I, Ryan E Duncan, hereby submit this original work as part of the requirements for the degree of Master of Architecture in Architecture.

It is entitled:
Objective: Amelioration
Applied environmental psychology to foster convalescence in transitional care and transient housing for U.S. veterans.

Student's name: Ryan E Duncan

This work and its defense approved by:

Committee chair: Vincent Sansalone, M.Arch.

Committee member: Udo Greinacher, M.Arch.
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Applied environmental psychology to foster convalescence in transitional care and transient housing for U.S. veterans.
Throughout the course of history, traumatic experiences shaped the way human beings survived and adapted to their environment and fit into their society. The repercussions of these experiences has left permanent impact on the psyche of individuals and groups of individuals. A universal experience shared across time, geography, and culture is warfare. Ancient societies fought with one another for power, rivalry, imperialism, and various other motives. The battlefield was a place of extreme stress and intense traumatic experience. However, soldiers operated in a battlefield of extreme intensity and danger followed by long periods of low intensity and relative safety when soldiers were at camp or marching. Additionally, soldiers very commonly had long periods of time between combat and re-entering society spent participating in marches, riding trains, and aboard ships as a means of returning home. This return home allowed decompression from intense experiences and time to fraternize with comrades regarding shared experiences. In August of 1914, a paradigm shift in the experience of warfare occurred when the early battles of the First World War took place on the Western front. Soldiers were subjected to endless periods of high intensity and continuous risk. The dichotomy of combat and rest had diminished into perpetual unease without break. This condition defines modern (20th century) warfare. These conditions create a difficult transition process for veterans, epitomized by the rampant
homelessness, post-traumatic stress disorder, and substance abuse of Vietnam veterans. Modern soldiers are trained to be hyper-sensitive to their surrounding environment and can have a difficult time re-adjusting to the traditional environment of civilian life.

Operations Homefront is a non-profit organization that aids veterans in the transition home. They provide housing for physically and mentally wounded veterans. After discharge, a soldier's VA benefits may take months to become effective. Operations Homefront offers temporary housing during the transition from full salary to stipend disability pay. The environment where this transition takes place has psychological impacts on the occupant.

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.  

The architecture of the place can directly respond to the occupant and the desired outcome of that experience. That is not to say that by controlling the environment, every experience will be better than the alternative, but rather, that the overall place environment will be better than the traditional model. "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."  

This project explores the psychological impact of environments on individuals undergoing a transitional process. The project applies theories and research in seven prominent continuum's of environmental psychology and architectural design including: cognition, stimulation, nature, light, social connection, physical health, and universal design. Applied environmental psychology can improve transitional care and transient housing for post-traumatic survivors; guiding the design of a transitional facility for U.S. veterans.

2 Ibid.
Through the history of mankind, there is no organization of people enduring more sustained traumatic experiences than armed forces fighting in combat. During the turn of the 20th century, armed forces throughout Europe were entering the greatest paradigm shift in warfare ever to occur; the transition of limitations. Before this time, man was limited by the power and utility of himself and his horse, from this time onward, the entire industrial power of a nation became the limitation of soldiers in combat. The result was catastrophic, and today’s economic, political, and combative atmospheres are all resultant of the ‘Guns of August’ and man’s inability to place the value of life over the value of ideals. The political turbulence of the 1960s and 1970s attributed to the poor support programs and lack of support for Vietnam veterans, perpetuating a rampant influx of veteran based drug abuse, homelessness, and suicide. Today’s US armed forces receive much greater civilian and institutional support that they did 50 years ago.

The armed men and women of the United States enlist to fight for our ideals, and voluntarily accept the burdens of their service. The time is appropriate for a better way to offer support and awareness of the sacrifice given by our service men and women. In recent years, the CEO of Starbucks, Howard Shultz, donated $30 million to brain trauma in post traumatic stress disorder in United States Veterans. Beneficiary acts like this are
Strategic bombing over Europe in WWII was particularly dangerous. B17 crews were expected to be shot down or disabled after 8-12 missions. The US air force required 25 completed missions before returning to the US.

Figure 1: Strategic bombing over Europe in WWII was particularly dangerous. B17 crews were expected to be shot down or disabled after 8-12 missions. The US air force required 25 completed missions before returning to the US.

evidence that social awareness and funding for military veterans are increasing. The social climate is in great support of our troops. Designers of spaces for our troops must follow suit.

My grandfather, Donald Miller, was a veteran of World War II. He was a waist gunner in B-24s and B-29s and was shot down over Hamburg, Germany on August 6th, 1944. He was a prisoner of war in Nazi Germany and upon release, weighed approximately 80 pounds. My grandfather never talked about the war, and never showed any signs of post-traumatic stress disorder for almost the entire duration of his life. During his last year alive, he was placed in hospice care. His reactions to the space he lived in became very negative. He often remarked that he felt like he was in a cage, showing signs of extreme discomfort.

Our family believes that the impact of solitude and limited positive stimulation created an environment in which my grandfather began to demonstrate signs of post-traumatic stress disorder that he had been suppressing for over 60 years. This is one of countless examples of veterans suffering from post-traumatic stress from events they experienced.
The expectations of our armed service men will not change in the near future. Neither will the impact these experiences have on the human psych. However, the way in which these veterans transition from military service into civilian life can change.
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Psychology is the academic discipline and applied science regarding the mind and behavior. The role of psychology is to understand individuals and groups of individuals through the establishment of general principles. This helps to understand the role of mental functions both in individual cases, and in social behavior. In psychology, practitioners and researchers are known as psychologists:

Psychologists explore concepts such as perception, cognition, attention, emotion, intelligence, phenomenology, motivation, brain functioning, personality, behavior, and interpersonal relationships, including psychological resilience, family resilience, and other areas.³

Psychological knowledge is known to be used in the assessment and treatment of mental health problems as well as problem solving in several spheres of human activity.⁴ Ultimately, psychology is a scientific study of how humans think, feel and behave.

There are various perspectives in the realm of psychology that explore different reasons humans think, feel, and behave. It is widely agreed that there are five major perspectives in

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⁴ Ibid.
psychology that guide modern psychological research. The five main approaches include the biological approach, psycho-dynamic approach, cognitive approach, the humanistic approach, and the behaviorism approach. Most psychological professionals and researchers agree that human thought, feelings, and behavior are driven by a combination of nurture and natural factors. These factors can be analyzed through the five primary psychology perspectives.

The biological perspective that looks at the human nervous system, hormones, and genetic makeup as the driving force in behavior. Some early work in this approach is driven from Charles Darwin (1859) and his demonstrations that genetics and evolution influence human behavior through natural selection. Biological factors include chromosomes, hormones, and gender. Biological psychology explains behavior in neurological terms.

First developed by Sigmund Freud, the psycho-dynamic perspective suggests that events in our childhood have significant impact in our behavior as adults. Freud believed that many of our impulse are driven by sex. He maintained that conflict occurs when societal restrictions are placed on these urges. One of Freud’s conceptual analogies is comparing the human mind to an iceberg. Only a small amount is visible but the underlying (subconscious) part has the most influence on behavior. Freud’s theories are criticized for over emphasizing the importance of sexuality and under-emphasizing of the importance of social relationships.

The cognitive approach was developed by Wilhelm Wundt (1879) and institutionalized psychology as a science. Cognitive Psychology revolves around the notion that if we want to know what makes people tick then the way to do it is to figure out what processes are actually going on in their minds. In other words, psychologists from this perspective study cognition which is ‘the mental act or process by which knowledge is acquired.’ The cognitive perspective is concerned with “mental” functions such as memory, perception, attention etc. It views people as being similar to computers in the way we process information.

This approach was furthered by Swiss psychologist Jean Piaget (1960s) who developed a study

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6 Ibid.
7 Ibid.
8 Ibid.
9 Ibid.
of the origins of knowledge, known as genetic epistemology. The goal of this study is, “to link the validity of knowledge to the model of its construction.” This uncovers how knowledge is gained and what its validity is.

The humanistic approach suggests that humans are essentially good and that they seek more than just survival, they seek to realize their full potential. This perspective is driven by the idea of individual empowerment. “The humanistic perspective centers on the view that each person is unique and individual, and has the free will to change at any time in his or her lives.” An individual can feel good by fulfilling needs and goals. “The prominent humanistic psychologist Carl Rogers called his patients ‘clients’ and offered a supportive environment in which clients could gain insight into their own feelings.” Essentially, whether good or bad, you are motivated to be the best person you can be.

The behavioral approach maintains that external environmental stimuli influence behavior. Moreover, our behavior is based on the result of what we have learned from our environment. There are two ways an individual learns from their environment, classical conditioning and operant conditioning. “Classical conditioning involves learning by association, and operant conditioning involves learning from the consequences of behavior.” Behaviorism is criticized for underestimating the complexity of human behavior.

In conclusion, no one perspective have exclusive explanatory powers over another. The different perspectives explain different types of behavior in different ways. We can only understand problems and create effective solutions when all types of psychology are considered. This often leads to contradictions in train of thought.

