows us standing in the corridor between two rows of rooms. To add "character," Safety Wolf has decorated the walls with fake blood. Openings between every room turned the floor plan into architectural swiss cheese; there were endless openings between spaces. I felt constantly exposed to the possibility of Clint jumping out from behind any one of these corners.

Appendix C dissects the process of walking into a room, and further explains the character of the building.

To give me a sporting chance, Clint and I set boundaries to include only the rooms on one side of the corridor, which allowed me to move through the rooms one by one without the possibility of Clint circling around behind me. The process of entering the first room was intense; I knew he could be standing around the first corner, paintball gun pointed right at me as I turn the corner, but he wasn't. This feeling of anticipation persisted as I turned every corner, each time growing more intense, as I knew the likelihood of finding him increased the further I progressed. Simply looking was exhausting, and I had the knowledge of knowing I was looking for exactly one "enemy." No more, no less.

Corner after corner I pressed on until suddenly, it was over. Without warning, I was hit, shot through an opening in the wall from Clint standing in the next room. I think I managed to pull the trigger on my weapon before it was too late, but I was hit first. I asked Clint if I got him, and with a telling chuckle, he replied “no.”

This was an eye-opening experience; it gave me perspective into the emotions one must experience entering a fortified building. I had every advantage imaginable. I knew I was in a safe environment, there were no booby traps, I knew exactly how many enemies there were, and I knew roughly where he was going to be, but I still feel like I never stood a chance.

Clint shared with me some statistics that explain how dangerous situations like this are for our soldiers. A well-experienced, appropriately sized, and well-equipped marine unit entering a fortified building could suffer up to 50% casualty rate. A unit similarly sized and equipped, but with only 6-12 months of experience, may suffer as many as 70% casualties.

This is why such a mission is used as a last resort; only to recover a high-profile hostage or retake a high priority building, such as an embassy.

IST Day 2

On June 28th, Clint and I reconvened, this time to introduce another layer of complexity, teamwork. We were joined by friends and colleagues:

- Zach Ames, AIA, LEED AP BD+C, Architect, HDR Inc.
- Steven Lambert, Creative Director, Mims Management Group
- Francisco Reyes, LEED AP BD+C, Architect, Perkins+Will

Training with a group was also enlightening. We began to understand the dynamics of working as a team and the trust exchanged in combat.

The practice necessary to build fluidity was far more than what could be done in a single day. We failed to truly get the hang of it, let alone master these exercises. At the end of the day, we ran several mock missions, similar to those Clint and I had done before. We all agreed there was a feeling of comfort provided by knowing we weren't fighting alone. The camaraderie we shared between exercises eased the tension; I assume Marines experience something similar in combat.

At the end of the day, we sat and discussed the project and what we had learned. One by one, we took turns walking through the facility alone and unarmed, each observing some degree of anxiety because of what we had experienced earlier that day.

Self-Observation

The intent of this training was to get my mind in a place where I could, just for a minute, make self-observations about code-switching and incorrectly associating memories with a present context. I didn't have PTSD, but when I got home from our first day of training, depleted physically and emotionally, I was looking around my apartment with a little more intent than I had that morning. This experience truly helped me understand the human component of this condition. It further underscores the value and meaning of this project and has allowed me to better understand the depth of sacrifice our veterans make.

APPENDIX B

USMC MOUT KEY CONCEPTS

The concepts provided in this appendix are not intended (and are intentionally insufficient) to teach someone how to use techniques of the United States Marine Corp Military Operations & Urban Training in practical application. These concepts are intended to achieve an awareness of the guiding principles practiced in combat context. These are the same behaviors that are most likely to be used by a veteran suffering from some degree of posttraumatic stress in a code-switching event, within a safe context.

Environmental Awareness

The battlefield is three-dimensional; danger is capable of coming from any direction. This not only includes the 360° surrounding a man on the ground, but also from below and above. In an outdoor environment, this may include buried IEDs or enemy combatants in an upper level or on the roof of surrounding buildings. Within a building, threats could be hidden underfoot within a crawl space or floor below, as well as overhead, concealed by a ceiling.

With this understanding, there are limitless directions threat could merit surveillance. Because this is impractical and inefficient, the soldiers exercise a degree of judgement to prioritize based on severity, likelihood, and immediacy of a threat.

