WHAT IS THE EVIDENCE?

THE APPLICATION OF EVIDENCE-BASED DESIGN IN HEALTHCARE FACILITIES

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DEDICATION

To my mother, for her strength, support and encouragement.

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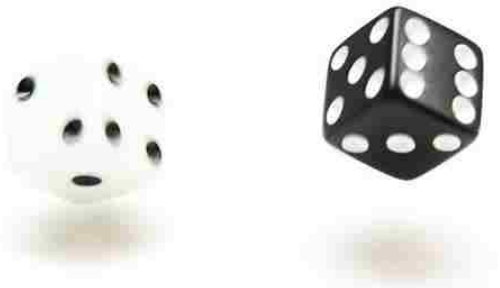

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1.0 INTRODUCTION

1.1 PERSONAL MOTIVATION AND PROJECT BACKGROUND

Every student pursuing a Master of Architecture degree is asked to prepare and defend a master's thesis. The thesis project is intended to be the culmination of a graduate education, and should show evidence of the student's ability "to carry out an independent investigation and to present the results in a clear and systematic form" (UW Graduate School). The motivations for picking a thesis topic vary widely, particularly within the field of architecture. For some students, it is an opportunity to tackle a design problem or a particular building type that they feel passionate about. For others, it allows for the opportunity to pick a specific location or site of significance and discover what type of physical intervention would be most appropriate to pursue. No matter the motivation, a thesis project is an opportunity for each student to independently challenge themselves by utilizing a broad range of skills.

When envisioning this thesis project, I realized that I was less interested in the "what," and far more curious about the "why." For me, the idea of working on one singular project that was supposed to encompass all of my design knowledge seemed futile. I struggled throughout my architectural studio courses when tasked with designing a project based on relatively uneducated assumptions. This became incredibly apparent to me during the Spring of 2011 when I was challenged to design a children's hospital and medical clinic in a studio project. I was painfully aware that the decisions made by myself and other students regarding the design and layout of the building were not based on the user's specific needs nor on any true credible research. Instead, our quick decisions were made on personal intuition and assumptions, gleaned from limited knowledge and the minimal study of precedent projects, and our final design decisions were typically selected based on how well the layout fit with our larger building concept, rather than what

would be the most economical, efficient, and productive space for the specific users of the building. I felt as if we were asked to find the solution without first understanding what the problem really was. We made broad assumptions about how the space would be used, without any true understanding of what our user client's needs actually were from an operations and flow standpoint. Consequently, we become confident in our assumptions, but our assumptions were just that, which means they were unreliable when applied to specific real-life scenarios.

Over the past three years, I have come to realize that I struggle with the idea of decisions being made and evaluated based on an ambiguous set of criteria. This was something that really troubled me, and eventually led me to a much larger question: How do architects make decisions? What is the evidence for which we base our decisions on?

1.2 SCOPE

I decided early on to take a different route from my peers and to pursue this thesis project from a research perspective. This thesis focuses on the interaction between research and design, and examines what goes in to the decisions made that are based on research findings pertaining to "better" design strategies for optimal environments. The ultimate goal of this project was to enhance my understanding of the design process and to acknowledge my future relationship with it.

The research for this thesis does not focus solely on one particular building, but rather it focuses on the processes that were used in making decisions regarding topics relevant to research-based design findings. Criteria for decision making in design is vast, and can be affected by such factors such as timing, budget, client needs and objectives, personalities, site constraints, code restrictions, and organizational goals and values. While numerous factors surely played a part in the ultimate decision making for the overall facility, the scope of this project deals with how a designer evaluates their options when presented with multiple scenarios, all of which happen to be supported by research findings.

Research in design is utilized in a wide variety of project types. Because of my particular interest in understanding the most challenging of all building categories, the bulk of this thesis inquiry will focus on the decisions made in healthcare facilities and the use of evidence and research on the built environment within facilities that provide health services and medical care to humans. This thesis will not specifically address the use of evidence in other types of buildings.

1.3 PROCEDURE

Research for this thesis began with a literature review on the history and trends in environmental psychology and research-based design. The objective was to get a meaningful grasp of the existing information pertinent to healthcare facilities and to compare the available evidence that has been published on the topic. The sources of literature that were reviewed can be categorized into three main groupings: articles and web-based sources published in industry and trade publication, peer-reviewed scientific research publications, and published texts and books discussing research and science in design.

In addition to a literature review, two professional conferences were attended, one national and one regional: the 2012 Healthcare Design Conference in Phoenix Arizona, and the 2013 Northwest Regional AIA Medical Design Forum, held in Seattle Washington.

And finally, as part of a qualitative research inquiry, multiple rounds of one-on-

one interviews were conducted with architects, designers, medical planners, a real estate developer, and a healthcare facility owner/ manager; all of whom practice within the greater Seattle area. A total of ten (10) individuals representing seven (7) different organizations participated. In the earlier group of interviews, the discussions were more conversational in nature and topics included emerging trends and common practices in the industry. The questions asked in the final round of interviews were directed more specifically towards the topic of "evidence" in the built environment, and how evidence is used to make decisions when designing. Specific information regarding the interviews will be discussed in a later section.

The interviews were conducted with the promise that any information gathered and used within this document would be kept anonymous. This was done to relieve the interviewees from professional privacy concerns, and to encourage the most honest and objective responses possible. For these reasons, responses were generalized with all identifying information removed from this document.

1.4 LEARNING OBJECTIVES

This thesis seeks to understand how architects interact with and incorporate research derived from scientific research findings. This thesis is unique in that it is specific to my professional interests and serves as a documentation of my personal understanding of architecture and the process of how architects go about making decisions.

The learning objectives for this thesis are as follows:

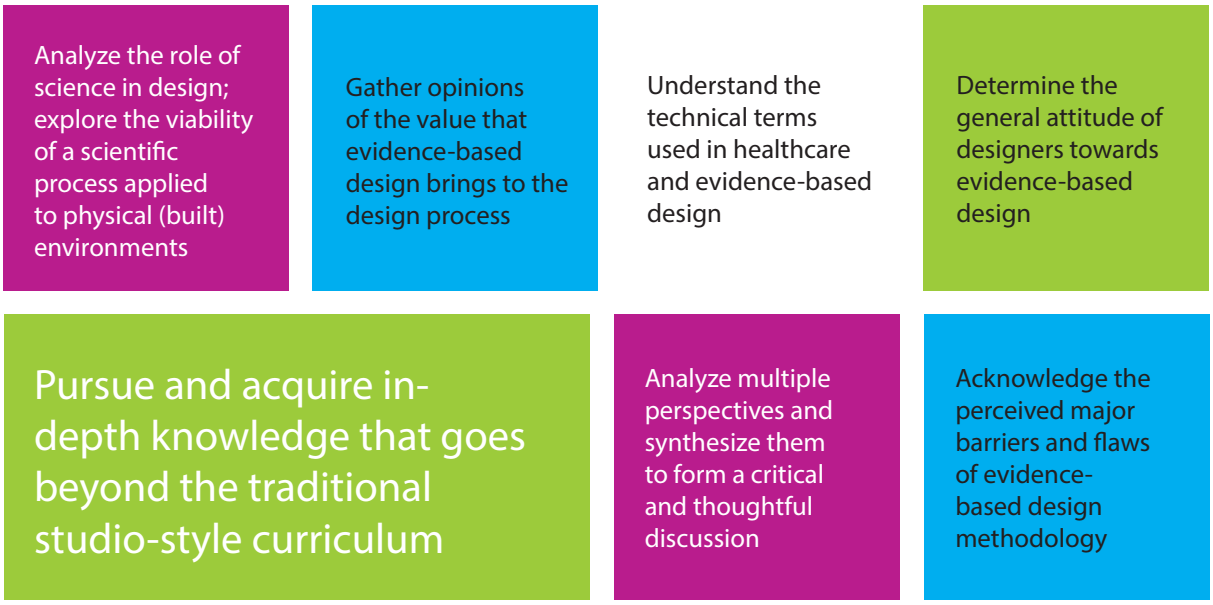


FIGURE 1: Learning Objectives

Bellevue Children's Hospital
Photo Credits: NBBJ

2.0 CONCEPTUAL FRAMEWORK

2.1 DECISION MAKING IN DESIGN

Design, as a mental process and physical activity, involves making decisions based on knowledge, experience, and observation. It typically involves an array of intangible facets such as intuition, imagination, and creativity. Design as a process has broad guidelines, with no fixed rules. Each element of a design can usually be discussed and explained based on how it aligns with the project goals and/or the overall design concept. Designers often utilize analogies to visually and verbally relate design solutions back to the overarching conceptual framework. In order to make improvements and to evaluate ideas, designs need to be tested, and solutions are often analyzed based on a variety of personal, theoretical and practical reasons. Comparisons, reviews, critical examination, judgment, and reflection are just a few of the skills that are utilized when testing design ideas. "It is an iterative activity, and solutions often come at random from any stage of the process" (Zeisel).

Traditionally, most decisions within the realm of design were made based on intuition or previous experience. 500 years ago, building types were much more simplified than they are today. Architects were typically responsible for royal residences, churches, cathedrals and various places of worship, and other important monuments. It is plausible to conceive that the decisions required of the designer during that time period were much clearer, especially since the architect was considered to be the expert; an authoritative figure in the design and construction process with full control over the project's outcome. In the past, tradition and reputation were paramount to success. Today, however, there is a wildly divergent set of building types with an expansive list of internal processes and needs that must be accounted for. In today's industry, it is much harder, if not impossible, to depend on reputation and tradition to make decisions. Designers must constantly validate and defend their ideas, and they also have the added pressure of being held

accountable for the outcome.

