Design and our Health: The Link between Comfort, Aesthetics and Healing

Mariah Ruth Hay, MFA

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ABSTRACT

As the cost of healthcare in the United States grows, individuals and companies faced with this financial burden look to alternatives. These include practicing preventative care and encouraging shorter in-patient medical stays. As a patient’s personal responsibility for their treatment increases, so does the array of medical devices they must learn to incorporate into their day-to-day routine. Here the lines blur between hospital and home, sick and well, rest and activity. The challenge for the medical design community is to identify and address the physical ramifications medical devices have by crossing the psychological boundaries of hospital vs. home, communicated by product design.

The objective of this thesis is to explore the psychology behind American’s complex relationship with the medical industry. By examining psychological, sociological and historical pretexts, the impediments to designing effective medical devices surface, providing a deeper understanding of damaging and dangerous oversights in current medical design. This understanding can be applied to a new generation of products that relate to the user on an emotional level, shifting the paradigm to what products Americans associate with illness and with healing.

INTRODUCTION

The intention of this thesis is to create a new context in which to design products used to aid in human healing. In order to do this, the current context in which these products are designed must be examined. Unhealthy lifestyles, an aging population, increase of disease and the shift of medical responsibility from the healthcare organization to the individual are some of the major issues facing the current American community. This unhealthy context grows increasingly unstable as fewer and fewer Americans are able to afford the rapidly inflating cost of healthcare and medication. To counteract these obstacles, many people have already begun to seek other ways to treat themselves. This includes finding information online, a phenomenon that has only taken root in the past decade.

The epitome of a successful product ultimately satisfies the need of the user to create a personal relationship with the object on both a psychological and physical level. These needs have been discussed by industry professionals such as Donald Norman, Professor Emeritus of Cognitive Science at University of California, San Diego and a Professor of Computer Science at Northwestern University, and Patrick Jordan, Design, Marketing and Brand Strategist, regarding emotional design and pleasure based approaches. The ideas and structures Norman and Jordan express are a good

1 CDC National Center for Health Statistics, January 28, 2009, Press Release, US Outpatient Surgeries on the Rise. (The number of outpatient surgery visits in the United States increased from 20.8 million visits in 1996 to 34.7 million visits in 2006. Outpatient surgery visits accounted for about half of all surgery visits in 1996 but nearly two thirds of all surgery visits in 2006.)

2 Greider, Katherine. The Ups and Downs of Outpatient Procedures: What You Need to Know. AARP Bulletin Today, August 15, 2008 (Josef Woodman, 56, of Chapel Hill, N.C. Was discharged from a hernia surgery before staff confirmed that he could urinate. Two days later in the emergency room he was relieved of a liter and a half of urine. Then staff discharged him with a catheter to use at home—with no instruction.)

3 Population Health Integration Within a Medical Curriculum: An Eight-Part Toolkit American Journal of Preventive Medicine, Volume 29, Issue 3, Pages 234-239


starting point for bringing a more human centered design approach to many medical design applications. Despite the intimate level of interaction users have with medical products, most fall short of satisfying this need. By identifying the fatal flaws in the perception of the medical community and the mismatched perception as interpreted by the patient, a new language of healing can be created to meet the needs of both parties. By investigating the root of what makes medical design different from other products, a solid foundation can be formed on which to build a guide to designing within a new context.

The objective of this thesis is to investigate the psychological reasoning behind the current perception of health, healing, and the medical community in the United States. By understanding the cognitive and psychological reasoning behind these perceptions it is possible to identify the breakdowns which affect the healing process. These breakdowns include problems such as medical non-compliance, lower quality of care and social segmentation. By studying the causes, this thesis will show the connection between emotional satisfaction and physical healing, working to provide not only a new framework to design by, but a new context in which to design.

CHAPTER 2
STATE OF SCIENCE

2.1 Introduction
Traditionally, decisions that involved medical issues were left in the hands of doctors. Patients seeking care were often in the dark as to the details of treatment, possibly extending as far as the medications they were expected to take. With the advent of malpractice lawsuits, the skyrocketing price of medical insurance and the availability of exchanging information on the internet, the burden of responsibility transitioned to the patient. Gone are the days when physicians made house calls and one doctor served all the needs of the family. Today, individuals may have a different doctor for each of their medical needs, or in some cases, a group of doctors for each need. The once intimate relationship between patient and doctor has segmented, leading to impersonal service and incomplete medical records. The confused patient is left with the responsibility of keeping track of their scattered medical history, payments, insurance, labs, and major treatment decisions.