One of the most prominent contradictions in modern psychology is the debate regarding the extend in which aspects of behavior are inherited or acquired. This is known at the nature verses nurture debate. Nature factors are derived from genetic inheritance and biological

Figure 3: The combination of nature factors and nature factors in an individual’s life is what defines their unique personality.

13 Ibid.
factors. Nurture is influence of external factors that are learned after conception, which is the product of exposure. Both sets of factors are known to influence human behavior.

It is widely accepted now that heredity and the environment do not act independently. Instead of defending extreme nativist or nurturist views, most psychological researchers are now interested in investigating the ways in which nature and nurture interact. For example, in psychopathology, this means that both a genetic predisposition and an appropriate environmental trigger are required for a mental disorder to develop.\textsuperscript{15}

In summary, biology interacts with cultural context and personal decisions that people make regarding the lifestyle they wish to peruse. There is not a monochromatic or simple way to unravel the qualitative and reciprocal influences from nature and nurture on human behavior.

Personality can help explain or predict human behavior. It is a set of traits and characteristics that influence the way humans think and actions they take in given situations. Our personality has a lot of influence on how we think, what we feel, and how we relate to one another. Personality can be understood through the lenses of all five psychology perspectives.

Although there is debate between whether or not our personalities are inherent when we are born (nature) versus the way we grew up (nurture), most researchers agree that personality is usually a result of both nature and our environmental/education experiences.\textsuperscript{16}

Our experiences help shape individual values which in turn, determine our personality. Values

Perception can be split into two processes. Firstly processing sensory input which transforms these low-level information to higher-level information (e.g., extracts shapes for object recognition). Secondly processing which is connected with person's concept and expectations (knowledge), and selective mechanisms (attention) that influence perception.

are a set of principles or standards of behavior that individuals find most important. Both personalities and values influence individual attitudes.

Our attitudes are favorable or unfavorable opinions toward people, things, or situations. Many things affect our attitudes, including the environment we were brought up in and our individual experiences. Our personalities and values play a large role in our attitudes as well.\(^7\)

Ultimately, an individual’s attitude is based on how we set up our expectations, the way a situation is handled if expectations are not met, and how we summarize another person, situation, or experience. Our personality, values, and attitudes shape how we interact with others. To encourage the growth of human relations, we need to promote underlying personality characteristics, values, and attitudes that strengthen or inhibit relateability to others.

Perception is the way individuals understand and interpret something. “Perception is the recognition and interpretation of sensory stimuli based upon our memory. In other words, it is the way you interpret data around you. The data could come from sight, smell, touch, taste, and hearing.”\(^8\) Expectations, interests, peer groups, needs, and heredity are among the many influences on an individuals perception. A halo effect can influence perception. A halo effect is when one characteristic of a perceived thing is likable, it is assumed the rest of the perceived thing is likable. The same is true in a reverse halo effect, which is the reciprocal of a halo effect.\(^9\)

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\(^7\) Ibid.
\(^8\) Ibid.
Environmental psychology is a branch of psychology that is focused on the interaction of humans and the environments they inhabit. The term “environment” is used broadly, as it refers to the built environment, natural environment, learning environments, informal environments, and social settings. There is a vast continuum of theories and research conducted in the realm of environmental psychology. To begin to understand the various theories and research it is important to first understand the foundation for research on the Human Environment.

There are four primary theories that make up the foundation for research conducted on the human-environment:

1. Integration theories describe a collection of models used to understand the complex human-environment relationship. Within this theory, there are five major elements that work in harmony to facilitate particular behavior:
   • Global environment is the general characteristics of an environment.
   • Instigators are stimuli that trigger behavior.
   • Goal objects and goal noxients are situations that create positive or negative sensations.
   • Support and constraints are environmental aspects that facilitate or restrict

What is environmental psychology?
behavior.

- Directors are features that tell us what to do and where to go.

2. Control theories suggest that having a sense of control over our environment is crucial to our well-being. We can control our environment in three ways:
  - Behavioral Control: Change the event within the environment.
  - Cognitive Control: Changing the way we conceive an environment.
  - Decisional Control: Choosing how we respond to an environment.

3. Behavior-setting theories suggest that at an early age we learn that certain behaviors are expected in certain types of environments and other behaviors are expected in other environments (i.e. studying at a public school vs. a library vs. a café). Most behavior settings are public and include these three settings:
  - Physical properties
  - Social Components
  - The environment setting

4. Stimulation theories conceptualize the environment as a source of sensory information that is perceived through the 5 senses. Each of these five sense can be over stimulated or under stimulated in a specific environment. The attention restoration theory is based on three types of attention, either voluntary or involuntary:
  - Directed attention: voluntary and intended attention.
  - Attention deficit: inability to concentrate.
  - Effortless attention: involuntary and interest based attention

Everyone perceives their environments differently. The research conducted on the human environment stems from 4 primary theories. Each theory explores a facet in research on human environments, and similar to nature vs. nurture theories, different approaches contradict themselves but also offer the most holistic approach to research conducted on the human-environment.

Everyone perceives their surroundings differently, however, there are fundamental laws that describe how people experience their physical environments. In Place Advantage, Sally Augustin describes the significance of place design and the impact of applied psychology for design, specifically, for interior architecture. Augustin offers access to insights in environmental psychology and how the built environment begins to shape and influence human attitudes and behavior. “The design of a physical place influences the mental state of the people in that space. That shapes their attitudes and behavior.”

The author maintains the significance of place and the impact of the place design for groups of people and also as an individual’s response to place and the related memories of that place and their importance throughout time. “Place-related memories were very important for human survival in the past – we had to remember where camp was and where it was safe to sleep. Now each of our individualized sets of place memories influences the design of the spaces where we can thrive.”

There are 16 basic motives that propel human beings through their lives. The place environment more or less closely effects in each example.

- **Power** – Places provide information and this information can influence us.
- **Curiosity** – A space can help you grow and develop as a person.
- **Independence** – Spaces allow us to control our own, and others, destinies.
- **Status** – Space, objects in it, and how it communicates power.
- **Social Contact** – Public versus private spaces control interaction with others.
- **Vengeance** – Spaces can be used for good or evil.

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21 Ibid.
Honor – A place communicates how much we value tradition.
Idealism – The causes we support are manifested in our spaces.
Physical Exercise – Spaces can provide are reduce opportunities for exercise.
Romance – Mutually acceptable physical spaces provide opportunities for romance.
Family – Homes become the physical medium we use to raise families as we desire.
Order – Our lives have obvious or underlying order, so do the places we inhabit.
Eating – Food, as a basic necessity, is enjoyed in designated and impromptu spaces.
Acceptance – People communicate desire for approval in space through social conventions.
Tranquility – Place design can help people reduce stress and tension.
Saving – Places can be financial and emotional equity.

Additional to the 16 basic motives for human beings that relate to space, the author outlines five continuum's of well-designed spaces; complying, communicating, comforting, challenging, and continuing. These five attributes exist in all successful spaces and allow the space to function ergonomically and support human behavior within the space:

Complying: A space that complies helps people complete their task at hand through physical resources as well as setting a mood for the task at hand.
Communicating: Communication, verbal and non-verbal, is essential to socializing with other humans. The design of a place has visual and acoustic implications that affect the way humans verbally and non-verbally communicate.
Comforting: Well-designed spaces are comfortable, “Spaces must provide us with a respite from the demands of our world. Being alive is, and always has been, stressful.”
Control over a space is comforting. Different types of spaces require varying levels of control.
Challenging: A well designed space helps us develop and grow, both as an individual, and as a population. The space should cater to the needs of the individual.
Continuing: Finally, a space must evolve over time. The changes can take place at varying scales and intensities.

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22 Ibid.
23 Ibid.
The ultimate goal of any space is to improve lives of the occupants in that space. This involves the amenities in the space, the ergonomics of the objects shaping the space, and the environmental attributes that affect the behavior of the space.

Within the realm of psychology, environmental psychology is the study of the relationship between an occupant and the space that is occupied. Architecture is the design of the built environment. There are psychological studies that go beyond the design of the environment. An article by Ross Johnson describes 10 psychological principles to design with. This article is intended for web design application. However, 6 of the 10 principles are applicable to environmental psychology:

**Visceral Reactions** - Much of human behavior is still rooted and influenced by our “old brain,” the part of our mind controlling the survival instincts that kept our ancestors alive. The old brain reacts much faster than conscious thought and is triggered

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Not only are old brain signals faster than conscious thought, they influence us without our knowledge (i.e. visceral reactions are subconscious.) Ever love a design but have a hard time explaining why? Chances are you had a visceral reaction and your old brain reacted to the visuals positively. Because visceral reactions are rooted in our genetic makeup, the responses are fairly consistent across all cultures, genders and demographics. As a result, visceral design produces very predictable reactions.

Gestalt Principles - Developed by German psychologists in the 1920s, the principles describe the ways that our brain assumes unification or relatedness to visuals based on

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Figure 8: Unification and relatedness are based on a proximity and white space.
Figure 9: The more options available, the longer the decision process.

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proximity and whitespace.  