Architects and designers make hundreds of decisions every day. Some decisions are delegated to clients and other professional disciplines, or are determined by building code requirements, engineering standards, life-safety standards, or ADA requirements. But what about the decisions that are not dictated by the codes and standards of the industry? What about the decisions regarding the functionality of the physical space? Intuitively, many architects understand how their design decisions impact the human experience. It is common knowledge that what we design and build has an impact on the way people live, work, learn and interact. Our environment subtly shapes how we feel, how we act, and how we communicate. But how well do we really know how our design decisions impact the users of the space? How reliable are our intuitive decisions? And how do we evaluate our decisions to know that we are making the best choice? Unfortunately, as I learned

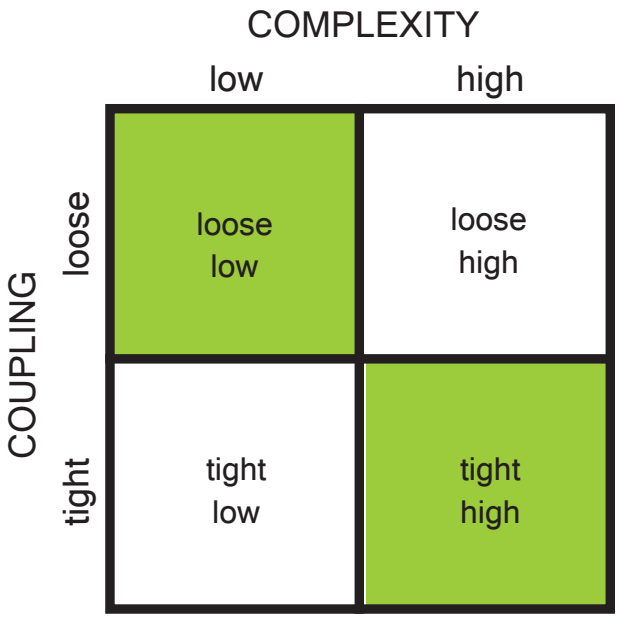


FIGURE 2: Coupling and Complexity
Perrow; Reason
http://www.sucf.suny.edu/pdf/complex.pdf

in my earlier graduate design studios, many young designers make important decisions on the basis of incomplete knowledge; many are typically confident with their decisions but rely heavily on assumed information, previous experience, common-sense, and commonly-accepted industry best practices.

COMPLEXITY OF DECISONS

The complexity of a project or building type directly correlates to the complexity of important decisions that need to be made. There is a broad range of building types that range from simple to complex. In acknowledging the vast array of building types, it is assumed that some types are more flexible than others in terms of decision making. The necessary rigor varies depending upon the specific building type or project being pursued. The complexity of the environment and the amount of subcomponents within the larger unit greatly impacts the importance of decisions. This idea becomes clear when examining the relationship between complexity and coupling. Charles Perrow and James Reason defined two scales – complexity and coupling – which explain how components of systems react (Dickerman, Barach, Pentecost 2008). As shown in the diagram on the left, complexity can range from low to high, while coupling ranges from loose to tight. Complexity is fairly self-explanatory; it speaks to the level of difficulty. Coupling refers to whether or not a task or activity is highly dependent upon the exactness of preceding activities (Dickerman, Barach, Pentecost 2008). In other words, coupling refers to the degree of interconnectedness and dependency of different parts within a whole.

In applying these scales to building types, it is easy for us to intuitively understand the relationships within simple building types: most residential projects, basic hotel, warehouse, speculative office spaces and other standardized plans fall into this category of low complexity and loose coupling. The decisions

LOW + LOOSE

simple building systems

residential
hotel, retail, spec-office buildings
warehouse and storage
standardized plans

HIGH + TIGHT

exceptional complexity, multi-department, advanced technology-dependent

hospitals
data centers
laboratories and clean-rooms
transportation infrastructure

made in these types of projects are simple, with few consequences. Intuition is acceptable here.

On the other hand, not all building types cater to intuitive decisions. The relationships within technology dependent, multi-department facilities fall into the opposite category, of high complexity and tight coupling. Here, intuitive decisions can mean the difference between success and failure, or as in healthcare facilities, life and death. Because hospitals are often considered the most complex of all building types, and because they are a building type that is of particular interest to me, the majority of my discussion is going to focus on the decisions made in healthcare facilities.

Healthcare environments are simultaneously a work environment for the staff, a healing environment for patients and families, a business environment for the provision of healthcare, and a cultural environment for the organization to fulfill its mission and vision (Stichler 2007). Healthcare facilities are comprised of multiple subsystems that

are tightly interrelated, with no 'wiggle room' in the connections. "If one component fails, the adjoining components are immediately impacted, sometimes in unforeseen ways" (Dickerman, Barach, Pentecost 2008). Therefore, the decisions required of complex, tightly coupled building types are far more critical than others. Because of these complex, interdependent relationships, there is a strong concern for "rightness" in the physical design of complex healthcare environments. A lot of this concern is due to the understanding that errors and accidents can be attributed to the design of the physical environment "just as much as to the fallibility of the people who operate them," and the way the environment affects the systems and operations occurring within (Dickerman, Barach, Pentecost 2008). For this reason, architects also have intuitively adopted the notion of *primum non nocere,* the Latin phrase meaning "first, do no harm." This phrase has roots in the Hippocratic Oath, which is one of the fundamental principals in the teachings of medical ethics. With this in mind, architects acknowledge the idea that the health, safety, and wellbeing of patients and staff are innate characteristics that must be embedded and designed within the entire physical system, on both a physical and an operational level. The concern for rightness has led researchers to try and systematically understand which design solutions lead to an increase in the performance of health and safety in the built environment.

This is what lead me to try to understand how architects interact with and incorporate research, and how we go about making decisions when the stakes are so high. The application of research in architectural design is often quite difficult. Many groups, studies, and projects have put forth claims about what research suggests to be the "best" or "right" way to design technically-demanding spaces. But how credible is research when conducted on physical space, which is an uncontrollable and ambiguous environment?

An incredible amount of knowledge and

data has been collected about the way in which building design can positively or negatively impact the users and occupants of the building and the way those occupants behave and function within it. While much of the knowledge concerning the built environment has contributed towards vast improvements in the industry, much of the hard data for which we base our decisions upon is lacking in rigor and credibility. For years now, designers have has sought to apply more rigorous research techniques to the design process when evaluating the successfulness of complicated projects. However, despite popular claims, it is fair to say that the evidence generated from such studies is questionable at best.

With the introduction of documented data and research findings on projects in the built environment, how are design decisions made? How does data influence decision making? How do we test our designs and decide which one to pursue? What are the criteria for making these decisions? What is acceptable in terms of research and evidence findings?

Photo Credits: Enloe; Murray Mitchell

2.2 HISTORICAL REVIEW

Taking a look back through history, we know that the environment has always played a role in affecting safety, mitigating stress, and contributing to the emotional wellbeing of its occupants. Access to daylight, nature and fresh air has always been associated with the process of healing, and has been well documented since the time of Ancient Greek and Roman hospitals. Air and light were the basic, fundamental characteristics of early Greek and Roman hospitals, which positioned patient rooms within hospitals facing eastward with the belief that a view of the rising sun would promote healing. Florence Nightingale further promoted these benefits and implemented them into healthcare wards in the 1850's. During the Crimean war, the mortality rate due to the spread of infection within a hospital in Scutari, Turkey was 47% (Dickerman, Barach, Pentecost 2008). Nightingale conceived of a modular 30- patient ward that introduced an innovative ventilation system forcing air through ducts beneath the floor (Dickerman, Barach, Pentecost 2008). Today, modern studies have proven that natural light, access to nature, good ventilation and a quiet environment can support healing and reduce patient stress, as well as making the hospital a better place for staff to work (Ulrich, etc).

SCIENTIFIC AND HISTORICAL CONTEXT OF ENVIRONMENTAL PSYCHOLOGY

Up until the 20th century, the principles of fresh air and natural daylight continued to be prominent design features in most healthcare facilities. However, with the growth of industrial modernization and technology in the 1950's and 1960's, those basic principles of light and air were lost. Both the United States and Europe experienced a boom in the construction of hospital buildings, but human factors were not part of the discussion explored in the design process. As a result, hospitals were intended to operate as modern institutions in every way, and

were designed and constructed as monuments to the medical sciences and technologies housed within. With the Industrial Revolution and the intense focus on new technology and machinery, most of the focus within healthcare environments was delegated to transforming hospitals into "functional, medical machines" (Berg, A., Wagennar, C. 2006). As a result, many facilities became "oblivious to the personal concerns of the people they served" (Stokols, D., & Altman, I. 1987). In the hospital, "patients were not treated as persons, but rather as a collection of possible diseases, all of which were the exclusive domain of medical specialists. In the hospital, the patient practically disappeared" (Stokols, D., & Altman, I. 1987). Hospital facilities were over-crowded with illness, and infection spreading throughout.

By the late 1960's, there arose a social movement surrounding the relationship between people and their everyday environment (Stokols, D., & Altman, I. 1987). Concerns about illness, environmental

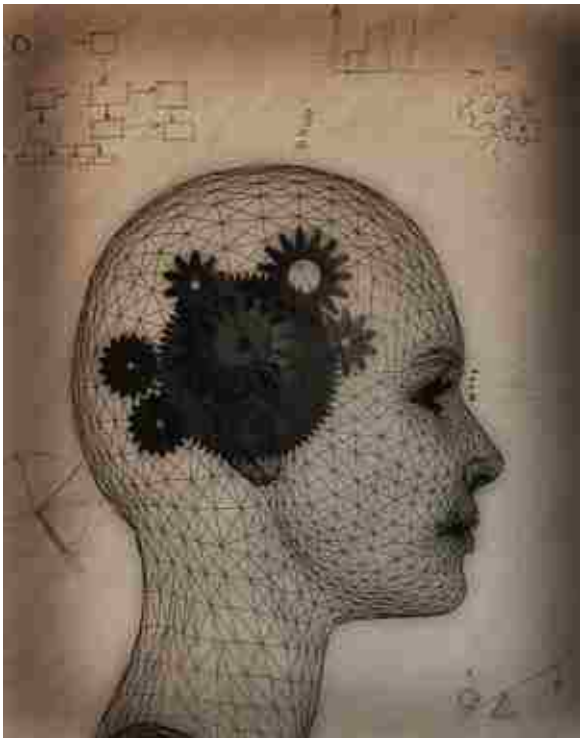


Photo Credit: Environmental Psychology

degradation (both natural and man-made), pollution, shortages of natural resources, crowding, and urban violence spurred the discussion about how our treatment of the environment was impacting our psychology, our health, and our performance as a human race. The field of Environmental Psychology quickly emerged due to the heightened awareness of these environmental issues. Environmental Psychology is formally described as the study of "human behavior and well-being in relation to the socio-physical environment" (Stokols, D., & Altman, I. 1987). Essentially, it is the study of various spatial arrangements and their effects on social interaction and behavior. The field grew rapidly throughout the 1970's and 1980's, and successfully developed "new scientific approaches for studying human behavior and well-being from an interdisciplinary" perspective (Stokols, D., & Altman, I. 1987).