In a worst-case scenario, when entering a context an enemy may have had time to fortify, great caution must be taken. Any opening in a wall, ceiling, or floor large enough to shoot a gun through could be concealing just that; booby traps may be present and well-concealed. Permitted a slow enough pace can be taken, every inch of a building merits investigation. When more speedy movement is necessary, threats of lesser likelihood and immediacy of danger must be temporarily overlooked, until one's immediate surroundings have been secured.

Once the immediate surroundings have been cleared of obvious threats, attention may be given to re-examine at finer level of detail and eventually elsewhere.

One example of a feature that is considered highly dangerous in a combat context is referred to as a "fatal funnel", which is any point along a path that forces soldiers to file through a narrow passageway. This is highly dangerous for two reasons; it is an ideal placement for an IED and enemy combatants could be armed and waiting on the other side. The most common example of a fatal funnel would be a doorway. When it is absolutely necessary to pass through a fatal funnel, ideally, soldiers first circumnavigate the opening, surveying as much of what lies beyond as possible, then move quickly through the funnel. The key to this concept is an attempt to gain knowledge of what lies beyond, before entering a new space.

In Motion

In battle, speed can mean the difference between life and death, but with speed often comes a lack of accuracy. To help walk the fine line between speed and accuracy, the Marines use the mantra:

Slow is smooth, smooth is fast.

This saying is indicative of the systematic, detailed, surveillance of one's surroundings. When entering a new space, this is best practice. Once a space has been cleared and secured, it is critical to maintain occupation of that space as the larger group (platoon, etc.) moves systematically through the building until the entire facility is secured.

While moving, it is best to do so in a path that maintains the qualities of a dominant position, and to avoid passing in front of openings that could be in an enemy's field of fire. It is also advantageous to minimize the fields of fire for which you are responsible. For example, walking down a corridor with a teammate allows each of the soldiers to be responsible for only one side of the corridor, a far more manageable task than watching both.

When moving through a building, marines practice looking for clues as to what may lie beyond. When approaching a door, it is possible, by noting the location of the handle and hinges, to know if the door will swing in or out, and that a wall is probably

closer to the hinge than the handle. There may be clues in one space that suggest the location of partitions beyond, like a framed opening in a corridor. These clues are not promises, and ultimately the soldiers won't know until they have committed to fully enter a room.

Of all the spaces in a building, stairs are the most spatially complex, and therefore most hazardous to transgress in a combat situation. Entering an unsecured stair is highly dangerous, especially while ascending because the enemy could have already established a dominant position above.

Dominant Position

Within a given space, it is advantageous to establish a dominant position. Qualities of a dominant position include:

- Facing towards openings into the space you occupy
Example: doorway(s), windows, etc.
- Back towards secured area
Example: corner of a room with no openings.
- Minimize "Fields of Fire"
Example: Areas to which you are exposed, where gunfire could originate.
- High Vantage Point
Example: descending a flight of stairs is far more advantageous than ascending, in part because it reduces the likelihood of a threat from above allowing the soldier to focus their attention downward.

Teamwork

As previously discussed, it is imperative for Marines to work cooperatively at all times. There is a clear hierarchy to the ways a team operates, and these teams take time to build and achieve fluidity. It is most

important to never wander off without your team. Being alone is considered one of the most dangerous situations a soldier could ever find themselves in.

The bond between teammates is quite interesting; there is a responsibility to protect your teammates, but also a responsibility for your teammates to protect you. This symbiotic relationship sets up a tricky situation relative to leaving active duty. There is a strong distinction between people you trust to not harm, and those you trust to protect.

Communication

Teammates must communicate in ways that are intelligible in stressful and noisy situations. Below is a list of words commonly used in combat. A series of nonverbal communications via physical and hand gestures provide the option for silent communication.

- *Move*
Not *Go*, which sounds like *No*
- *Halt*
Not *Stop*, which sounds like *Shot*
- *Shot*
Communicates you are about to discharge your weapon into another room; teammates must stop moving immediately to avoid potentially crossing your line of fire.
- *Reloading*
Communicates others need to cover your area.
- *Clear*
Communicates a space has been cleared of immediate danger and is safe for other teammates to enter.

APPENDIX C

SYSTEMATIC OBSERVATION

This series of photos and diagrams illustrates the process of systematically entering an unsecured space of unknown layout. Image 01. represents a staging position; after the decision has been made to move, the remainder of images represents a time lapse of approximately two seconds. In this short amount of time the soldier will learn the layout of the room, identify the presence of any immediate threats, and establish a dominant position. This is the perspective of an individual soldier, without acknowledging coverage that would be provided by their teammates in an actual combat scenario.