**Hick’s Law** - Simply put, the law states that more option one is exposed to the longer it takes to make a decision.

**Cost-Benefit Analysis** - Related to visceral reactions is the cost-benefit principle which surmises behavior is regulated by the perceived difficulty of a task in relation to the perceived reward. Basic human behavior can be summed up in two patterns: opportunity seeking and threat avoidance.

**Pattern Matching** - Pattern matching (or pattern recognition) is the way we process everything we see from people’s faces to the written word. When visual stimuli enters our eye it immediately starts a chain reaction in the brain. We subconsciously start hunting for anything similar to the current stimuli that we have experienced in the past. If the stimuli is matched to a preexisting pattern we recognize what we are seeing, otherwise the stimuli is perceived as being new. This process goes beyond recognizing forms and colors, it also triggers any cognitive associations with the pattern being matched.

**Social Influence** – The influence of others extends far beyond facial expressions, there are specific actions that have predictable influences on human behavior. In the article Persuasion in Design, author UX Designer Elisa del Galdo references the six universal principles of social influence. These principles are hardwired into the human psyche, developed as a necessity to human survival.

1. **Reciprocation**: We are compelled to return favors, often in greater value than the original.
2. **Authority**: We trust experts and those of high status or power.
3. **Commitment/Consistency**: We want to act consistently with our commitments and values
4. **Scarcity**: The less available a resource, the more we want it.

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30 Ibid
31 Ibid
5. **Liking:** The more we like people, the more we want to say yes to them.

6. **Social Proof:** We look to others to guide our behavior.

These 6 principles help inform design in all facets, and can supplement the theories and research that exists in environmental psychology.

During a lecture at the Boston Architectural College, Dan Kopec discusses the meaning of environmental psychology, how it effects design, and how what role architecture plays. Kopec holds a PhD in environmental psychology, a Master of Architecture degree and a Master’s degree in Social psychology. His definition of environmental psychology is, “the interaction between humans and the environments they inhabit.”

He continues with three paradigms regarding environmental psychology:

- We influence our environments
- Our environments influence us
- A symbiotic relationship exists between humans and their environments

Figure 10 is a mirrored room that metaphorically represents the relationship humans have with the space they inhabit and how they are both continuously influencing one another.

One key aspect to consider when designing spaces is to avoid thinking of things and events as singularities. As Newton’s third law of motion state, “for every action there is an equal, and opposite reaction.” The same is true with environmental design. Kopec uses the illustration shown in figure 11 as an example of unintended reactions for an action, or lack of action. A man can’t find a trash can to throw away his gum because the designer omitted them from the proposal. Despite his respectful upbringing, he has to dispose of the gum. Even though there is a $500 fine for littering, the man throws his gum on the ground. After receiving a phone call, he returns to his office before heading over to a friends house. He accidentally steps on his gum, which he later tracks into his friends house. This causes an angry reaction from his friend. The lesson learned is that the reaction caused by the action of omitting the trashcans from the design is multi-layered and has a trickle down affect.

The environment that humans occupy affects neurobiology and learning. To understand these impacts, consider sensory organs as nothing more than tools for the brain. Essentially,
Objective: Amelioration

**Figure 12:** Neural connections in the brain. New connections are highlighted in Orange.

**Figure 13:** Human performance throughout the day.

*Fig. 2.3.1.* A general representation of performance at different times of day.
eyes, ears, nose, etc, are mechanical tools that relay information to the brain. The act of learning is the input of stimuli to the brain which forms and maintains neural connections. These neural connections are essentially cords that grow together. Figure 12 illustrates what neural connections look like and the orange spots illustrate new connections. Over time, the neural connections can decline. The theory to maintain neural connections is summarized in a common euphemism, “if you don’t use it, you lose it.” This means, that environments intended for learning or maintaining knowledge require multi sensory stimulation. The strategic stabilization of the different senses is the best for creation and maintenance of neural connections. However, it is important to only stimulate sensory input that are vital to the current cognitive process, “The central process receives information from all sensory sources and, even though it has no relevance for other stimuli which are present, any additional stimulus will affect the ongoing central process, and may alter performance... It might be possible to improve performance by including or excluding additional stimuli.” The most effective way to include or omit the most effective stimuli requires a thorough understanding of the cognitive process at had, the environment, and the individual or group of individuals.

One of the most prominent ways the brain receives sensory input is through the visual cortex. The visual cortex is the part of the cerebral cortex that receives and processes sensory nerve impulses from the eyes. Through ocular biology, we know that the development of visual cortex is not fully mature until 8 years old. Throughout an individual’s lifetime, the eye does not have the ability to remove the build-up of keratin from the lenses of the eye. During the middle part of an individual’s life, the visual acuity begins to decline. Using high contrasting color and material pallets allows an individual with damaged eyesight to distinguish between different objects in the built environment. Visual cognition is the brains way of combining visual data with prior knowledge to construct high level representations and make unconscious decisions about scene content. As the visual acuity of an individual declines, their visual cognition skills decline as well. Kopec provides an example of a visually impaired individual mistaking shadows in a room with level changes on the floor. The individual’s visual cognition caused the individual to take a step downward when there wasn’t actually a level change, causing them to fall and injure themselves. Within the built environment, the designer has the ability to control some forces that impact visual cognition including: shadow, glare, contrast, depth perception, and material change.

In any environment, it is common to distinguish between noise and sound. Noise is simply unwanted sound. Sound is measured and interpreted in the brain as pitch and pressure against the eardrum. The human ear is capable of perceiving sound in the range of 20 Hz- 18,000 Hz. The pressure applied to the eardrum is measure in pascals. Decibels are the conversion of this pressure into a perceived loudness of sound. The range of frequency and the loudness of sound have affects on humans, both physically and mentally, including; hearing damage, hearing loss, annoyance, and noise sensitivity. Noise annoyance results in irritation, masking, and distraction. Noise can also cause sudden startling, which is especially problematic for individuals with mental disorders. This is known as the startle response:

   The strength of the startle response depends on how relaxed or aroused the person is, so that the person who is highly charged emotionally is more reactive to noise. This point may have a peculiar significance for noise in buildings. Whereas there is habituation of our responsiveness to most of the stimuli which affect us repeatedly, it

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33 Ibid.
36 Ibid, 47.
37 Ibid, 51.
has been suggested (Saegart, 1976) that the alerting, arousing affect of other people does not habituate. If this is the case, other people’s presence may itself accentuate the effects of noise by increasing arousal. Whether this speculation is well-founded or not, people along with devices, design, and noises which penetrate from outside, are the most commonly reported sources of annoying noises in buildings.

The effects of noise can limit cognitive functions and create distractions for individuals and groups of individuals.

The effects of noise and vibration are sometimes one in the same. However, vibration can be a result of a non audible source. The feeling of vibration is the displacement of all or part of the body at a certain frequency. The frequency and magnitude of the displacement create varying affects on humans. A hertz (Hz) is a unit of measurement referring to one full oscillation in 1 second. Different organs and parts of the body have different resonant frequency, therefor 

Figure 14: The circadian cycle produces timed tendencies in all humans.

38 Ibid. 52.
the effect of the vibration varies throughout the body. For example, the chest and abdomen resonate at 4-8 Hz. Studies have shown that effects of vibration begin at 1 Hz. However, conditions regarding motion sickness usually begin at frequencies less than 1 Hz. Visual acuity is adversely affected at 10-20 Hz. Scanning is most impaired at 3-5 Hz. In conclusion, the three largest problems within vibration in buildings are disorientation, visual impairment, and interference of controlled movements.

Smells have a very powerful impact on behavior. Acceptable and unacceptable conditions of odor are assumed more often than they are studied or discussed. “For buildings, the main odor concerns center on air pollution effects from petrol from traffic, air conditioning and ventilation, and, to some extent, smells from other people. The last is dealt with by spacing and ventilation.” When applying environmental psychology to architecture, the effects of odor are important to consider, as they do affect human behavior within buildings.

Humans generally function on a 24 hour cycle, known as the circadian rhythm. “Circadian rhythms are important ergonomically so far that human performance is better at some times of the day that others [figure 14], and also because if resetting the internal ‘biological clock’ becomes necessary, it takes time before performance regains its characteristic level.” The human body is naturally calibrated to the circadian cycle. The main factor that mediates daytime and nighttime appears to be the presence or absence of light. Although many environments rely heavily on artificial light, natural light is the best form of full spectrum light. Direct sunlight passing through glass loses the majority of the benefits of full spectrum light. These include the reception and production of vitamin D, melatonin, and serotonin.

Full spectrum sunlight light enters our eyes and reaches the pineal gland. This activates our Endocrine system which is connected to our immune and nervous systems. The pineal gland controls the production of melatonin, which is a hormone that is related to sleep and being awake. At night, the pineal gland produces melatonin at %100 capacity. When sunlight reaches the pineal gland, this reduces to %10. The same gland produces serotonin during the day. Serotonin is a neurotransmitter that is related to feelings of wellness and happiness. Individuals who suffer from seasonal depression have a surplus of melatonin and deficiency of serotonin in winter months when full spectrum sunlight is less accessible. Individuals who suffer from depression are often prescribed selective serotonin re-uptake inhibitors (SSRIs). SSRIs limit the amount of serotonin being removed from active circulation in the body, synthetically regulating higher amounts of serotonin to effectively contribute to wellness and happiness. Stimulating the pineal glad to produce proper amounts of melatonin and serotonin is paramount to good health.