Many advocates of environmental psychology wanted "a more natural society, and stressed the overwhelming importance of the physical and social environment for the well-being of mankind" (Stokols, D., & Altman, I. 1987). Many people argued that society needed to change, and that the role of the individual should be enhanced. It was out of this social revolution that the idea of patient-centered care emerged within healthcare environments: "instead of fragmenting the patient into diseases that corresponded to the various medical specialties, the hospital organization should be built around the individual patient" (Stokols, D., & Altman, I. 1987).

Due to these concerns, the fields of science and medicine came under scrutiny. Archie Cochrane was a prominent epidemiologist who published a book in 1972 that delivered "a biting, scientific critique of medical practice." In his book, Cochrane accuses the medical profession of implementing many tests, treatments, procedures and interventions that had no evidence to demonstrate their effectiveness, and may in fact be doing more harm than good. As a solution, he promoted

To Err Is Human:
Building a Safer Health System
Institute of Medicine: 1999

An estimated 44,000 - 98,000 people die in the US each year as a result of medical errors.

Crossing the Quality Chasm:
A New Health System for the 21st Century
Institute of Medicine; 2001

2 million people contract healthcare-associated infections (HAI), of which 88,000 cases are fatal. Causes of errors are linked to technology, human performance, clinical processes, and the physical environment.

Photo Credit: Luckett & Farley

the use of randomized controlled trials as the best means of research and practice. Data could then be used to evaluate which practices led to improved outcomes.

From this, evidence-based medicine grew its fundamental roots. It was born from epidemiological studies and was soon implemented into medical practice in an effort to promote the use of randomized controlled trials in medical science. In its core definition, the use of evidence suggests the use of randomized controlled trials and other research methods of equal rigor.

In the design field, change was also happening. The focus spread to the need to create healing environments for patients and their families. The term 'healing environment' refers to a physical setting and an organizational culture that are "psychologically supportive, with the overall goal of reducing stress in order to help patients and families cope with illness, hospitalization, and sometimes, loss. It provides opportunities for patients to exercise control,

to express themselves, and to partner with caregivers in learning about their illnesses and treatment options, and it offers life-enhancing experiences for enrichment, laughter, relaxation and spiritual renewal" (Malkin, J. 2006).

In 1978, the non-profit Planetree was founded on that very premise, to promote the patient-centered care movement. Angelica Thieriot founded the non-profit Planetree after a personal and emotionally traumatizing in-patient experience. The organization dedicated itself to "radically changing the way health care was delivered," and it was the first organization that focused specifically on the promotion of the patient-centered care movement (Frampton 2003). The first Planetree hospital, built in 1984, was a thirteen-bed medical-surgical unit located at Pacific Presbyterian Medical Center in San Francisco (Frampton 2003). This groundbreaking facility transformed the typical hospital environment into "a physical space that promoted healing, learning, and patient participation" (Frampton 2003). It prompted an enormous change in the patient-centered care revolution. But while many facilities and organizations adopted this philosophy, most did not.

THE QUALITY CHASM

Even though patient-centered care was prominent throughout the Planetree health system, it was less utilized in other institutions. In fact, healthcare facilities continued to be very dangerous places for individuals, sick or otherwise. Following the patient-centered care movement, there was a dramatic focus on patient safety within the hospital. "One of the great ironies of modern medicine is that the very environments created to heal often are the cause of countless injuries, illnesses and death to the vulnerable populations they serve" (Dickerman, Barach, Pentecost 2008).

This news was brought to the attention of the public with the release of the Institute of Medicine's reports about medical errors

and healthcare-acquired infections. In 1999, the nation was shocked with the landmark report produced by the Institute of Medicine (IOM) titled To Err Is Human: Building a Safer Health System. Within this report, the IOM estimated that between 44,000 to 98,000 people die annually in the United States as a result of medical errors (IOM 1999). In 2001, a second report produced by the IOM, Crossing the Quality Chasm: A New Health System for the 21st Century, identified causes of errors to be linked to technology, human performance, clinical processes and the physical environment (IOM 2001). Two million people in the US alone contract healthcare-associated infections (HAI) annually, of which 88,000 cases are fatal (IOM 2001). Much of the time, these are errors that can be prevented or mitigated.

With these reports, the IOM launched a national public campaign to focus on issues of quality and patient safely. More and more information about the quality and care of patient's safety is being made available to the

public, and this knowledge is driving changes that are impacting not only the way healthcare is provided, but also the physical environment in which it is provided in. Both patient-centered care and evidence-based medicine were introduced and promoted as forward-thinking solutions to these problems within healthcare.

ARCHITECTURE RESPONDS

With so much negative attention on the failures of the healthcare industry, this impacted conversations about the future growth and expansion of facilities, and the architectural profession had to respond. Within the field of medicine, data was being gathered to evaluate best practices and to see where improvements could be made in order to reduce the occurrence of adverse health effects. In an effort to be relevant and to be part of the conversation, we had to figure out a way to assist in delivering a solution. The message was clear: we should to communicate to medical providers and organizations that our profession can adopt the same language and the same rigorous research techniques, and that we could deliver buildings and environments that would enable their organization to provide better, safer care to patients. We argued that by implementing evidence-based research into design, we could provide documented strategies in which design could improve a healthcare organizations' efficiency, outcomes, and their financial bottom line. From this, the notion of evidence-based design was born.

Evidence-based design was conceived of as the architectural response and solution to the lack of quality and rigor in the built environment. Essentially, it seeks to turn each design decision into a testable scientific hypothesis with emphasis on the eventual outcome. Obviously it appeals to the building types that are of high complexity and tight coupling, such as healthcare facilities, and because healthcare environments have little room for error, it is the perfect testing ground for improving rigor within design.

EVIDENCE-BASED DESIGN

"A process for the conscientious, explicit, and judicious use of current best evidence from research and practice in making critical decisions, together with an informed client, about the design of each individual and unique project."

2.3 OVERVIEW OF EVIDENCE-BASED DESIGN

The use of reason and empirical support as an evidence-based approach to design is not new, but the term "evidence-based design" has become more prominent in the mainstream world of architectural design, particularly within the realm of healthcare design. But what is evidence-based design? What does the process involve? What is credible evidence, and how do we evaluate it? More specifically, how does the evidence influence the decision-making process in design?

The accepted definition of evidence-based design is commonly referred to as "the process of basing decisions about the built environment on credible research to achieve the best possible outcomes (CHD, 2012). D. Kirk Hamilton, Director Emeritus for The Center for Health Design, Professor of Architecture at Texas A&M University, and co-founder and editor of the HERD Journal, has crafted a more formal definition, one which borrows heavily

from evidence-based medicine, to be "a process for the conscientious, explicit, and judicious use of current best evidence from research and practice in making critical decisions, together with an informed client, about the design of each individual and unique project." (Stichler & Hamilton 2008 A). Hamilton further describes evidence-based design as a process that "gives rise to buildings that generate positive health outcomes in hospitals through a growing body of best practice strategies that are informed by research and practical knowledge" (Hamilton 2003).

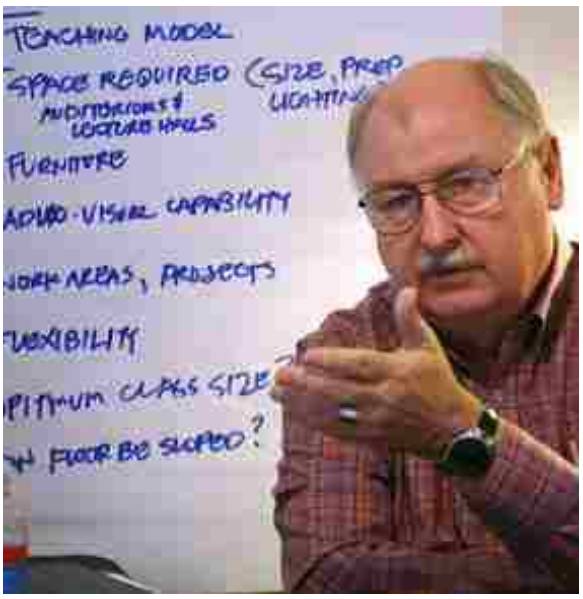
Evidence-based design is most often associated with healthcare environments, but applications have also been applied to multiple other building types. A growing body of rigorous, scientific-based research findings have been published in peer-reviewed journals that seek to further understand the relationship between the built environment and physiological and behavioral measures, clinical outcomes, and organizational and financial performance in healthcare facilities. (Ulrich, Zimring, Quan, Joseph, & Choudhary, 2004; Ulrich et al., 2008; Hamilton, 2012). Supporters argue that design decisions can and should be based on a chain of logic directly linked to research findings; this quest for research and knowledge has been driven by advocates of the evidence-based design process.

STATEMENTS IN SUPPORT OF EVIDENCE-BASED DESIGN

Evidence-based design combines rigorous research and focuses on measurable outcomes, all with the intent of creating therapeutic, patient-centered environments of care. Proponents of evidence-based design argue that design-based research can provide substantial evidence or "proof" for the way healthcare facilities should be designed. Supporters are often adamant that the use of this methodology is instrumental in achieving an overall optimal environment; one where outcomes are quantified and solutions are

Evidence-based design "helps improve healthcare facilities' outcomes, productivity, and customer satisfaction, as well as their economic performance."
-Center for Health Design

validated by scientific research. However, many practicing designers are cautious about jumping on to the evidence-based bandwagon, which causes enthusiasts to respond defensively and be very vocal about their support. Kirk Hamilton strongly promotes evidence-based design because he believes that clients will soon be demanding detailed data about our designs. Hamilton wants to add more rigor and credibility to the profession and believes that the profession can build credibility and trust by showing demonstrated metrics of past projects. Hamilton also states that, "like motherhood and apple pie, evidence-based design should be widely popular. Only the most jaded or ego driven could object to basing design on knowledge that can help achieve predictively positive results" (2004).