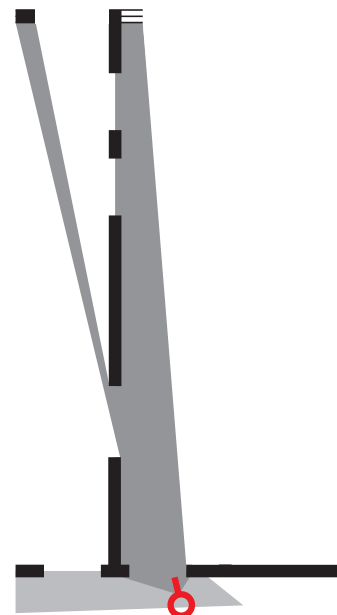
01.

While staging outside the doorway, a small opening in the wall is noticed; this “mouse hole” poses a threat of possibly containing a detonator, IED, or the muzzle of a gun. Because what lies beyond the doorway is completely unknown, the soldier must prioritize on the fly, as he approaches and passes through the doorway. The doorway itself, is a fatal funnel, and should be transgressed as quickly as possible.



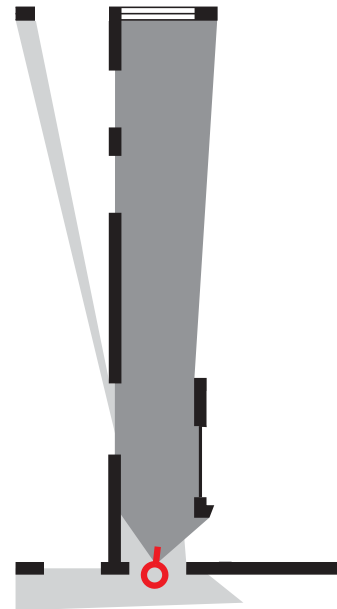
02.

At this point the soldier is in motion, has exposed themselves to whatever is beyond the doorway, and is fully committed to entering the room. Approaching the doorway, the soldier sees another mouse hole and multiple doorways into another room, all of which could pose a threat.



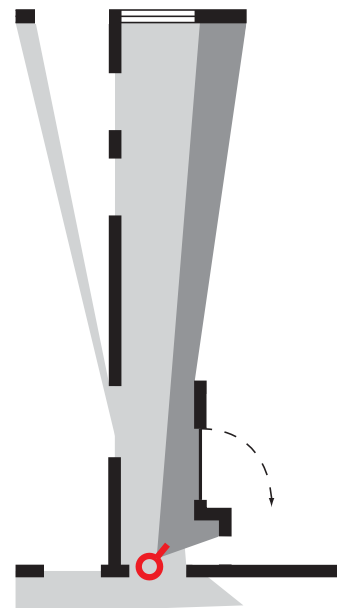
03.

As the soldier reaches the doorway, they realize there is an opening immediately to their right; because of its proximity to the soldier, this becomes highest priority and must be cleared immediately. This will partially ensure the soldier doesn't walk past an enemy and become surrounded once inside the room.



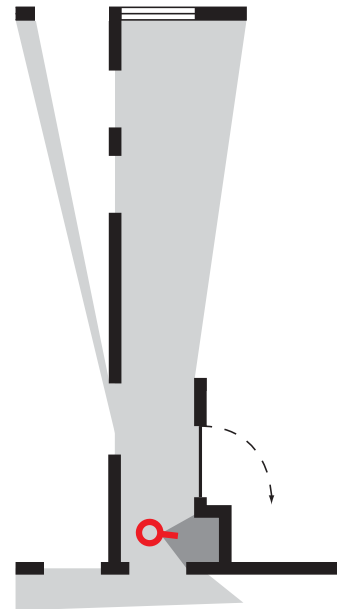
04.

While turning to assess the alcove, the soldier identifies a closed door as a high threat because of the handling; the slightest opening would expose the soldier to someone on the other side.



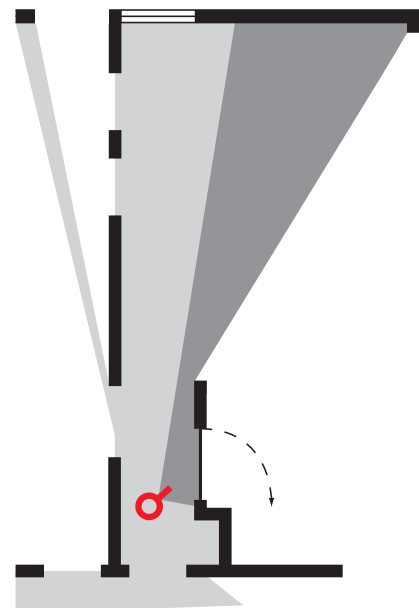
05.