The Circadian Cycle is just one of many cycles that humans are affected by. Other cycles include the menstrual cycle, the weekly cycle of work and rest that is adopted in many cultures, and seasonal cycles. “Some of the longer cycles are less easily studied simply because more variables can exert an influence during longer time spans, and more data tends to be lost as cycles move into months and years.” However, for unknown reasons incidents of suicides in people who suffer from depression illnesses are more common in late spring.

Elements of social learning affect the mind and contribute to associative meanings, and cultural meanings. “Association in psychology refers to a connection between conceptual entities or mental states that results from the similarity between those states or their proximity in space or time.” These associations are usually established through experience. The associations can

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39 Ibid, 62.
40 Ibid, 66.
42 Ibid, 20.
be expressed reflexively, deliberately, or spontaneously. These associations can create behavior settings. This is a setting in which the associated meaning encourages a certain behavior. For example, if a pair of people are walking down the street and conversing, their conversation is usually audible enough to exceed the ambient noise. If they walk into an empty church, their associated meaning of that behavior setting will encourage them to reduce the volume of their voices. Associated meaning can also create ideological connections. The architectural purpose creates a place attachment. A hospital is a place where people die, the ideological connection is historically solemn. The architectural purpose of a classroom is learning. It’s ideological connection is usually of teacher and students, a hierarchical system of power. The only way to remove the ideological connection from the architectural purpose is to deconstruct the environment. In the classroom, this can be done by removing the dry erase boards and presentation equipment facing the students desks.

Cultural norms effect how we perceive social learning. One example of cultural norms is gender norms. Figures 15 & 16 demonstrate the different ways men and women converse with one another in a social setting. Men do not directly face one another, but prefer to sit at acute angles from one another, facing a common source of visual stimulation. Sitting face to face is subconsciously more competitive for men. Women tend to face one another when conversing. Women are generally more expressive and pay closer attention to body language and emotion. Another cultural norm that exists and is often different between men and women is the concept of personal space. Men typically have a larger personal space “bubble” than women. Personal space varies from culture to culture.

Biophilic Hypothesis

The biophilia hypothesis is a theory that suggests there is an instinctive bond between mankind and other living systems.

Edward O. Wilson introduced and popularized the hypothesis in his book, Biophilia (1984), He defines biophilia as “the urge to affiliate with other forms of life”. The term “biophilia” literally means “love of life or living systems.” It was first used by Erich Fromm to describe a psychological orientation of being attracted to all that is alive and vital.

Figure 15: Men tend to face a common object when casually conversing.
Figure 16: Women tend to face one another during casual conversation.
Wilson uses the term in the same sense when he suggests that biophilia describes “the connections that human beings subconsciously seek with the rest of life.” He proposed the possibility that the deep affinities humans have with other life forms and nature as a whole are rooted in our biology. Unlike phobias, which are the aversions and fears that people have of things in the natural world, phlias are the attractions and positive feelings that people have toward organisms, species, habitats, processes and objects in their natural surroundings. Although named by Fromm, the concept of biophilia has been proposed and defined many times over. Aristotle was one of many to put forward a concept that could be summarized as “love of life.” Diving into the term phillia, or friendship, Aristotle evokes the idea of reciprocity and how friendships are beneficial to both parties in more than just one way, but especially in the way of happiness.46

Nature has even been shown to have a healing affect on humans. This affect has been researched in several studies:

A growing body of science is showing that nature is good for you. That includes spending time in nature, but it even includes looking at natural scenes out a window. Some of what we know about the impact of nature on health is incomplete. One recent study tested over 1,200 elderly adults. Those who had not engaged in outdoor recreation in the past year were the most prone to major depression. Those who spent time outside four or more times a week suffered the least depression. This study found a correlation, but it did not necessarily find causation. Were people depressed because they did not go outside, or did they not go outside because they were depressed? The basics behind the “nature is healthy” concept goes back decades. In 1984, a classic study found that hospital patients recovered from surgery quicker if their room offered a view of nature compared to those who looked out on a brick wall. Another study, published in 2003, found that health increased with the amount of greenspace in one’s living environment. Nowadays, scientists are using this basic understanding to fine-tune the hows and whys of nature’s impact on health.47

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Transitional care is the continuation of healthcare during a movement from one healthcare setting to another or to home. This care transition is the result of changing care needs of patients from one setting to another. The American Geriatrics Society defines transitional care, Transitional care is defined as a set of actions designed to ensure the coordination and continuity of health care as patients transfer between different locations or different levels of care within the same location. Representative locations include (but are not limited to) hospitals, sub-acute and post-acute nursing homes, the patient’s home, primary and specialty care offices, and long-term care facilities.

The basis for transitional care is a comprehensive plan or care and the availability or healthcare practitioners who have specific training and information regarding patient goals and preferences. Transitional care, “encompasses both the sending and the receiving aspects of the transfer, is essential for persons with complex care needs.”

During the transitional process, patients deal with complex medical needs that can leave them at risk for poor outcomes due to medication errors, communication errors, or practitioner

49 Ibid.
The transitional care continuity or continuum involves the combination of rehabilitation, nursing facilities, hospitals and the patient’s house.

**Figure 18:** The transitional care continuity or continuum involves the combination of rehabilitation, nursing facilities, hospitals and the patient’s house.

Errors. Adverse patient outcomes include continued symptoms, temporary or permanent disability, or even death.

The continuum of care (transitional care continuity) refers to the degree in which care is coherent. Care is the singularity or combination of a hospital or medical treatment facility, rehabilitation center, the care-giving personnel, and the patients house. The continuity of care includes the continuity of information on prior events used to give appropriate care. It also includes the continuity of clinical management and the continuity of personal relationships between patients and providers.

After leaving a particular care setting, patients may not understand the management of their personal care conditions. Transitional care has the potential to empower individuals to better manage their own care.

Poorly managed transitions can lead to physical and emotional stress for both patients and their caregivers. During a transition, the patients’ preferences or personal goals
Transitional care has varying levels of continuation. This diagram illustrates how the human mind processes traumatic events.

Figure 19: Transitional care has varying levels of continuation.
Figure 20: This diagram illustrates how the human mind processes traumatic events.

in one setting may not be passed on to the next setting. This may result in important elements of the care plan “falling through the cracks.”

Figure 20 illustrates the way the human mind processes a traumatic event. Stimuli passes through the gatekeeper and triggers the autonomic nervous system. This process can potentially bypass higher-order thinking, which is the cause of PTSD. Stimuli can trigger flashbacks or reactions to the traumatic event. During the transitional process for post-traumatic survivors, the environment creates stimulation. Conclusively, the environment can be the cause of PTSD symptoms and affect the healing and transitional process for post-traumatic survivors.
In May of 1993, an idea was conceived to change the role of architecture in medical treatment facilities in a profound and meaningful way. 

Writer and designer Margaret Keswick Jencks sat in a windowless corridor of a small Scottish hospital, dreading what would come next. The prognosis was bad—her cancer had returned—but the waiting, and the waiting room, were draining. Over the next two years until her death, she returned several times for chemo drips. In such neglected, thoughtless spaces, she wrote, patients like herself were left to “wilt” under the desiccating glare of fluorescent lights.  

Margaret Keswick Jencks argued that the architecture of a place, specifically a place where one endures such intense treatment and hears life changing news, has a profound impact on that individual. She maintained that if architecture could, “contribute to extreme and mental enervation, could it not also prove restorative?” This is the central idea that, with the help of her husband, architectural historian and theorist Charles Jencks, launched their mission to provide

What are precedent examples of this type of architecture?

[52 Ibid.]
OMA’s Maggie’s Centre in Glasgow Poland. The building is a sequence of interconnected L-shaped figures that create distinct spaces and minimize the need for corridors and hallways.

Figure 21: OMA’s Maggie’s Centre in Glasgow Poland. The building is a sequence of interconnected L-shaped figures that create distinct spaces and minimize the need for corridors and hallways.

free care for cancer patients through great architecture. Since inception, there are 17 projects that include works by internationally celebrated architects. This esteemed list of architects includes, but is not limited to; Rem Koolhaas, Zaha Hadid, Snøhetta, Frank Gehry, Thomas Heatherwick, Steven Holl, and Norman Foster.

OMA won the prestigious Andrew Dooland Best Building in Scotland in 2012 for the welcoming, light, and spacious design of the Maggie’s Centre in Glasgow, Poland. The single story building serves as an alternative healthcare center that is composed of a series of interlocking rectangular spaces that encircle a green courtyard. There are transparent walls within the building that connect the patients to nature and fill the interior with light. The building provides “spaces of interaction, personal privacy, and discrete counseling rooms, along with private nooks and corners. A notable characteristic of Maggie’s Gartnavel is the rich use of materials, from the flush inlaid timber and concrete ceiling to the simplistic concrete exterior and expansive floor-to-ceiling glass walls.”