D. Kirk Hamilton
Photo Credit: Texas A&M College of Architecture

Several prominent individuals and organizations promote and support the research and methodology behind evidence-based design. The largest promoter is The Center For Health Design, a non-profit

organization that serves as a "consortium for knowledge in the many fields that contribute to the creation of healing environments for both patients and staff" (CHD website). Founded in 1993, The Center for Health Design collects and disseminates research findings that connect the built environment to other scientific-based knowledge disciplines such as neuroscience, behavioral architecture, biology, psychology, and neuro-immunology. The Center for Health Design established their Pebble Project program in 1999, which collects knowledge gained from the use of evidence-based design in built projects. Much of the research is published in the Health Environments Research and Design Journal, commonly known as HERD, which seeks to enhance the knowledge and practice of evidence-based design by disseminating research findings, issues and trends (HERD 2012).

One of the most noteworthy statements in support of the process is that evidence-based design "helps improve healthcare facilities' outcomes, productivity, and customer satisfaction, as well as their economic performance" (Taylor 2010). Other statements emphasize that a large part of the reasoning behind evidence-based design is the desire to create a healing environment that minimizes stress, promotes healing, and provides a positive patient and staff experience. Understandably, healthcare facilities should be efficient in terms of staff organization and operation, and should serve as a supportive, restorative environment for patients, families, and staff. It is a common belief that patients may heal faster in certain environments over others, and that the built environment can affect the efficiency and wellbeing affecting human performance (Taylor 2010). Therefore, much of the emphasis on evidence-based design is led by the desire to promote a patient-centered environment of care, one that enhances the patients' experience and accelerates their healing process (Taylor 2010).

Other statements of support emphasize

Bellevue Children's Hospital
Photo Credits: NBBJ

that designers need to have a better understanding of the disciplines of those who will occupy our buildings and spaces, and that designers need to expand their knowledge outside of the design and construction trades. Multiple components, such as human factors, ergonomics, and way-finding, as well as the psychological, physiological and sociological impacts of design, must be understood.

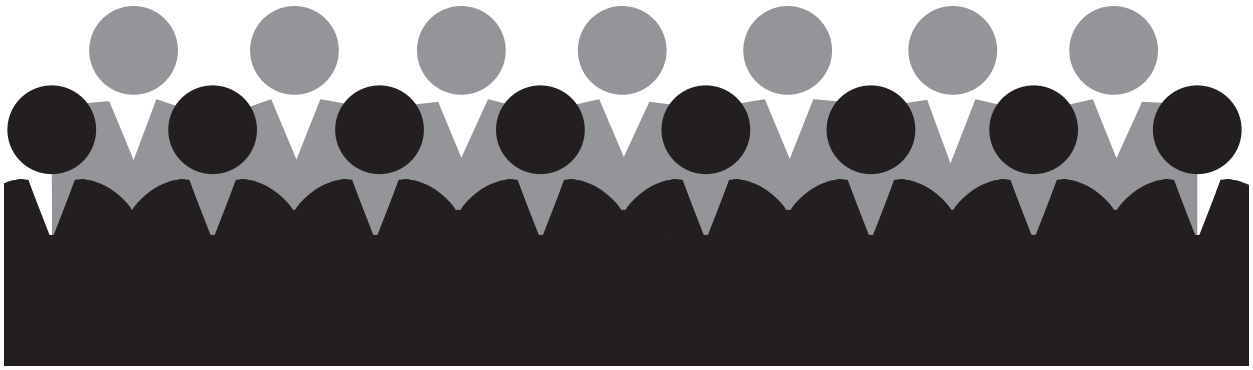
THE EVIDENCE-BASED DESIGN PROCESS

In order for designers to implement current research trends, D. Kirk Hamilton recommends that designers adopt a rigorous process for gathering, analyzing, and disseminating applicable research findings. The basic approach involves conducting a literature search to gather relevant findings and recommendations, prioritizing those findings and recommendations based on data gathered from the client and from other site visits, and finally, the creation of a hypothesis concerning the predicted outcomes based on the implemented design solutions.

Hamilton defines the nine official steps in the evidence-based design process to be as follows (CHD 2010):

FIGURE 3: Steps in the Evidence-Based Design Process

"Wisdom begins in wonder."
- Socrates



3.0

USE AND PERCEPTION IN PROFESSIONAL PRACTICE

3.1 PROCESS OF INQUIRY

After reviewing all of the available literature on evidence-based design, I was left curious about how practicing designers and professionals in the local Seattle market perceive evidence-based design, and how they use it, if at all, in their projects with clients. In choosing to do a research thesis over a design thesis, the goal was to discover why we design the way we do; what decision was made, and why was that decision chosen. I wanted to focus specifically on the process as opposed to the product. To understand more about how the process is used in real life, I conducted multiple interviews with a total of ten professionals representing seven different organizations. The intent was to understand their perception of the process, and to see how evidence-based design was used in everyday practice. Eight local architects representing five different architectural design firms were asked to participate. Additionally, a real estate developer specializing in healthcare facilities and a director of facilities for a local healthcare provider organization were also interviewed. The interviews were held during the months of April and May 2013, however, several informational meetings occurred with numerous participants prior to those interviews to gather knowledge and insight concerning industry trends. Together, the interview responses from each participant were reviewed, with the significant highlights being mapped out graphically and interwoven together to highlight correlations.

The goal of these interviews was to determine the perceptions and general attitudes towards the methodology of evidence-based design, and to gather information about how evidence-based design was actually used in real-world projects from the points of view of the architect, developer and owner.

Interviews, as a general method of investigation, provide the opportunity to explore details more in depth than most other research methods. Although interviews lend themselves to less scientific rigor, especially

when compared to a multiple choice survey, for example, they provided me the opportunity to converse with knowledgeable people and ask questions that don't easily lend themselves to being answered. Quantitative studies such as controlled studies or surveys, while the most objective, and also tend to be the most removed from the design problem. "They provide scientific credibility, but may not account for the specifics of the particular situation" (Tannen 2009). Similar to the task of interpreting a client's needs, the skills of listening and interpreting performed during these interviews was a valuable experience.

The interviews were conducted with the understanding that all identifying information would be removed from the final document. This was done to encourage candid responses and to eliminate any concern regarding professional privacy issues.

3.2 ISSUES EXPLORED

The questions presented during the interviews were (generally) as follows:

FIGURE 4: Issues Explored

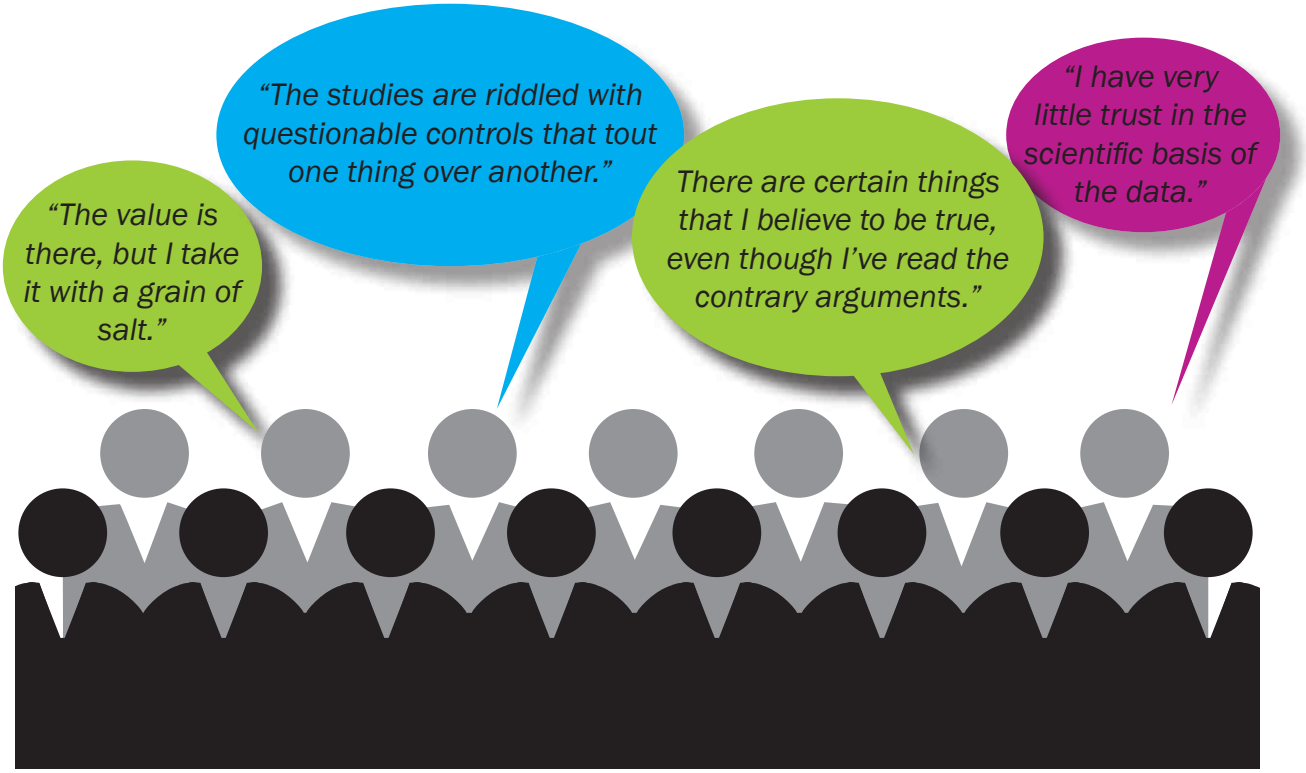


FIGURE 5: Quotes

3.3 FINDINGS

Among those individuals questioned, most were not extremely passionate about the topic of evidence-based design. In fact, it seemed to be quite controversial, with numerous interviewees expressing their concern of and distrust in the method of practice.