To add insult to injury, bewildered patients are left few decisions as to the quality of products associated with care and recovery. Many patients’ choices are restricted by preferred brands of the insurer or their doctor for major purchases. This can include a variety of products from wheelchairs to CPAP breathing machines. Choices are also restricted regarding lower cost, short term items. For items like canes, arm slings and crutches, patients often purchase from their doctor or pharmacy. Doctor’s offices typically carry one choice of health aid and pharmacies often carry one or two, depending on the size of the store.

These products help sustain quality of life, yet patients may only have one choice when it is time to purchase a device they must use for weeks, months, or perhaps a lifetime. This lack of choice has become more pronounced over the past two decades, as life expectancy lengthens and the cost of care for the elderly and infirm skyrockets. For many, care has become cost prohibitive leading patients to purchase home health care equipment and aids in the attempt to remain in the home environment as long as possible.

2.2 Looking at Current Context
By looking at the current context of health in the American public we can better understand the health problems individuals face. The majority of issues can be analyzed through dividing current context into the following four categories: Unhealthy Lifestyle, Aging Population, Increase of Disease and Shift of Responsibility.

2.2.1 Unhealthy Lifestyle
It is no secret that as a whole, the American public trends toward living an unhealthy lifestyle. This epidemic has many contributing factors such as poor diet, lack of exercise, stress, extended workweeks and over-stimulation. Most markedly, this combination has contributed to a dramatic rise of obesity in both children and adults, which continues to climb. The US National Health and Nutrition Examination Survey (NHNE) by the Center for Disease Control and Prevention (CDCP) has found that currently 64.5% of US adults ages twenty and over are overweight, almost half of these being obese or morbidly obese. This is a marked increase from 56% in 1994 and 46% in 1980.

The risk factors linked with obesity contribute to creating innumerable health conditions such as diabetes, coronary heart disease, high blood cholesterol, stroke, hypertension, gallbladder disease, osteoarthritis, sleep apnea, cancer, psychological disorders, increased mortality, increased surgical risk and many others. A recent study estimated

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6 Williams, Anita E, Christopher J Nester, and Michael I Ravey. Rheumatoid Arthritis Patients’ Experiences of Wearing Therapeutic Footwear - A qualitative investigation. BMC Musculoskeletal Disorder, UK, November 2007. (Case study conducted which yielded results proving emotional disappointment in product by consumer.)

7 www.obesity.org/subs/fastfacts/obesity_us.shtml (accessed 06.07.07)

8 www.niddk.nih.gov/statistics/index.htm (accessed 06.15.07)
annual medical spending due to overweight and obesity to be as much as 92.6 billion dollars in 2002, comprising 9.1% of all US healthcare expenditures.

2.2.2 Aging Population
Throughout the history of man, there has been a steady trend of each successive population being larger than the last. Each successive population also manages to increase its lifespan through lifestyle, nutrition, and medical advances both in pharmaceuticals and medical care. In the last two hundred years this growth has maintained a gradual but steady climb. That all changed with the Baby Boomer generation. Named for the sudden population boom, this generation has shifted economics, culture and politics as they grew from children to adults.

Currently ages 47 to 67 and totaling approximately 25% of the U.S. population, the Boomers are retiring, and about to shift the definition of retirement, and within the next ten years, how we care for special medical needs associated with aging. This active population will not age quietly, demanding excellence in products and care. This sets the stage to make now the time for major overhauls in the way medical care is handled. The shift is already evident in the way private industry is beginning to market elder care to the Boomers.

Both private and public companies and organizations are discussing the issue and making accommodating changes to their business models. Many private companies such as Leisure Care and Atria provide living and health care options that previous generations were never privy to. These companies offer an all inclusive packages which provide levels of care according to the individual's needs. Levels begin at independent living (providing relatively little assistance) to hospice care for severely ill patients. Leisurecare markets its facility as "Resort-style Living" appealing to the hardworking boomer mindset that retirement equals vacation.