In clearing the alcove, the soldier slows passage through the fatal funnel and exposes their side to several openings and the closed door.



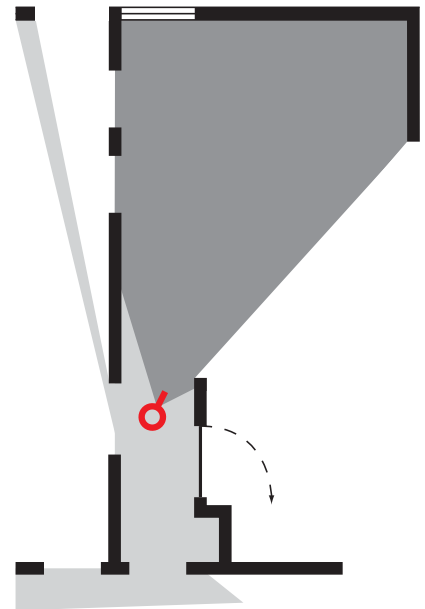
06.

The soldier must quickly move beyond the threat posed by the closed door and openings into the adjacent room.



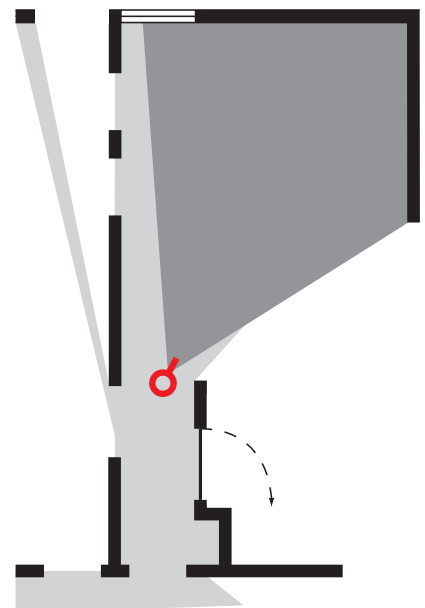
07.

The priority here remains the immediate space the soldier occupies, forcing the soldier to turn their back to the openings into the next room.



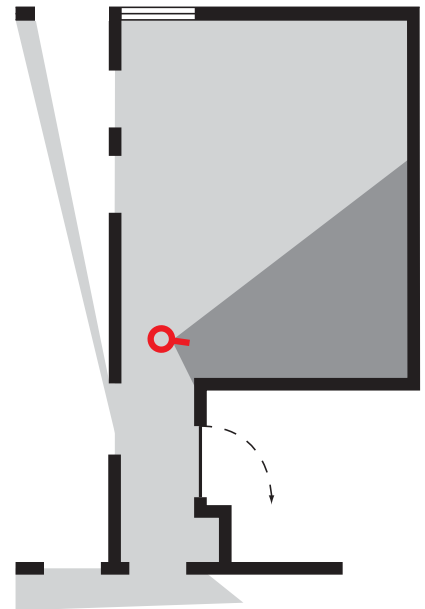
08.

Upon rounding the corner into the larger space, markings on the wall consume cognitive energy to be deemed safe or threatening.



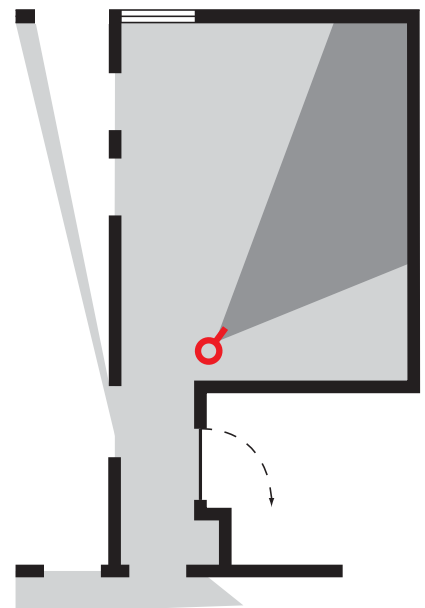
09.

Objects in the corner consume further cognitive energy to be deemed safe or threatening.