In general, there was a consensus that evidence-based design is valued for the knowledge and attention it generates towards conversations about the rigor and quality of design decisions impacting the built environment. It places a lot of emphasis on the environmental qualities of our surroundings, and the effect our surroundings have on the users and the financial and economic operations of the facility. All respondents agreed that there is value in the dialogue surrounding evidence-based design, but not necessarily in the "evidence" itself. The most beneficial aspect to designers is the increase of awareness in how others are solving problems. It was emphasized that the design cannot guarantee success; however, design can get in the way of success.

Practitioners also question the design of the research study, and say that published research does very little to sway their design decisions. Publications and magazines are full of studies with questionable controls that tout one thing over another. One consistent flaw in the studies is that they often exclude the contextual information and prohibits you from being able to compare apples to apples. What kind of hospital is it? A teaching hospital has a very different structure from a regional trauma center. When comparing research findings, it is critical to compare what type of facility it is and to understand how their organization is run, whether it be similar or different from the project facility. For example, Planetree is a closed system where everyone who goes to that organization pays upfront for that care, so you know that the patients have money and likely have access to preventative medical care and necessary medications. When comparing their design solutions to a facility such as

"Are they enough like me to where this idea will transfer across??"

Photo Credit: Trane

Harborview, where 34% of patients can't pay for their healthcare, the comparison of health outcomes is likely skewed. Since those 34% of patients can afford to pay nothing for their health care, they likely don't have the necessary life resources to benefit from small environmental changes in the hospital, at least not in any way that an environmental study is going to be able to accurately target.

For this reason, judgment plays a critical role in deciding how to apply the evidence. The evidence must be individualized for each project, and since not all studies are equally well designed or interpreted; it is up to the designer and the user to critically appraise the evidence.

When analyzing research methods, emphasis was on qualitative methods of research involving immersion in the client's needs and goals, while less emphasis was placed on looking at past precedents or case studies in outdated textbooks. The importance of becoming knowledgeable about the client's existing space and their future needs was strongly conveyed. This is most often achieved by physically exploring the existing space and observing what is happening in terms of the workflow and operations of the staff through squatter sessions and site visits. Communication with the staff and the users is critical, and first-hand opinions appear to be much more valuable as an educational endeavor than reading about second-hand data in a published report.

"If we think of design as a process of choosing the single best solution from among all possible alternatives, we run into difficulties. First, among an infinite number of possible alternatives there will be an infinite number of best ones. Second, for complex problems there may be no such thing as a best solution -- and any problem can be as complex as one wants to see it." (Zeisel 27)

Evidence: The available body of facts or information indicating whether a belief or proposition is true or valid.

oxford dictionary

4.0 EXAMINING THE EVIDENCE

4.1 DEALING WITH THE EVIDENCE

From these interviews, the message was very clear: We don't trust the evidence; therefore, we rely on it. This led me down another path, which was to dive into the ideas surrounding what constitutes evidence of performance, and why it's so difficult to produce accurately within the built environment.

At first glance, the amount of research and evidence that exists, published and non-published, is overwhelming. There are new reports, books, electronic journal entries and research reports with a wide variety of claims, and statements made nearly every day, with each supporting different things. There are many facets of research, all of which have different approaches and end goals. Research affecting the physical environment of healthcare facilities is conducted in a variety of manners across multiple disciplines, involving sociology, anthropology, politics, geography, public health, medical and nursing professions, epidemiology, and environmental psychology. The information available can be easily overwhelming to digest.

The most common types of data produced about the built environment are typically of the qualitative nature, and are often categorized as anecdotal, epidemiological, or empirical. The conflict often arises when trying to overlay quantitative numerical analysis to investigations involving social or behavioral phenomena.

Most published information attributed to research in design is in the form of case studies, which are often descriptive text summaries of projects. Literature reviews typically look at a group of case studies but don't often compare one to the other in an investigative way. A systematic review attempts to navigate the relationships and findings across multiple projects, and while this type of review hold the most promise for evaluating performance, it is rarely accomplished.

After conducting a literature review of a broad array of current publications, it was

apparent that most sources had significant flaws in the reliability of the claims. The vast majority of entries were written as anecdotal case studies of a single project, and consequently, were lacking the contextual information needed to decipher whether or not the findings can be applied to any other projects or organizations. The case studies were often too small to be deemed reliable or valid. (Shoemaker, L.K.; Abby Swanson Kazley, A. S.; White, A., 2010). Clearly, there is incredible access to a vast amount of information. However, the quality of what is characterized and accepted as evidence is lacking.

SOURCES OF EVIDENCE

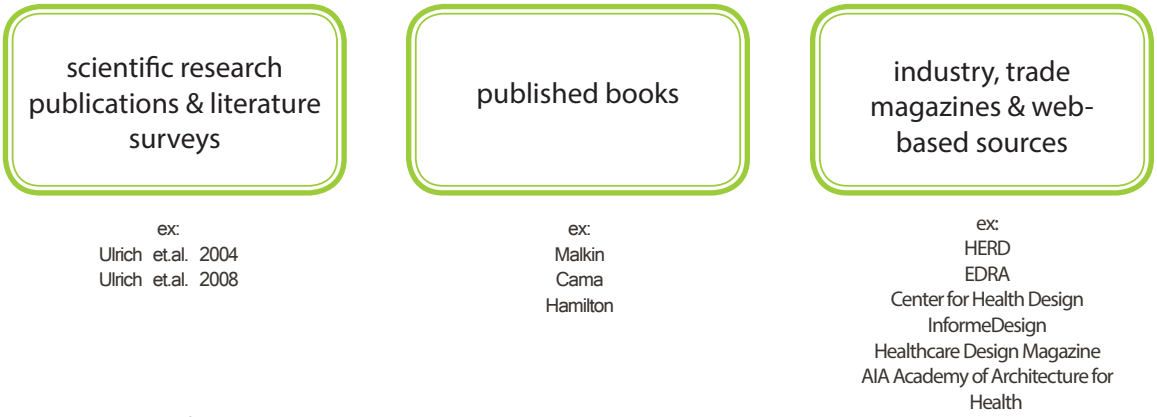


FIGURE 6: Sources of Evidence

An example of an anecdotal case study is the work by Roger Ulrich. In the 1980's, Roger Ulrich utilized environmental psychology techniques to measure "the effects of the environment and the people who are exposed to it" (Berg 255). In 1984, Ulrich published a pioneering study about the effects of window views on patient recovery. The study was conducted by comparing the results of two groups of patients who were admitted for gall-bladder surgery. One group had a view of trees out of their window in their patient room; the other group had only a view of a brick wall. Ulrich concluded that patients with a view had shorter stays, used fewer narcotic medications, and had other positive outcomes such as positive evaluative remarks in their charts, all because they had a view of nature out of a window. (Ulrich 1984; Hamilton 2010).

This study demonstrates the power that can come from what would be called poor evidence from a scientific perspective: it is anecdotal in nature, it is of a small sample size in a single facility, and it hasn't been rigorously repeated at other locations with the same controls. But, from the design side, it has intuitive appeal, and we have taken it as truth. Even though it might be called bad science, it is a great example of an anecdotal observation of the way the environment affects human perception.

Another conclusion drawn from the literature review is that the definition of what "evidence" is within the realm of design seems to have deviated from what is commonly accepted within the scientific community. Evidence is officially defined as something that indicates "proof of the existence of truth of something, or that helps somebody come to a particular conclusion" (Dictionary.com). In medicine, evidence-based findings typically refer to measurable outcomes found in randomized controlled trials. Different forms of evidence exist in a hierarchy based on how the data was derived. In science and medicine, evidence is of the highest quality and credibility

when determined by double-blind, randomized controlled clinical trials, followed by carefully controlled experiments and field observations. Hypotheses are supported after multiple experiments result in the same outcome, and the process is able to be repeated multiple times with a low level of variability in outcomes. The method of assessing the validity of individual research studies is whether or not the process is replicable and the outcomes are reliable.

The gold standard in scientific research is a double blind study that utilizes randomization and shows causation. The full gambet of scientific research tools either require a large study population or a very controlled environment in order to produce results with any credibility. When we talk about evidence-based deisgn or evidence-based research in the architectural realm, we have the challenge of not having a large study population (of buildings), no flexibility for randomization that allows for double blind studies, and there no way to utilize a constant control (keeping a

Roger Ulrich, Professor of Architecture
Photo Credit: Oregon Daily Journal of Commerce

"Most frequently cited researcher internationally in evidence-based healthcare design"
Center for Health Design

certain thing consistent) while modifying one or two variables. So what often comes out of EBD in the architectural world is very correlative without there being substantial enough proof that it qualifies as "evidence" of a better way of doing things.

What then is the equivalent of the double-blind, random clinical trial in research of the physical built environment? Reality is, the built environment has no real way to be controlled in a similar level of rigor. In fact, what is defined as evidence is continually revised with new information from each and every project. "Evidence"is often determined to be what is only the best solution for that specific project at that specific moment in time (Hamilton & Watkins, 2009). Findings published in peer-reviewed journals are considered the most reliable in terms of architectural research, followed by articles in popular press publications.

In reviewing the literature's claims of evidence about the built environment, it seems that anything and everything can be claimed as evidence, including anecdotal observations, regardless of the scientific accuracy or reliability. While there is certainly great value from these methods of inquiry, can any truly be viewed as a rigorous method that creates hard conclusive evidence about the built environment? It seems that the usage of the term "evidence-based" may be incorrectly borrowed from medicine and is perhaps a misuse of the term. It simply does not mean the same thing, nor does it imply the same amount of rigor and credibility. Which begs the question, how do we specify what qualifies as credible evidence within the built environment?? What does evidence really mean, and how reliable is it? Essentially, what is the evidence?