Products catering to the boomers have also joined the market. OXO Goodgrips collaborated with Smart Design in 1990 to create high quality kitchen tools that could accommodate individuals with problems gripping conventional tools. Also in line with the Boomer generation, these products are not branded to target the disabled user. Instead, OXO uses a strong platform of functional universal design, high quality products and “addresses the needs of the widest range of people possible.” The design and marketing tactics have paid off. In 14 years, OXO went from a small startup company to a company that sold for over $273 million in 2004. They have also won hundreds of awards for their universal designs and have the honor of having many products featured in museum collections.

2.3 Increase of Disease
As the Baby Boomers age and obesity continues to rise, the medical community is charged with counteracting the increase of disease. The most common diseases on the rise are cancers, heart disease, Alzheimer’s, and autism. All of these diseases (with the exception of autism) can be linked to the increased life expectancy of the current generation. Despite the lower mortality rate due to advances in medicine, these illnesses can often drastically lower the quality of life for stricken individuals. Serious health or disabling conditions often result in nursing home residence because of the difficulty of managing patient care. The chances of being placed in a nursing home are even higher when social, financial and housing resource options are limited.

According to the U.S. Administration on Aging (AOA), life expectancy was 79.3 years for women and 72.5 years for men in 1995. Projected to 2050, life expectancy increases sharply to 92.3 years for women and 86.4 years for men. A team from the University of Chicago and the University of Illinois studied this dramatic increase and its effects. They projected that if residency ratios remain unchanged, the number of persons residing within nursing homes will double or triple by 2030, meaning that the number could rise by over 300% for those aged 85 and older.

2.2.4 Shift of Responsibility
Over the past two decades the leaps and bounds in technology coupled with the economy's demands for specialization in all fields (including medical) has left a gap in the way individuals receive medical care. Due to the fact care is now segmented by specialized medical industries and stipulations placed by medical insurance, individuals have...
been left with no choice but to manage responsibility of healthcare making decisions.

The phrase ‘getting a second opinion’ is now common vocabulary for the general American public who must now shop around for what they consider to be the best care. This growing trend is particularly evident in the media. Landmarks include special edition publications such as Newsweek and Readers Digest, as well as growing media coverage on medical advances in common cover stories. The 2005 summer publication of Newsweek titled “Your Health in the 21st Century” featured an eighty-eight page spread of information on new treatments for cancer, Alzheimer’s, diabetes and depression, as well as information on current knowledge of medical conditions creating treatment options in years to come. “Addiction and Alzheimer’s could become as manageable as high blood pressure” stated on article titled The Future of Medicine. The March 2007 issue of Reader’s Digest featured Top Medical Breakthroughs & How You’ll Benefit with special sections such as Health IQ which explained which specialist to go to for different allergy problems.

This recent shift in responsibility is also evident in alternatives available to individuals in order to cut the cost of care. Because of rising healthcare cost and limited offerings for cost coverage by insurance companies individuals are turning to online services, phone services and immediate care facilities.

Websites such as WebMD.com offer comprehensive information for self-diagnosis. Some insurance companies such as United and Blue Cross offer 24-hour helplines where a medical professional can be reached for advice. Both the online service and the phone service help individuals rule out problems to help avoid unnecessary costs associated with a doctor’s visit. Immediate care facilities offer options for sick individuals who do not have or cannot get an appointment with their primary care physician and do not want to go to the emergency room for treatment. Immediate care facilities offer services for minor illness and injuries and usually cost much less than a trip to the emergency room. However, these facilities have no records of the patient’s medical history so it is up to the individual to provide that information.

2.3 The Perception of Medical Care
Sterile, harsh, cold, impersonal; those are just a few of the words most frequently mentioned when a person is questioned about their perception of hospitals, doctor’s offices, medical devices and equipment. These words say a lot about the perception of medical care. For example, the word sterile is defined by Merriam-Webster as 2b: free from living organisms and especially microorganisms <sterile syringe>; c: lacking in stimulating emotional or intellectual quality.

2.3.1 Projected Image
Most traditional healthcare marketers would use the word sterile as a positive indication that the medical facility is perceived as clean and professional. This however, is not necessarily the case. While the individual might believe that the environment is sanitary that is not what they are trying to say. By using the word sterile they are actually using definition 2b; lacking in stimulating emotional quality. This actual definition of how the word is being used by the patient is further re-enforced by the fact that they mention the word ‘impersonal’ shortly thereafter. The truth is that while all medical products and environments should give the impression of cleanliness, the last thing they should do is impart sterility. This misconception pervades just about every part of the medical industry. Facilities and products alike give few choices to their patients. Despite the unfortunate belief by the medical community that sterility equals good, there is quite a bit of evidence to the contrary. Environment plays a huge factor in the mental well being of a person, especially a patient with an ailment or illness. Experiencing a medical facility or using a medical device is a constant reminder to the individual that all is not well. In most cases it is not comfortable or friendly, and the patient can have feelings of anxiety and confusion. This could be as subtle as residing in the subconscious, but regardless creates a state of depression. Even slight depression impedes healing turning the situation into a negative healing cycle.