The building provides a place that allows people to feel at home and cared for by creating spaces that are warm, receptive, and welcoming.

In 2015, Heatherwick Studio has received planning permission for a new Maggie's Center that aims to harness the therapeutic effect of plants. The biophilic hypothesis is exercised, suggesting that humans have an innate connection with nature. The building was designed to act as a series of stepped “planters” that provide access to nature in public, private, interior, and exterior spaces. Thomas Heatherwick commented in a press release, “The site is a small patch of green surrounded by the huge volumes of the existing hospital buildings. Instead of taking away the open space we wanted to make a whole building out of a garden.” The design utilizes soft, natural materials and natural light to create comfortable places for comfortable interaction.

Figure 22: Heatherwick Studio's Maggie's Centre in Yorkshire, England. A mixture of private and communal meeting spaces take advantage of the healing power of plants.

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Located in Aberdeen City, UK, the Snøhetta designed Maggie’s Centre is a 3700 sf pavilion that serves not as a treatment center, but as a place where individuals can meet one another. The program allows cancer patients, friends, and family to connect with one another while receiving help and guidance. The freestanding structure features a soft curved exterior that sculptures the main spaces. Timber interior surface create more intimate rooms and spaces within the structure. The building features office functions, meeting rooms, and a lounge space. The key features of the building include ample sunlight exposure and connections to nature. The approach and surrounding context of the pavilion are populated with grass, trees, and various plants. Openings in the exterior shell allow views to the surrounding fields as well as natural light to enter interior spaces. A courtyard allows spaces for visitors to receive the positive health effects of full spectrum light.

The Maggie’s Cancer Care Center in London is designed by Steven Holl Architects. The site location is the large courtyard of St. Bartholomew’s Hospital, the city’s oldest hospital. The design of the building is a concrete frame with perforated bamboo interiors. The most recognizable material is the matte white glass that is interspersed with soft, colorful elements. The glass facade is layered in horizontal bands that resemble a musical staff. Steven Holl comments on the design:

The interior character of this building will be shaped by colored light washing the floors and walls, changing by the time of day and season. Interior lighting will be organized to allow the colored lenses together with the translucent white glass of the facade to present a new, joyful, glowing presence on this corner of the great square of St. Barts Hospital. The building tops out in a public roof garden with flowering trees open to a large room for yoga, Tai Chi, meetings, and more.

The design features open atrium space with an open-curved staircase that is lined with perforated bamboo. The translucent glass changes to clear glass at the base of the facade, creating an inviting entrance to a light filled interior. “The building is envisioned as a vessel within a vessel within a vessel.” The layering of contemporary materials and forms is intended to be a contrast to historic stone buildings without creating an overwhelming presence. The intents was not to mimic context, but compliment the historic surroundings. Upon completion, the 3 story, 6500 square foot building will be the second Maggie’s Center in the greater London area.

57 Ibid.
58 Ibid.
Figure 26: Shadows on the facade silhouette the activities of the interior. The colored elements are an interpretation to frozen music on the matte white glass layered facade.
The bamboo interior is used as a canvas for the bright and colorful natural lighting that illuminates the interior atrium space.

Figure 27: The bamboo interior is used as a canvas for the bright and colorful natural lighting that illuminates the interior atrium space.
Completed in 2014, the 3200 sf Maggie’s Centre at Monklands General Hospital is designed as the tale of enclosed gardens. The design features perforated brick walls, and glass boundaries that blur the interior from the exterior. The architect defines the building:

The garden walls of the new Maggie’s Center conceal a modest low building that gathers together a sequence of domestic scaled spaces, both internal and external. The external courts catch sunlight, creating sheltered sitting out places, siotoeries. Visitors enter a quiet simple space, an arrival court, defined by brick walls and two lime trees. At once there is a sense of dignity and calm. A linear rill, a spring, animates the space with the sound of running water, a refreshing source and an intimation of beginnings.  

The building plan contains four small sheltered courts, allowing spaces for quiet and reflection under exposure of full spectrum light. The building is framed in steel and timber. “The overall material palette is muted and soft, blonde Finnish birch to walls, limed oak to floors and white stained pine to ceilings.”

The journey through the building forces visitors to emerge into a walled garden with generous terraces to enjoy richly planted gardens. The building is designed as a connection between man and nature, creating pockets of intimacy and privacy.
The architecture and landscape work in tandem with these four walls forming the framework of the single story center. These fixed walls are made from cast ceramics, rooting the center to the earth in which it stands.

Amanda Levete Architects (AL_A) has proposed a new Maggie’s Centre in Southampton, located at the Southampton General Hospital. The center will provide free emotional, practical, and social support for cancer patients, their friends, and their family.

Bringing a bit of magic to the place, the building emerges from this wild naturalistic landscape with an almost ethereal clarity. Subtle, understated and imbued with light, it is designed to lift the weight from the shoulders of all who visit and work there. The 4500 sf facility is set within a shallow bowl to create a natural enclosure. This separates the building from the topographic uniformity. Dense plants around the perimeter of the building create a sense of natural isolation and privacy for the center.

The heart of any Maggie’s Centre is the kitchen, the first space that visitors encounter and an important gathering space for users and staff alike. A reference point in the middle of the building, the kitchen immediately establishes a comforting, domestic atmosphere in contrast to the more institutional spaces of the hospital. It sits below a circular skylight that brings daylight and sky views deeper into the building.

Movable partitions divide communal spaces allowing flexibility for a wide range of activities. Throughout the interior, reflective materials and surfaces drawing the changing, seasonal colors of the gardens into the building that support the sensation of a oneness with the natural woodland context.

62 Ibid.
SMR Architects partnered with Imagine housing to create a transitional housing facility for homeless veterans as well as formerly homeless individuals and their families. St. Margaret’s Episcopal Church initiated the 40 unit project that incorporates Housing, a Church, and a thrift store. The building defines the street edge and dictates vehicular and pedestrian connections to the three program uses. The layout, in plan view, is organized around a central spine that combines shared spaces including meeting space, laundry, and play areas. The exterior is kept modest and respectful in massing, materials, and scale with regards to the surrounding context. The design features limited amounts of bright colors to indicate entrances while respecting the monochromatic context. The units include many universal design features to increase their accessibility to a variety of tenant needs. The interior colors palette is soothing and contrasting to help visually impaired tenants. Some of the casework is removable/adjustable depending on the tenants needs. Windows are full height and are proportional to the human body, allow deep penetration of natural light. The progression to outlook terraces takes the user through shared hallways, to interior common rooms, which connect you to outdoor covered terraces, and then to spaces that are open to the sky, creating varying levels of natural and peer connection.

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The exterior of the 40 unit transitional housing project is respectful to the community in massing and color. Units include universal design features including contrasting color palettes and removable vanity cabinets.

Figure 30: The exterior of the 40 unit transitional housing project is respectful to the community in massing and color.
Figure 31: Units include universal design features including contrasting color palettes and removable vanity cabinets.
The proposed project will be a transitional facility for veterans who have suffered mental and/or physical wounds. The facility will not only offer housing for the veterans and their families, but supporting facilities that contribute to a positive and successful transitional process. Ideally, the facility will be viewed as a baseline for improving current transitional facilities. The contributed work can be used to improve transitional housing facilities for the homeless, battered women, drug and alcohol abuse programs, and facilities for halfway housing. The project will not only address the issue of transitional housing, but develop a better understanding of the psychological impacts of environmental design and the meaning of place. The project will explore concepts of visual balance and stability in many theories of the visual arts and architecture.

The project will be a facility that contributes to the transitional process of veterans to independent living and wellness in society. The construct the project will be a single building that has varying program areas, creating an internalized campus, where each element represents a specific function.

The program is intended to be the conglomeration of various non-profit organizations, creating a “mega” facility that takes the best elements from previous examples. The intent is to create a place where the most effective methods and facilities from various organizations...
can all come together, serve the same general purpose, and effectively improve post-service care for US veterans. Recently, the CEO of Starbucks donated $30 million for research in PTSD in combat veterans. It is with this mindset and funding that the facility is conceived. At a price point of $400-$600 a square foot, the projected program will be between 50,000 sf and 75,000 sf. The project funding will come from a single donation and operational expenses will be shared among various non-profit organizations.

**Program:**

**Entry**

**Reception**

**Dwelling**

- Entry space – threshold from exterior to interior, gateway to the interior of the home.
- Common space – shared space to augment interaction, host multipurpose activities.
- Kitchen – food preparation and storage, cultural hub of dwelling.
- Dining – food enjoyment, connects family and guests, facilitate interaction, multipurpose potential.
- Bedroom – place of intimate dwelling, private and personal solace, place of rest.
- Bathroom – sanitary, most private of all spaces, self-reflection and maintenance.
- Flexible spaces – additional bedroom or common space, flexibility.