Photo Credit: Pittsburgh Post Gazette

Herbert SImon, 1916-2001
Professor of Psychology, Carnegie-Mellon
Nobel Prize in Economics, 1978

"The social sciences, I thought, needed the same kind of rigor and the same mathematical underpinnings that had made the "hard" sciences so brilliantly successful."

The Science of the Artificial:
an exploration of the organization of complexity and the science of design

4.2 THE CHALLENGE OF PRODUCING EVIDENCE WITHIN THE BUILT ENVIRONMENT

Herbert Simon explored the issues of the science of design and the organization of complexity in his book, "The Science of the Artificial." Simon was a former Professor of Psychology at Carnegie-Mellon University and was awarded the Nobel Prize in economics in 1978. In an effort to analyze decision making within the man-made, or artificial, world, he states the premise that certain phenomena are "artificial" in that they are as they are because of a systems being molded, "by goals or purposes, to the environment in which it lives." When Simon uses the term "artificial", he is referring to anything that is man-made, as opposed to natural. The common dictionary defines "artificial" as "produced by art rather than by nature; manufactured; simulated" (Simon 1969).

Simon explains that "engineering, medicine, business, architecture, and painting are concerned not with the necessary but with the contingent—not with how things are but

with how they might be—in short, with design. The possibility of creating a science or sciences of design is exactly as great as the possibility of creating any science of the artificial. The two possibilities stand or fall together" (Simon 1969).

Like the advocates for evidence-based design, Simon too aspired for greater rigor in the areas of qualitative analysis: "The social sciences, I thought, needed the same kind of rigor and the same mathematical underpinnings that had made the "hard" sciences so brilliantly successful" (Lindbeck 1992). The challenge with creating rigor in the built environment is that, since behaviors are malleable by their environment, we are essentially incapable of guaranteed success since success is highly dependent upon the behaviors and activities of the users operating within the facility (Simon 1969).

The difficulty often resides in "predicting how an assemblage of such components will behave" (Simon 1969). Behavior is an unreliable component, yet is a key part of creating a reliable system. How do we create a "reliable system from unreliable parts?" (Simon 1969). It turns out that the ability to accurately collect information from the built environment with any amount of scientific rigor is hampered by the users of the space. "Only fragments of theory are available to guide the design of a time-sharing system or to predict how a system of a specified design will actually behave in an environment of users who place their several demands on it. Most actual designs have turned out initially to exhibit serious deficiencies; and most predictions of performance have been startling inaccurate" (Simon 1969).

There are many metrics and methods on how to evaluate the quality of evidence, including new and emerging studies (Pati, 2011; Stichler, 2009, 2010) which attempt to create a framework for considering evidence related to safety and clinical outcomes (Ulrich, Berry, Quan, & Parish, 2010). At the same time, it is important to note that the built environment

"Although many studies may not be well-controlled, the strength of the evidence is enhanced by the fact that, in the case of certain environmental factors, reliable patterns of findings across several studies emerged with respect to outcome influences. Furthermore, these patterns were broadly consistent with predictions based on established knowledge and theory concerning environment and healthcare outcomes… Future research should be carefully designed and controlled so that the independent role of specific environmental changes or interventions can be better understood."
(Ulrich, R. S., et. al. 2008)

does not easily lend itself to randomized clinical trials or controlled outcomes, making it nearly impossible to create a "control-group,' which often causes some to erroneously analyze useful findings derived from rigorous research involving the built environment (Hamilton 2011; Hamilton 2012).

An initial investigation by Rubin, Owens and Golden (1998) was involved the review of 84 studies of rigorous research. The group was interested in whether the built environment played a role in healthcare patient outcomes, and they found that of these 84 studies, the "methodological rigor of this small volume of research varied enormously." In fact, the study openly states that the majority of investigations were "significantly flawed," with few if any producing "incontrovertible evidence." The study concluded that there was "suggestive evidence" of a cause-effect relationship that the physical environment affects clinical outcomes and patient care, "however, the case must still be proved. Accurate, valid scientific data based

on careful, credible studies are needed" (Rubin, H., Owens, A., Golden, G. 1998). This study called for more rigorous studies that utilized randomized controlled trials or observational studies, further emphasizing that "studies of the effect of the healthcare environment on patient outcomes need to be as rigorous as those of any other healthcare intervention" (Rubin, H., Owens, A., Golden, G. 1998).

Through a literature review of peer-reviewed journal articles, a 2006 study entitled "The Role of the Physical and Social Environment in Promoting Health, Safety, and Effectiveness in the Healthcare Workplace" (Joseph 2006) examined how the physical environment plays a role in improving health, safety, effectiveness and satisfaction of the healthcare team. "The genuine problem is to show how empirical propositions can be made at all about systems that, given different circumstances, might be quite other than they are" (Simon 1969). An improvement in physical environment alone will not help an organization achieve its goals without a significant shift in work culture and work practices that prioritizes the health and safety of the healthcare team. Improved outcomes addressing staff injuries, medical errors, hospital-acquired infections, operational failures, and wastage should contribute towards a reduction in staff turnover and an increase in staff retention and satisfaction. The challenge is to create settings where the physical environment and organizational culture come together to support ways of working that ensure health, safety and effectiveness for both patients and staff (Joseph 2006).

The use and impact of evidence-based design was again evaluated in 2010 in a survey that seeks to understand how research is being generated and applied to healthcare design (Taylor 2010). With only 1,000+ responses, its focus was solely on the use of design research in healthcare settings. One argument made was that a weak economy may be presenting a setback for the progress in the use of EBD. The survey seems to accept "trends over time" as

SATISFY + SUFFICE = SATISFICING

Satisficing: a decision-making strategy that attempts to meet a threshold of acceptability.

In order to satisfy the greatest possible amount of criteria, we often have to make sacrifices affecting the "optimal criteria;" consequently, the entire system operates at a sub-optimal level.

"evidence" when evaluating the most-common EBD features. One surprising find was that industry perception was skewed, with 38% of respondents indicating that perception was equally positive and negative, and 47.5% gravitating towards mixed or mostly positive perception (Taylor 2010).

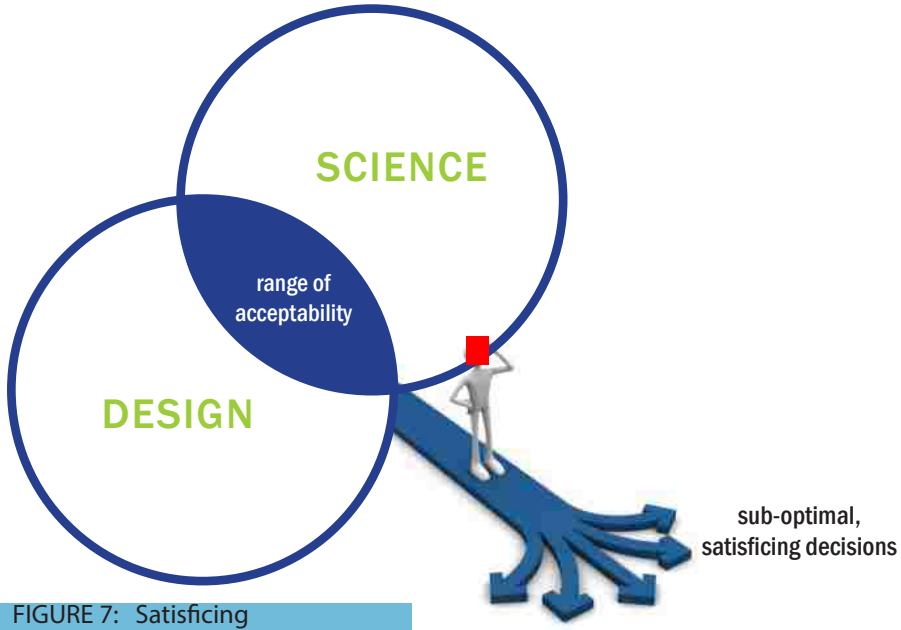


FIGURE 7: Satisficing

"Often, we shall have to be satisfied with meeting the design objectives only approximately."
- Simon

"We don't make optimal choices. We satisfice."
- Simon

SATISFICING

When evaluating decision making in design, Simon coined the term "satisficing," which is a play on the combination of "satisfy and suffice". Simon claims that it is impossible for a decision-maker to be able to always make the best possible decision in all scenarios, and as such, the decision-maker is forced to "satisfice," or make a combination of sub-optimal choices in an effort to satisfy as many constraints and parameters as efficiently as possible.

This can further be explained by comparing the complexity of decision making in the fields of science and design. In science, you have the ability to create optimal scenarios and to limit the design of the study and can control the parameters. In design, however, we often have very limited control over external parameters. Where these two methods of inquiry overlap, there is a range of acceptable decisions that can be made, however, in order to satisfy the largest amount of criteria, we are often forced to make small sacrifices. Consequently, everything operates at a sub-optimal level.

So, how do we reach that optimal level? Is there any good scientific evidence in design?? To date, the most promising research in terms of reliable data and studies comes from other disciplines that are investigating the science of human perception and behavior. For example, research has proven that the risk for errors is greater for swing shift nurses who are not adequately exposed to the benefits of blue, natural light, and are thrown off their natural sleep cycle. These disciplines of epidemiology and behavioral psychology, and others, help us to understand how our non-visual perceptions affect us physically.

4.3 TYPES OF RESEARCH

There are two basic types or categories of research methods. The first is a basic or academic research model, which aims to create new knowledge or add to existing knowledge, and it is typically done in an academic setting and involves scholarly or theoretical inquiries.

The second category is defined as applied research, which originates from the need to solve a real life, practical problem. It is intended for direct and immediate application to improve real-life conditions.

Both types of research categories can be of use when conducting research about the design of the physical environment. Challenges arise, however, when implementing the structural rigidity of scientific rigor into the flexible, ambiguous world of design.

Photo Credit DaSilva Architects

SCIENCE AND DESIGN

Science is understood to be a natural approach to challenging ideas by asking questions. Derived from the Latin word for

knowledge, "scientia," science is commonly understood to be an investigation in to how things in the universe work. It is a systematic and logical approach that aims for measurable results through rigorous testing and analysis.