Mary Blegen, RN PhD presented Patient Perceptions of Hospital Care: Psychometrics and Relationships with Physical Conditions and Adverse Events after experiencing it firsthand. Her hypothesis stated; “if it can be shown that patient perceptions of quality are related to other independent measures of quality these tools will be more acceptable as valid indicators of quality.” What Dr. Blegen was trying to prove is that patient’s opinions about their environment and experience within the hospital matter, and should be given credit as indicators of quality of care. She proved this by performing a 21 item questionnaire with a Likert Attitudinal Scale of 1-5 with 6 subscales to show strong reliability. Through this research, Dr. Blegen concluded that “tools using patient perceptions can, within limitations, be useful indicators of quality for researchers, policy makers and providers.” She proved that by listening to patient’s

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20 www.webmd.com (accessed 8.20.07)
21 www.m-w.com/dictionary/sterile (accessed 6.24.09)
22 Http://gateway.nlm.nih.gov/meetingabstracts/102272616.html (accessed 08.20.07)
perceptions, the healthcare industry can benefit in making the quality of care better, and in improving areas that create poor perception.

2.3.2 Emotional Connection
The most important takeaway from Dr. Blegen’s study might also seem to be the most hidden while only implicitly implied, Dr. Blegen has validated not only the patient’s opinions, but also their emotional connection throughout the experience of care. Blegen may have validated this data by comparing it to data collected from non-emotional gathering methods, but ultimately arrived at a much more valuable conclusion. The conclusion proving that the same quantitative data can be gathered from the patient, as well as qualitative information about the emotional experience. What Dr. Blegen justified was gathering information through contextual research, a method long valued in the industrial design community to inform product design decisions.

In Mike Kuniavsky’s book, Observing the User Experience, he asks the question, “Do you know who your real users are?” By using contextual research methods like the ones outlined in his book, and the ones that Dr. Blegen followed, information can be gathered to answer this question. By discovering the ‘real user’ the designer is doing more than just gathering anthropometric statistics of demographics which can be applied to medical devices, they are uncovering the user’s emotional connection to the environment, product and situation. Because of the mental impact these variables have on healing, it would only make sense to place an equal amount of importance on these emotional factors as well as the anthropometric ones. Unfortunately, the emotional connection of the user is still very much left out of the picture.

CHAPTER 3
THE PSYCHOLOGY BEHIND USER NEEDS

3.1 Classical Theories
Psychology and human need have been inseparable in regard to deciphering what drives human behavior. Noted psychologists and psychiatrists have published century’s worth of theories explaining actions, reactions, social norms, acceptance and rejection. Two of the most revered classical theories include those of Bruce Bracken’s Multidimensional Self Concept Scale, and Abraham Maslow’s Hierarchy of Needs. Both of these theories retain the self-concept construct, one of the oldest and most widely accepted frameworks in psychology. The self-concept construct is important to understanding the individual, and in turn a better understanding of the user’s needs. By applying this information to medical design, products would have a better chance of succeeding not only on a physical level, but also on a psychological level.

3.1.1 Multi-dimensional Self
While the Multidimensional Self Concept Scale (MSCS) is predominately used as an assessment tool for youth and adolescents, it is helpful in identifying social-emotional adjustment. Its main focus is to assess self-concept and self-esteem through “concept dependant self-concept domains.” Bruce A. Bracken, creator of the MSCS, determined six major domains that were important for psycho-social functioning. These include social, competence, affect, academic, family, and physical. Each item or domain has 25 points that it covers on the evaluation. Typically administered together, this creates a 150 item assessment.