**Shared facilities**

- Laundry – washer(s) and dryer(s).
- Mud room – place to clean oneself and equipment.
- Storage – individually assigned units and large common space.
- Shared Common Space
- Leisure/ lounge space – casual setting, outdoor views, fireplace, couches, chairs
- Common hallway
- Common room (indoor)
- Common covered outdoor space
- Common uncovered outdoor space (connects to the sky)
- Individual space – place for solitude, temporary (small garden, reading room)

**Classroom/ gathering**

- Formal and/or informal places used for instructive and education purposes
- Access to technology, work space, and chalk/ dry erase boards

**Physical Fitness/ Rehab**

- Mixed scale spaces containing equipment, weights, mats, etc.
- Swimming and water rehabilitation potential

**Mental Rehab/ Counseling**

- Private place, perhaps office environment
- Views to nature, adequate natural lighting

**Entertainment**

- Communal facility
- Could be a theater, small performance space, pool table, etc.

**Group activity**

- Foster sense of community, competition, and activeness
- Could be a basketball court, volleyball court, swimming pool, etc.

**Outdoor engagement**

- On site and off site
- Hiking, kayaking, biking, horseback, etc.
Wounded Warriors are a specific concern for Operation Homefront. Service members disabled from injuries return home where they are discharged from service. Veterans then have to vacate base housing and while waiting for their VA compensation to begin. Most of them experience a 50-75% cut in pay and their spouse may need to leave work to care for them. This can quickly put severe financial strain on their families as it may take months for their benefits to kick in. As a result, our young veterans returning from Iraq and Afghanistan are at risk of becoming homeless if programs are not put into place to help these service members transition back into civilian life while keeping some stability for their families. That is why Operation Homefront has established the Operation Homefront Transitional Housing Program.

There are various nonprofit organizations that exist throughout the country that offer services to veterans. Another organization that will contribute to the transitional process for veterans outlined in this project is the United Service Organization (USO). The USO outlines their general mission as:

Millions of times each year at hundreds of locations around the world, the USO lifts the spirits of America’s troops and their families. A nonprofit, congressionally chartered, private organization, the USO relies on the generosity of individuals, organizations and corporations to support its activities. The USO is not part of the U.S. government, but is recognized by the Department of Defense, Congress and President of the United States, who serves as Honorary Chairman of the USO.64

The USO offers a variety of programs and services that are designed to assist active troops and their families as well as veterans and their families. One of the USO’s primary initiatives is USO Transition 360 alliance, which helps military personnel, and their family’s transition back to civilian life after their service ends. A survey from 2013 showed that 97% of troops and their families agree that USO boosts their moral and 94% of troops and their families agree that USO eases their separation from family and friends. The USO is a dedicated organization to the rehabilitation and reintegration of troops as they navigate to recovery and healthy transition back into civilian life with their families.

Another non-profit organization that aids in the transitional process for returning veterans is the Wounded Warrior Project. Wounded Warrior Project (WWP) is a charity and veterans service organization that offers a variety of programs, service and events for wounded veterans of the military actions following the events of September 11, 2001. The WWP works to raise awareness and enlist the publics aid for the needs of severely injured service members, help severely injured service members aid and assist each other, and provide unique, direct programs and services to meet their needs. “WWP currently offers 20 different programs and services to wounded veterans and their families. The programs and services are separated into four separate categories: Body, Mind, Economic Empowerment, and Engagement. The WWP provides adaptive recreational activities for alumni of the program to improve physical health and wellness. The Combat Stress Recovery Program (CSRP) addresses mental health and cognitive needs of warriors returning from war. The TRACK program is a 12-month program that helps members meet their educational goals and aims to support their personal health and wellness, mental health and career development. The Alumni program provides long-term support and camaraderie for wounded veterans through events, discounted services and an online community. WWP alumni have access to Alumni Events & Activities throughout the year.

The place designed will be a place of temporary living for veterans and their families as well as support facilities that will be used by residents of the facility and by surrounding members of the veteran community. The facility will also feature short-term (24-72hr) temporary living

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arrangements for veterans and their families as an alternative to homelessness, battered women's shelter, or other alternative living conditions. The physical environment will have specific design responses, resultant of environmental psychology theories and research, specific to the various intended program uses. The end product will be a place for transitioning soldiers to reside, as well as a facility for veterans to call home while interacting with one another, participating in counseling, learning through empowering activities, and receiving educational benefits in a place that nurtures the mind and body.

The funding for the project will come from a large benefactor and the operation expenses will come from the various non-profit organizations outlined above. The overall scope of the project does not fall exclusively into the domain of any one of the organizations. Therefore, the intended client for the project will be a joint effort between Operations Homefront, the United Services Organization, and the Wounded Warrior Project. Additional partnerships and connections for project include the Veterans Association, the Next Objective, and Operation Troop Association. Through these connections, the project can gain a larger amount of support and awareness within the veteran community, as well as the general civilian population. The project will also need to gain support from the local military installations in relatively close proximity to the intended site. An official recognition by the Armed Forces, Congress, or the President of the United States, similar to the recognition the USO and WWP have received, will add to the creditability and viability of the project.
What is the architectural program for this project?
At its core, military training is about paying attention to details. The military knows how to turn on hyper vigilance. The question is: how to turn it off? This process used to be called decompression. Soldiers in conflicts two generations ago had unavoidable transition time: a long boat ride across an ocean, with a train to follow. In modern times, a flight from Baghdad to Baltimore is now less than 24 hours long, and modern soldiers expect a speedy trip home to a waiting family. When they get it, the experience is usually jarring; a closing scene in “The Hurt Locker,” an infinite variety of cereal boxes have replaced the depravity of war, and confusion reigns. The extreme contrast of military and civilian life is a difficult condition to balance for the men and women who are currently serving in our armed forces.

Throughout the course of history, warfare usually occurred as a series of relatively short battles followed by times of recovery and recalibration. The high intensity battlefield was followed by low intensity camps, marches, or times of recovery. During the First World War, this changed. Soldiers endured months of brutal shell fire, trench living conditions, and frightful charges over the top across no-man’s land without the traditional dichotomy of combat and recuperation. This extreme experience left thousands of men with what was known as “shell shock.” This term was coined in the First World War and is characterized by, “psychological disturbance caused by
prolonged exposure to active warfare, especially being under bombardment.” At the time, the phrase, “Shell-Shocked” was ill defined. Men would often exhibit physical trembling, uncontrolled panic, hypersensitivity to noise, and inability to sleep, walk, reason, or talk. This behavior was observed as a physical or psychological injury, lack of moral fiber, or even as a demonstration of cowardice.

During World War Two, the term Shell Shock was replaced by the term, “Combat Stress Reaction” (CSR), also known as “combat fatigue” and “battle neurosis.” Although similar to shell shock, CSR is generally characterized by slightly different symptoms including fatigue, slower reaction times, and disconnection to one’s surroundings. CSR is usually a short-term ailment and is not to be confused with acute stress disorder or post-traumatic stress disorder.

Acute Stress Disorder is a psychological condition that is the result of a terrifying or traumatic event or experience. The symptoms of Acute Stress Disorder include muteness, depersonalization, and de-realization. The event is often re-experienced in thought, flashbacks, and dreams. The victim usually attempts to avoid stimulation that reminds them of the experience and lacks function ability in at least one core area of assumed competence. Symptoms last for two days to four weeks from the time of the event. If symptoms continue past 4 weeks, the patient might then be diagnosed with PTSD.

Studies have been conducted to assess the efficacy of counseling and psychotherapy for people with ASD. Cognitive behavioral therapy which included exposure and cognitive restructuring was found to be effective in preventing PTSD in patients diagnosed with ASD with clinically significant results at 6 months follow-up. A combination of relaxation, cognitive restructuring, imagine exposure, and in vivo exposure was superior to supportive counseling. Another effective treatment method is mindfulness based stress reduction programs. Mindfulness involves being aware moment-to-moment of one’s subjective conscious experience from a first person perspective.

Post Traumatic Stress Disorder (PTSD) is an anxiety disorder that develops after exposure to one or more traumatic events or experiences. The term “Post Traumatic Stress Disorder” was coined in the 1970s predominately as a way to diagnose US military veterans returning from the Vietnam War. Symptoms include flashbacks, numbing and avoidance of memories, hyper arousal (irritable, aggressive, self-destructive, or reckless behavior).