Science relies on fact, rather than opinion or preferences. Often, scientific inquiries evolve by eliminating alternative explanations until a logical conclusion is reached (LiveScience.com).

When comparing scientific research to design research, it is understood that scientific inquiry relies on the analysis of empirical data, while design emphasizes synthesis and intuition. Science is exclusive, while design is required to be inclusive of all potential scenarios and variables. Scientific hypothesis and methods are specific and clearly defined, while design concepts are often vague and flexible. Science is typically initiated with a logical, pre-defined research method, whereas design must constantly respond to a wide varieties of scenarios and conditions. In science, small differences matter a great deal, whereas they are less meaningful in the realm of design. Finally, science seeks to control extraneous variables as much as possible, and to end with very specific conclusions, whereas the design process is required to embrace all variables, resulting in a final version that is only one of many plausible solutions. Research evidence is most compelling when the study is rigorously designed. In order to understand research and evidence across both science and design fields, we must establish a common language, and agree upon definitions of what constitutes 'evidence.' Consensus with terminology is critical to our understanding and use.

TYPES OF SCIENTIFIC EVIDENCE

Commonly, there are four main categories of evidence that are accepted across all industries: anecdotal, testimonial, statistical, and analogical. Each category is explained further in the table on the following page (Howard).

FOUR TYPES OF EVIDENCE

	DESCRIPTION	VALUE
ANECDOTAL	Evidence from anecdotes; openly acknowledged	• considered dubious support of a claim; accepted only in lieu of more solid evidence; description of one instance, or of a small sample of instances • better when used as 'negative' evidence or as a counterexample; an anecdote cannot prove a general statement; a single case cannot prove a general point. • a single anecdote or counterexample is alone sufficient to disprove a general statement
TESTIMONIAL	Verbal or written statements; physical, tangible articles or data; often uses empirical data	• Moderately strong evidence • Trustworth and credible source must be used • Testimony strengthens an argument but credentials are necessary to be valid
STATISTICAL	Data dependent findings	• Moderately strong or supportive evidence • Reference to empirical analysis, or to the results of methodical or scientific investigations • Citing sources is important
ANALOGICAL	Description of analogical relationships	• Strong supportive evidence • Explanatory modeling: compares an already understood phenomenon with the target phenomenon. • Illuminates the line of an argument; helps establish relationships. • Useful for articulating new perspectives • Illustrates points of view.

FIGURE 8: Four Types of Evidence
Dr. Philip N. Howard, Dept. of Communication, UW

METHODS OF GATHERING RESEARCH DATA

QUANTITATIVE

Systematic empirical investigation of social phenomena via statistical, mathematical or computational techniques; asks a specific, narrow question and collects a sample of numerical data from participants to answer the question

QUALITATIVE

Examines the reasons behind human behavior; asks broad questions and collects word data from participants. The researcher looks for themes and describes the information in themes and patterns exclusive to that set of participants.

EMPIRICAL

Information acquired by observation or experimentation; data is information that can be directly sensed and is demonstrable to other people: seen; heard; touched; tasted; smelled. Subjective data is considered empirical with it is gathered through interviews, questionnaire surveys, rating scales, and other measurement tools

EPIDEMIOLOGICAL

Study of patterns, causes, and effects of health and disease conditions in defined populations; various methods can be used to carry out epidemiological investigations: surveillance and descriptive studies can be used to study distribution; analytical studies are used to study determinants

POST-OCCUPANCY

measurement of performance indicators or metrics, variety of data collection efforts, Assess strengths and weaknesses of a facility in relation to original design intentions and resulting performance outcomes

FIGURE 9: Methods of Gathering Research Data
Kopec 2012

4.4 USING THE EVIDENCE

Discussions with practicing professionals revealed the perceptions and attitudes toward the use of the evidence-based methodology. The most popular discussion, by far, was the adamant response that the architect is most effective in the role of facilitator, and not as the expert. For this reason, designers are often hesitant to agree with certain trends over others. When it comes to hot topic issues, they are cautious about making declarative statements or stating a preference towards one way of doing things. This is because of the variability and range of healthcare clients.

"Because of the variability of our clients, we perceive ourselves more as facilitators than experts. Because of that, we're not as definite or affirmative about our opinions. Architects are easily swayed, because of the variability of our clients."

"It's about trying to accommodate ALL of the perspectives, including the patient arriving at the campus. It's not about being the expert, it's about facilitating the solution."

All evidence must be individually interpreted, and the best possible design must be specifically catered towards the user group's desired interaction and mode of operation within the facility. Evidence and data must be gathered from the organization and operations of the client, and it must be specific to the particular client's needs. The only reliable evidence you can truly count on at face value is the evidence that you generate yourself, with that one particular client.

"No data is important but your own. Testing is empowering."

In the traditional sense, the architect is typically seen as the expert of design. The architect is respected as a professional because of their ability to interpret people's needs and wants into occupied space. This persona of being an expert in design is often rooted in our education and training. We are taught to be open to criticism, and to be positive and declarative when making statements about our design choices. In essence, we are taught to defend our ideas and establish authority in front of a group of people who, for better or worse, have a large amount of control over our success or failure. One can easily argue that training for architectural practice is focused more toward the 'intuitive' side of architecture, and less towards research. For this reason, we have to believe that we are becoming an expert, especially about that one particular product type or project.

Portraying ourselves as experts in design also serves as a marketing tool. By demonstrating our expertise and skills, and emphasizing the range and quantity of completed projects, the mentality gets built in and we are forced to believe that we are experts in what we do. While this mentality is often true in most other building types, there is an exception in healthcare design. With healthcare, most designers have voluntarily shifted from the mentality of "we know better" to "maybe we don't."

COMMUNICATION OF FINDINGS IN DESIGN

CASE STUDIES

A descriptive or explanatory analysis. An explanatory case study is used to explore causation in order to find underlying principles; typically a catalog of facility examples, current trends, often lacks significant contextual information necessary to adequately compare projects; flexible, allows for the inclusion and exclusion of different types of evidence; strong potential for bias

LITERATURE REVIEWS

Narrative summaries of descriptive case studies; useful to report patterns and comparisons.

SYSTEMATIC REVIEW

A summary of evidence on a specific topic; uses a rigorous process; synthesizes studies to answer a specific question; draws conclusions about the data gathered.

FIGURE 10: Communication of Findings in Design

When evaluating decisions, the best decisions are those handed off or made by a well-informed client. It is critical that the design team accurately take the client's needs into account; allow them to become part of the design team, and give them the power to make decisions. The architect is less helpful at accurately predicting how specific design characteristics will impact the client's organization. "The gap between decision maker and user is too great to be overcome by designers using only a personal perspective" (Zeisel). Allowing the users to have a sense of control over their environment enables them to adapt a flow and structure that works best for their needs. Interaction with the user forces all involved to quickly get a better understanding of how staff and patients will actually be using the future space and how those decisions might have alternative impacts.

Bellevue Children's Hospital
Photo Credit: NBBJ

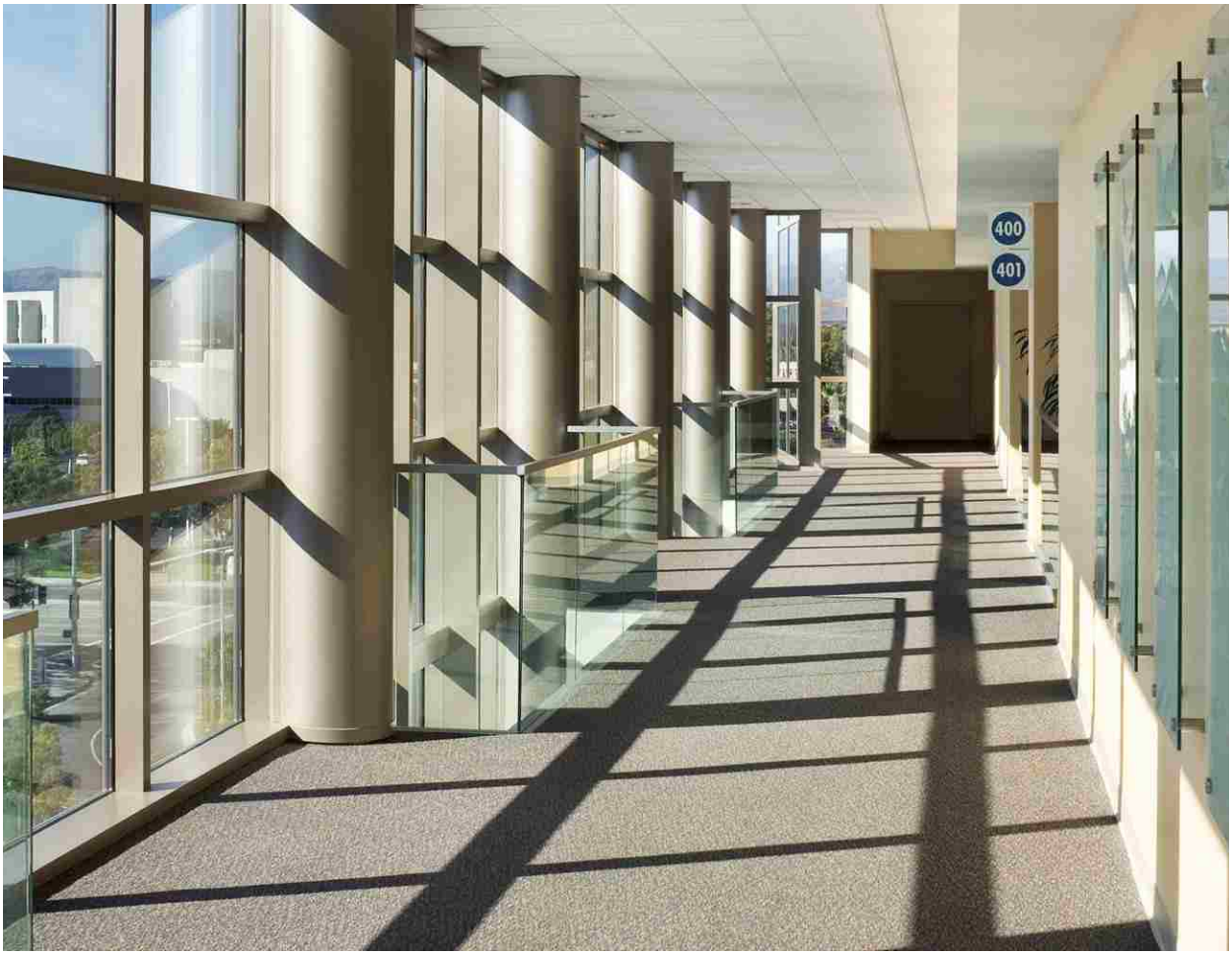


Photo Credit: Kaiser Permanente

5.0 CONCLUSION

5.1 STRENGHTS AND WEAKNESSES

Investigating the methods and reasoning behind architectural decisions is a surprisingly ambiguous task. It is difficult to imagine there ever being a prescribed method for how or why certain decisions should be made over others within the realm of design. At most, we can hope for a heightened discussion and awareness of trends and findings, and use the knowledge gained from others to influence or inform our decisions, but our decisions will still be uniquely crafted to suit the needs of each individual client. Architectural design and problem solving can be likened to the art and craft of cooking, whereas one recipe adored by some is ignored by others.