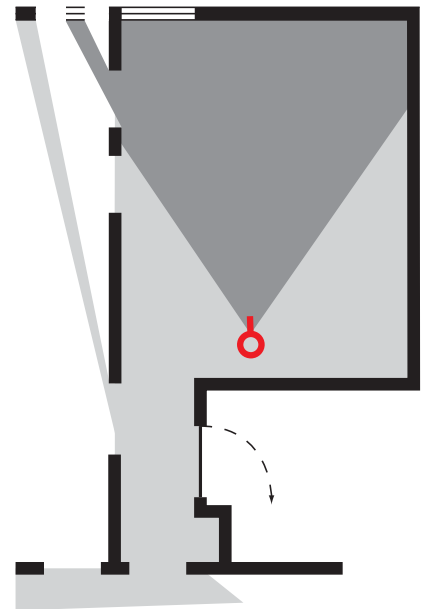
10.

At this point the room has been cleared, but in doing so the soldier was forced to turn their back towards openings into the next room and must now rotate 180°.



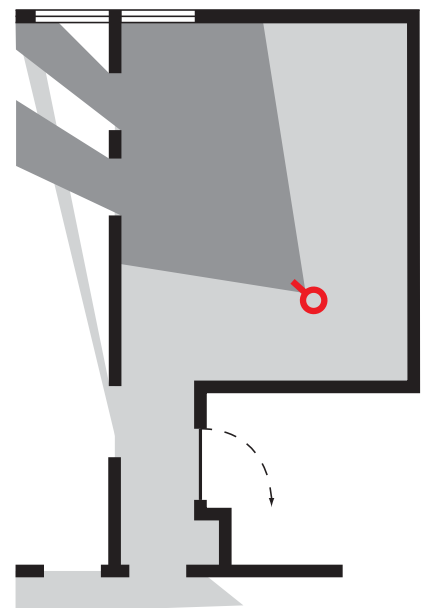
11.

The bright light entering through the window contrasts sharply with the interior light levels, making it impossible for the human eye to view both simultaneously. The immediate space remains the priority, although someone could be approaching the window unseen.



12.

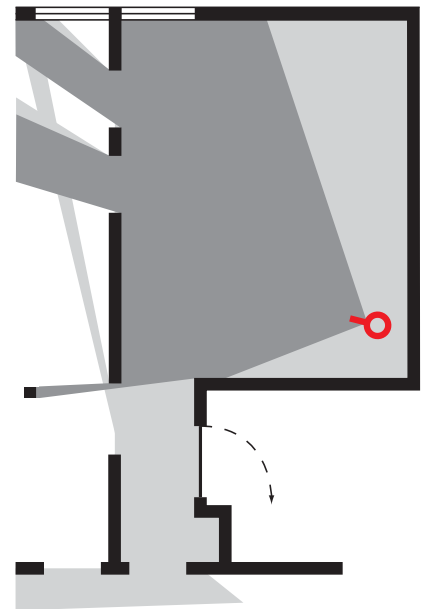
More of the adjacent room can now be seen, revealing the porosity of the space, a highly dangerous environment.





Now in a dominant position, the soldier will continually scan for any indication of a threat, keeping in mind the room beyond the closed door was not cleared.

At this time, the soldier would likely take a moment to let their eyes adjust and attempt to see what is outside the window, a difficult decision because doing so would temporarily make the much darker interior more difficult to monitor. They would continue to scan their surroundings until they determine it is time to move elsewhere. In a situation like this, because they cannot know what is happening beyond these walls, the space will never be deemed completely safe.



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IMAGE REFERENCES

Cover Image

Veteran

<http://www.flickr.com/photos/50389577@N03/7128265675>

Soldier

<http://edition.cnn.com/2008/POLITICS/02/28/dems.view.abroad/>

Desertscape

<http://galleryheart.com/2012/30-arabian-desert-landscape-photography/>

Cityscape

<http://www.wallconvert.com/converted/cityscape-wallpaper-29-172676.html>

Rod of Asclepius

http://www.artistsvalley.com/previewicons-Medical-Healthcare-Icons/Rod_of_Asclepius_Security_Check-icon.html

Figure 2.1

Soldier 1

<http://www.amazon.com/Mcfarlanes-Military-Desert-Infantry-Series/dp/B000AQDPHO>

Soldier 2

<http://www.shelflife.net/McFarlane-Toys-Military-6-inch-Figures-Redeployed-Series-1b/army-desert-infantry-1>

Soldier 3

http://www.flickr.com/photos/no_onions/88154695

Soldier 4

<http://www.sgcollect.com/forum/lofiversion/index.php/t30774-200.html>

Urban Scene

<http://www.flickr.com/photos/vincebm/8646210455>

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