There are various forms of available treatment for PTSD that includes medications, therapy, and counseling. Forms of psychotherapy sometimes referred to as counseling, include Cognitive Processing Therapy (CPT), Prolonged Exposure Therapy (PE), and Eye Movement Desensitization and Reprocessing (EMDR). A breakdown of the primary treatment methods can be summarized from a report from the Veteran's Association titled Understanding PTSD Treatment:

**Cognitive Processing Therapy (CPT)**

Trauma often causes people to struggle with memories and thoughts of the event. You may get “stuck” on these thoughts and feel unable to make sense of the trauma. CPT can give you skills to handle these distressing thoughts. It helps you understand what you went through and how the trauma changed the way you look at the world, yourself, and others. In CPT, you will focus on examining and challenging thoughts about the trauma. By changing your thoughts, you can change the way you feel. CPT has four main parts:

1. Learning about your PTSD symptoms and how treatment can help. Becoming aware of your thoughts and feelings.
2. Learning skills to challenge your thoughts and feelings (cognitive restructuring).
3. Understanding the common changes in beliefs that occur after going through trauma.
Prolonged Exposure Therapy (PE)
Repeated exposure to thoughts, feelings, and situations that you have been avoiding helps you learn that reminders of the trauma do not have to be avoided. In PE, you and your therapist will identify the situations you have been avoiding. You will repeatedly confront those situations until your distress decreases. PE has four parts: 1. Education: to learn about your symptoms and how treatment can help. 2. Breathing retraining: to help you relax and manage distress. 3. Real world practice (in vivo exposure): to reduce your distress in safe situations you have been avoiding. 4. Talking through the trauma (imaginal exposure): to get control of your thoughts and feelings about the trauma.

Eye Movement Desensitization and Reprocessing (EMDR)
In EMDR, you focus on hand movements or tapping while you talk about the traumatic event. The idea is that the rapid eye movements make it easier for our brains to work through the traumatic memories. Focusing on hand movements or sounds while you talk about the traumatic event may help change how you react to memories of your trauma over time. You also learn skills to help you relax and handle emotional distress. EMDR has four main parts: 1. Identification of a target memory, image, and belief about the trauma. 2. Desensitization and reprocessing: focusing on mental images while doing eye movements that the therapist has taught you. 3. Installing positive thoughts and images, once the negative images are no longer distressing. 4. Body scan: focusing on tension or unusual sensations in the body, to identify additional issues you may need to address in later sessions.

Selective Serotonin Reuptake Inhibitors

Figure 33: The above diagram illustrates that US Army veterans are the most at risk for PTSD related suicides when compared to civilians and other branches.
Additional to these three primary psychotherapy techniques, patients can also be treated with medication called Selective Serotonin Reuptake Inhibitors (SSRIs) that increase serotonin in the brain, which can make someone feel better. The effects of these medications have short-term effectiveness but do not have enough long-term effectiveness to be deemed a viable long-term option.
Who is the audience?
The proposed site for this project will be located in Colorado Springs, Colorado. Colorado Springs is the 42nd most populous city in the United States. The city covers 194.7 square miles, making it the largest geographic municipality in the state of Colorado. In 2009, Colorado Springs was ranked number one in Outside’s list of “America’s Best Cities” and was selected as the number one Best Big City in “Best Places to Live” by Money magazine in 2006.

In general, the state of Colorado provides extensive opportunities for recreational and outdoor activities. The Wounded Warrior Project advocates the power of equal opportunity recreational activities as a catalyst for healing. The unique terrain, weather, flora, fauna, and natural assets that exist in the mountain region of the United States provide great opportunities for environmental design, connection to nature, and universal outdoor activities. Colorado Springs is located in a high desert with the Southern Rocky Mountains located directly west of the city. Denver, Colorado is located approximately 60 miles north of Colorado Springs and is separated by the Palmer Divide, an elevated ridge ranging between 6,000 and 7,900 feet in elevation.

Colorado Springs has a semi-arid climate that is influenced by the rapidly warming Chinook winds during the winter that create drastic day-to-day variability in weather conditions.
Winters are mild to moderately cold, with some very cold days alternating with some very warm days. Springs can be very windy with large temperature changes and occasional blizzards. Summers generally have hot days and comfortable nights with threats of big thunderstorms. Falls are pleasant and relatively dry compared to the rest of the year. According to the Colorado Climate Center, “The climate of local areas is profoundly affected by differences in elevation, and to a lesser degree, by the orientation of mountain ranges and valleys with respect to general air movements.” The rapidly changing temperatures, low humidity, and generally pleasant weather patterns create design opportunities to respond to the environment. Not only to reduce energy consumption and utilize passive design strategies, but to respond to the ways humans interact with the environment. It will be important to connect the audience with daylight and views to nature, as well as respond to seasonal weather conditions. This could be as simple as providing a place to enjoy the cleansing power of a thunderstorm, provide spaces for exposure to the warm dry summer air and sunlight, or a place to enjoy the serenity of a heavy snowfall.

Figure 35: The site is located in Colorado Springs, Colorado. It is one of the largest cities in the country and is located on the eastern Rocky Mountain corridor.
Operations Home Front (OHF) is the primary client for this project. OHF currently has three existing facilities that provide rent-free living for veterans transitioning into civilian life. The SoCal program serves primarily Balboa Hospital and Camp Pendleton and is located in San Diego, CA. The San Antonio program serves those primarily being treated at San Antonio Military Medical Center and Audie Murphy VA Hospital. The Maryland program is located in Gaithersburg, MD and serves those primarily being treated at Bethesda Naval Medical. The 3 locations only serve veterans within a relatively close proximity to the facility. The central United States doesn’t currently have any facilities, making it a desired location for a new facility. Conceptually, the new facility would be located semi-equidistant to existing facilities. Colorado Springs was chosen specifically because of the veteran population per capita, as well as the military presence within the city. According to a census report, the 5th congressional district of Colorado, containing Colorado Springs, Cimarron Hills, and Fort Carson, has the 5th most veterans per capita of any congressional district. Colorado Springs has a veteran population of 13%. Additionally, the
4 largest employers in the city are armed service’s facilities, accounting for 19.5% of the city’s employment.

Colorado Springs contains several Military installations located throughout the city. The most prominent installation is Fort Carson, home to the 4th Infantry Division. The fort is home to various types of training for infantry, armor, and aviation units. Fort Carson is also home to the second and third battalions of the 10th Special Forces Group. The second most prominent military installation is Peterson Air Force Base. The base specializes in missile defense operations and development as well as Army Space and Missile Defense. Colorado Springs is also home to Schriever Air Force Base which controls warning, navigational, communications, and spy satellites. Along the north-western side of the city, the United States Air Force Academy trains cadets to become officers in the Air Force. The final military installation is the North American Aerospace Defense Command (NORAD) that operates as a component of America’s missile defense system.
The specific site location within the city is contingent on a few factors that are required for an ideal location with an ideal surrounding environment and place-making potential. The first factor to consider is proximity to the Rocky Mountains, views to the mountains, and access to trails on the mountain. Locating the site on the western side of the city allows direct access to the mountain trails and uninterrupted views to the beautiful landscape. The second factor to consider is the target audience and proximity to the various military installations. The target audience will be Army veterans, specifically those of the 4th infantry division. Therefore, locating the site close to Fort Carson will create a surrounding context and demographic profile that is familiar and relatable. The aforementioned two factors begin to position the site in the southwest corner of the city, along the Vietnam Veterans Memorial Highway. Another consideration is immediate surrounding context. The site should have unrestricted views and access to the mountains without feeling isolated and disconnected with the rest of the city. Only sites that have adjacent suburban neighborhoods were considered. The next consideration is distance to downtown, with an ideal commute downtown less than 30 minutes. The final factor for site placement is access to a main thoroughfare with appropriate surrounding amenities. The general location is prescribed in the first two factors and specific location was determined based on a consideration of the later factors.

The specific site location is located on vacant land that is located along Vietnam Veterans Memorial Highway, on the western most edge of Fort Carson. Cheyenne Mountain State Park is located across the highway from the site and provides several trail heads that lead into to the mountain's hiking trails. To the east, there is a suburban community that houses a high percentage of Fort Carson employees. The site is located less than 20 minutes' drive to downtown Colorado Springs. Additional benefits to the site include close amenities. To the south, Cheyenne Shadows Golf Club occupies a large amount of land. Within walking distance there is an archery range, elementary school, middle school, and 4th Infantry Museum. Additionally, there is a United Services Organization (USO) located less than two miles to the northeast of the site. This location allows reciprocity in facility usage between the USO and the transitional housing facility and supporting programming. The site provides ideal positioning and unique context, providing unique opportunity for the facility.

The site allows connectivity to the city based on proximity as well as the adjacency to a main thoroughfare in Colorado Springs, the Vietnam Veterans Memorial Highway, also known as US 115. However, there are no bus routes that service the site. Given the program and scale of the building, the usage intends to connect individuals with local facilities and organizations. The ideal connection method for users of the facility will either be private transportation or a shuttle between the most frequented facilities. This shuttle will ideally be a component of the original proposal. The facility will not only connect the users with the local amenities within walking distance, but also will the surrounding organizations including Colorado Spring's USO location.
The design is guided by theories in psychology and environmental psychology, vast continuums in design theory, transitional care research, site context, environmental conditions, the proposed client, and the proposed audience. The clearest way to summarize and execute the architectural research and design process is to enumerate the main actionable design guidelines. Seven guidelines have been established that are intended to shape the outcome of the architectural design of a transitional facility for post-traumatic survivors. The environment of the proposed project will be crafted in a way that capitalizes on physical, natural, and experiential elements.

How does this inform architectural design?
Cognition: Engage sensory inputs strategically to increase cognitive performance.