STRENGTHS

Evidence-based design promotes the use of credible research to make design decisions. Hundreds of thousands of articles have been published about the topic, applying it, evaluating it, debating it, supporting it and criticizing it; some all at the same time. It has done much to advance the field, and it has raised the level of conversation around the performance of our design decisions and the environment's effect on its users. Dramatic improvements have been made in the awareness of the patient experience and in the awareness of the consequences of our actions and designs. An increased emphasis on the importance of research and documentation has also been instrumental in advancing the standards of our profession. The most promising research comes with support from other disciplines. Research from other disciplines helps our profession to understand the complexity of how space is used and its effect on our physical and mental existence. Most notably, the work surrounding the science of human perception has impacted our profession significantly.

"An evidence-based, rational model of decision making does not fit the realities of individualized, contextualized practice, especially non-medical practice, wherein problems are less well defined." (Webb 2001

Photo Credit: Unknown

WEAKNESSES

Along with its many strengths, it also has numerous weaknesses and flaws: It is often criticized for failing to capture all relevant design information, for standardizing the design process, and for abusing the rigor defined by its very own title. Evidence-based design is also dismissed frequently on the grounds of many practical flaws in the designs of the research studies. While recognizing the importance of staying current in the client's field and collecting data related to their business, it is unreasonable to expect practitioners to collect relevant data independently and to continuously maintain that database. By default, evidence-based design limits itself to considering only the evidence. By stating claims and applying the "evidence-based" term to something, it gives the appearance and impression of being backed by scientifically credible findings, which is often incorrectly assumed. This leads to an unintentional consequence, one which allows projects to claim support from evidence-based design with little actual legitimacy, resulting the in promotion of ideas and solutions that haven't truly been vetted by scientific standards. Furthermore, industry publications such as Healthcare Design Magazine and the Center for Health Design routinely publish case studies and editorials with broad, uncritical statements about real-world examples, adding to the further illusion of legitimacy.

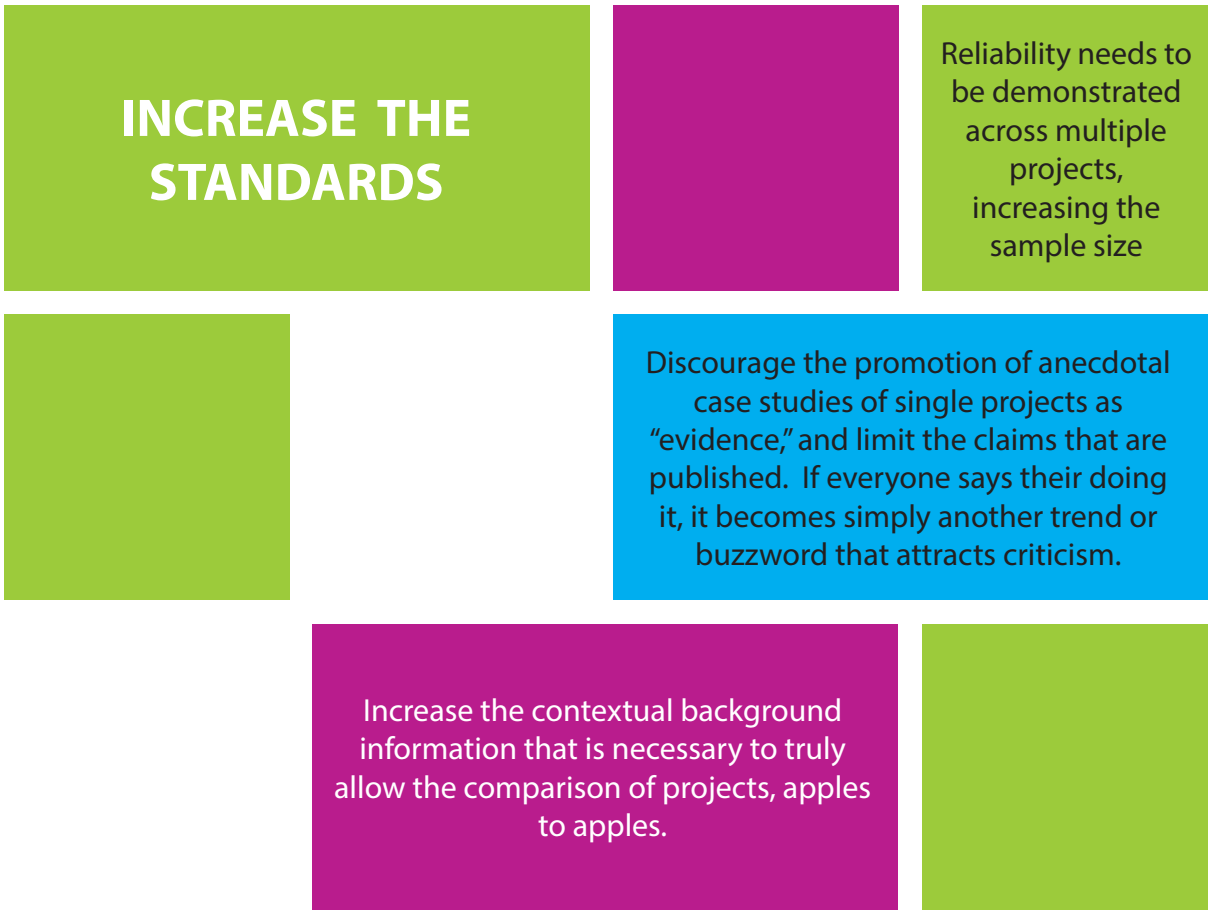


FIGURE 11: Increase the Standards

5.2 INCREASE THE STANDARDS

When describing evidence based design, typically the first response is that it has obvious, reasonable merit. How can anyone object the idea of improving design with informed research? While I am a believer in evidence-based design, my belief is tempered with a healthy dose of skepticism. While I fully acknowledge that there is great research being done that investigates the performance of our design decisions, I feel our profession needs to be clearer about the kinds of claims we make, and to acknowledge the limitations of our findings. In order for research to be successful in design, I propose that we need to raise the bar when it comes to the types of evidence and claims that we put forth and publish. See Figure 11 to the left for a summary of the proposed changes.

5.3 SUMMARY

When I first began working on this thesis project, my passion for healthcare design and distaste for ambiguity was what initially led me to discover the evidence-based design methodology. Initially, I fully adopted this train of thought and believed evidence-based design to be a logical, common sense solution to how design should be approached, especially for projects of high complexity and tight coupling. However, as time went on and my research became more involved, I discovered that I need to take a more critical look at the trends and findings that were being promoted. I quickly found that the promoters of evidence-based design spend a lot of time and effort on just that, the promotion, with less emphasis on the challenges of producing quality evidence that can be applied across the industry. I've come to the conclusion that while it has brought a lot of attention our profession, it is overly promoted as a marketing campaign and fails to adequately address the serious flaws in the

quality of the evidence published. The suspect that for the majority of practitioners across the world, the lack of confidence in the validity of the evidence prohibits the findings from being widely referenced across projects, and consequently, published research isn't used as a driver of decision-making within architectural practice. Because the evidence can often be misinterpreted and misrepresented, arguments consist about the quality and validity of the evidence, when the discussion should be focused on the research and the context involved in the process. It's not about finding out the correct solution, it's about the discussion of how to find the best solution for each individual project. The conversation needs to be shifted to how to use the data to innovate, instead of validate. Focusing on the process as opposed to the end data, or the "hard evidence," will allow designers to unlock the innovation that is so sorely needed in our industry.

Obviously, one of the important steps in the evidence-based process is to evaluate

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and critically interpret all available evidence. Understanding what makes research credible and how the research might impact a design outcome is an important and required skill of the evidence-based designer. As is evident from a review of the literature, there are surprisingly varied levels of rigor and validity, and so the designer must be aware of this and integrate appropriate findings as best as possible.

Our profession borrowed the definition of evidence-based design from the medical field. But then we completely alter the definition of evidence and consequently soften the definition of rigor. The advantage is that it injects research into areas where we formerly only had intuition. It raises the awareness of the consequences of our actions. However, simply put, the use of research in design is simply not built on the same ideas and definitions of proof or evidence. And when you doubt the fundamental terminology, you begin to doubt the whole thing, and you discount the advantages that do come out of it. I can't help but to pose the question: are we doing harm to our reputation by borrowing a phrase, and then manipulating its definition, all in an effort to give the impression of rigor and credibility?

With this project, I have developed a broader understanding of the design process as utilized in professional architectural practice, and am prepared to critically evaluate complex projects with a broad fundamental understanding of the complexity of issues and requirements when merging scientific rigor in to the field of design.

6.0

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