Figure 38: Cognition is the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses.

Cognition is how people acquire knowledge and/or understand through thought. The way people process stimulation affects how they learn, perceive, and create memories. When individuals learn, they can enter a state of metacognition, an awareness and understanding of one’s own thought processes. Learning can be implicit or explicit. When it comes to perception, humans learn through sensory organs as well as proprioceptors. Memory is based on emotion and can be long term or short term. It informs our thoughts and behavior and can be affected by stimulation.
Stimulation: Limit stimulation based on needs of the task and participant.

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.

How Design Can Help?

Stimulation or sensory excitation is the action of various agents or forms of energy (stimuli) on receptors that generate impulses that travel through nerves to the brain (afferents).

The top image illustrates the way the human mind processes a traumatic event. Stimuli passes through the gatekeeper and trigger the autonomic nervous system. This process can potentially bypass higher-order thinking, which is the cause of PTSD. Stimuli can trigger flashbacks or reactions to the traumatic event. During the transitional process for post-traumatic survivors, the environment creates stimulation. Conclusively, the environment can be the cause of PTSD symptoms and affect the healing and transitional process for post-traumatic survivors.

The lower images illustrate the way a soldier is trained to clear a room. A lot of attention is placed on the smallest details, which could be signs of an improvised explosive device, an assailant, or another threat. This hypersensitivity to the environment demands less stimulized spaces to focus on other tasks at hand.
The **Biophilia Hypothesis** suggests that there is an instinctive bond between human beings and other living systems. Biophilia is “the urge to affiliate with other forms of life”.

![Diagram of human and nature connected by biophilia]

### Nature: Promote the relationship between nature and wellbeing.

**Figure 40:** Nature is the phenomena of the physical world collectively, including plants, animals, the landscape, and other features and products of the earth, as opposed to humans or human creations.

Various studies have maintained the healing affects of nature. Humans innately have a love for nature. It has been suggested that introducing nature in indoor environments improves healing, learning, concentration, and stress. Plants have both physical and psychological impacts on the environment. Plants can increase the oxygen content in the air through the process of photosynthesis. During photosynthesis, Carbon dioxide in the atmosphere is converted to glucose, generating oxygen as a byproduct, which is returned to the atmosphere. Increased oxygen content in the air improves cognitive performance. Additionally, studies have shown trends in reduced stress and faster healing in patients when exposed to plants.
4 **Light**: Natural, full spectrum light promotes wellness and the circadian rhythm.

*Figure 41*: Light is the natural agent that stimulates sight and makes things visible.

The circadian rhythm is any biological process that is in attunement with the 24 hour sunrise/sunset cycle. In humans, the circadian rhythm controls hormones including serotonin and melatonin. These hormones control when humans are awake and serotonin has even been recognized as controlling the general feeling of well-being.
Figure 42: Social interaction is the way people talk and act with each other and various structures in society. It may include the interaction a family has together (eating, sleeping, living together) or bureaucracies that are formed out of the need to create order within the interaction itself.

Social: Social interaction must be promoted and limited based on space and occupant.

The social impact of recovery and transition is hard to overstate. The wounded warrior project advocates the power of engagement when serving veterans and their families. On the wounded warrior project websites, the non-profit organization has four key programs for transition including: Mind, Body, Economic Empowerment, and Engagement. Regarding social interaction and transition, it is important to ensure that veterans stay connected with one another and alumni of the programs, receive family support, international support, and policy/government support. It is vital to receive the proper social interaction as well as have respected times of solitude and reprise.
**Physical Health:** Promote physical wellness and health.

*Figure 43:* Physical health can be defined as an essential part of overall health of an individual, which includes everything from physical fitness to overall wellbeing.

The wounded warrior project envisions veterans who are well adjusted in body by receiving the proper care and living an active and healthy lifestyle. These activities include adaptive sports, health, nutrition, and recreational activities. Proper physical health can vary greatly from person to person. In some circumstances, it may mean a toxin-free body and lifestyle, for others it may be increased mobility from a wheelchair. Universal activities can be implemented to transcend physical barriers in improve peer connections.
One of the key take aways from Michael Grave’s Wounded Warrior House was the ability for everything to be fully accessible without the sensation of feeling accessible. This was accomplished with a sensitivity to the way physically and mentally limited individuals live their daily lives. It is under the assumption that every area within the facility will need to be accessed by someone in a wheelchair. Therefore, the design will be based on a root module of accessibility standards.
How does this inform architectural design?
There are various ways in which the environment interacts with its occupants. In a built environment, the architect controls building design. Thus, the architect is responsible for the way in which people interact with their built environments. The environment can affect an individual, or a group of individuals drastically. It can influence the way we interact, learn, think, feel, and behave. The following building design is the result of research in the realm of environmental psychology and military transition programs. The building design is a culmination of applied theories and research. There are elements that strategically engage certain sensory inputs while limiting stimulation from extraneous sources. Spaces promote social interaction and disengagement. All rooms and corridors offer natural light and strategic access to the outdoors. The building offers an environment that promotes positive transition and individual empowerment.
This diagram illustrates the architecture of the living conditions of soldiers during deployment and post-deployment civilian transition.
What does this architecture look like?
Figure 46: This diagram is a massing study using parametric scripting to iterate various masses that feature array pitched roofs.
What does this architecture look like?
The residential interior has views that focus on the Cheyenne mountain range in the distance. This reduces foreground distraction and enforces a connection with nature while reducing stimulation.

**Figure 47:** The residential interior has views that focus on the Cheyenne mountain range in the distance. This reduces foreground distraction and enforces a connection with nature while reducing stimulation.
Figure 48: A double layered sand-blasted glass window creates a silhouette of natural elements while eliminating distracting or alarming stimulation.
This exploded axon depicts the construction ethic employed throughout the building. The relationship between structure, surface, and translucency are critical to meeting the 7 primary design guidelines.
This section perspective displays the interior or the residential units. The residential units are modular in design and accommodate different household sizes.

Figure 50: This section perspective displays the interior or the residential units.

Figure 51: The residential units are modular in design and accommodate different household sizes.
The site offers significant seasonal change shown in the renderings above.

Figure 52: A single unit was developed and arrayed to create the residential component.
What does this architecture look like?
Figure 54: Double layered sand-blasted glass creates a translucent wall type that allows some light to pass through but limits the amount of stimulation coming in from the outside.
Figure 55: Numerous courtyards allow access to nature directly from communal spaces and an outlet for direct exposure to natural light.
The research, guidelines, and architectural design in this project focus on a specific outcome for a specific audience. The foundation of the research is generalized, covering a wide range of theories and concepts. The final building is very specific, intended for specific philosophies of use by specific members of society. Somewhere between the two ends of the process, there is a middle ground that is universally applicable to other facets of design interest.

The intended audience is for United States veterans. The program for the building is intended for physically and mentally wounded soldiers. In that realm of research and thinking, there are two key takeaways from the project. The design seeks to employ universal design without seeming accessible. This was a key component in the Wounded Warrior House by Michael Graves, and is applicable for more than just the veteran population. Any architecture that serves a large amount of handicapped users could have the opportunity to design with universal standards that don’t seem accessible. This would improve standards of architecture in healthcare, rehabilitation, and transitional facilities.

As an audience, veterans with mental injuries can be particularly sensitive to their surrounding environment and exogenous stimulation. The project was designed with that particular sensibility in mind, with particular material choices and spatial arrangements that
The transition from military life to civilian life is affected by the physical environment. However, there are additional large groups of people who have suffered a traumatic event and are sensitive to their environment. The homeless population, natural disaster survivors, recovering drug addicts, and battered women and children are among the many groups of people who have experienced trauma and may go through a transitional phase, process, or care. The environment where that process takes place can positively or negatively contribute to that transition. It is not possible to create an environment that cures people, but rather, and environment that maximizes the effect of care giving treatment.

At its surface, the contribution of this project is an exploration in the architectural design of built environments where the occupant of those environments has an intensified sensitivity to their surroundings rooted in surviving a traumatic experience. The impact of improved architectural environments can be felt at different levels and in different ways. From a treatment perspective, it is imperative to improve conditions in healing facilities for those that need it the most. Creating healing environments that maximize the impact of healing practices improves post-treatment outcomes. A study by Perkins + Will advocated that all design affects post-traumatic survivors, whether intentional or unintentional. Furthermore, all buildings create stimulation that can be distracting and sometimes alarming to post-traumatic survivors.

The overarching contribution of this project is to create a better understanding of how environments affect occupants at all times, both physically and mentally. Environments affect behavior, motivation, concentration, and learning. It is difficult to control the natural environment, but architects have a responsibility to control the built environment in a way that is responsive and respectful to all occupants all the time. Occupants with heightened sensitivity are the most vulnerable, and should be used as a baseline for environmental psychology in architectural design.
What is the overarching contribution of this project?
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Objective: Amelioration

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Figure 49: Duncan, Ryan. Cincinnati. Exploded Axon. The University of Cincinnati, 2015.

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Objective: Amelioration