Over the past two and a half decades, the investigation within the field of self-concept has grown by leaps and bounds in regard to theory, measurement and research. Prior to this growth, this particular construct was doubted and criticized by psychologists who chose to follow more modern theories of the day. Shadows were cast over particulars such as methodology, instruments of measurement, and consistency of test results. Today, the progress that has been made “is due at least in part to a stronger emphasis on a multidimensional self-concept instead of global measures of


Herbert Marsh, Ph.D. asserts that, “self-concept cannot be understood adequately if its multidimensionality is ignored, and recommends that researchers use well-constructed multi-dimensional measures of self concept instead of relying solely on global measures of self.” It is this well rounded approach to which the MSCS can thank its widespread popularity, and also the reason it can be valuable to design researchers looking to gain psychological insight.

3.1.2 Maslow’s Hierarchy of Needs
In A Theory of Human Motivation, Abraham Maslow created a detailed picture of what we now know as Maslow’s Hierarchy of Needs. In Chapter Two he qualifies needs such as Psychological, Safety, Love, Esteem, and Self-actualization, creating a ladder theory where the most basic need must be achieved before the next can be revealed and or obtained. Maslow is careful to state that this is not a rigid structure, and needs may change places in the hierarchy, depending on the individual. He also cautions that a need must not be completely satisfied for the next to emerge, and in fact are very seldom 100% satisfied. “It is as if the average citizen is satisfied perhaps 85 per cent in his physiological needs, 70 per cent in his safety needs, 50 per cent in his love needs, 40 per cent in his self-esteem needs, and 10 per cent in his self-actualization needs.”

Carefully stated in his summary, Maslow proclaimed “Man is a perpetually wanting animal.” Despite its succinctness, this statement provides an accurate glance at a structure which is much more complicated than meets the eye. Revolutionary for its time, it rejected the basic Freudian premise of human motivation being singly propelled by sexual desire. Instead of centering on illness (like many psychologists before him), Maslow researched exceptional people, believing that research of the mentally healthy would lead to a stronger philosophy. By utilizing his hierarchy, designs can be more accurately analyzed as to what needs they fulfill, and where they fall short. This framework provides an evaluation method that reached far beyond most product evaluations by helping to explore needs beyond utility and function.

3.2 Modern Theories
Theories like Maslow’s Hierarchy of needs and Bracken’s Multidimensional Self both exemplify the behaviorist or psychoanalytic school of thought that dominated the field of psychology before the early 1960’s. Today psychology has become increasingly diversified by the areas of specialty in which the psychology is practiced. The biological perspective, the cognitive perspective, the cross-cultural perspective and evolutionary perspective are just a sampling of the diverse viewpoints across the psychological spectrum. These specialized fields become increasingly important as we examine topics such as medical design. Here is where a specialized area such as medical psychology can be extremely useful.

Not to be confused with traditional cognitive behavioral psychology, medical psychology studies the relationship between emotional and physical well being, providing treatment for conditions which stem from interaction. Treatments utilize knowledge of human psychology through psychological, cognitive-behavioral and bio-behavioral techniques. Theories like Lionel Tiger’s Four Pleasure Framework and Patrick Jordan’s User Needs are particularly relevant in this regard. They separately assist in identifying and analyzing important areas in the field of medical psychology, uncovering psychological user needs.

3.2.1 Lionel Tiger: 4 Pleasure Frameworks
Canadian anthropologist Lionel Tiger’s Four Pleasure Framework focuses on addressing pleasure issues through the means of identifying physiopleasures (sensory), sociopleasures (the company of others), psychopleasures (accomplishment) and ideopleasure (experience). His

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extensive study is outlined in his book, The Pursuit of Pleasure. Tiger’s premise outlines a case for the physical and mental benefits of pleasure. “How could anyone object to the notion that pleasure is biologically desirable for good physical and mental health and that the motive and machinery for it has been programmed into our being by evolution?” Tiger argues that for a species that needs pleasure to survive, we spend a great amount of effort to ignore or even shun it. In an effort to demystify the concept of pleasure, Tiger investigates exactly what we are experiencing and how those experiences positively affect us.

Each of the pleasures in Tiger’s framework categorizes what we are feeling, depending on the source of the experience. From there, it is not a far stretch to relate this framework to Industrial Design. For what, if not experiences, do products facilitate?

Physiological pleasures may include tactile pleasures like holding or wearing a product. Olfactory pleasures would also represent a physiological pleasure. For instance, a child might enjoy taking a medication because it tastes like bubblegum. Sociophysical pleasure might arise from a product that facilitates positive social interaction. This same pleasure is present in individuals who belong to a social group whose identity is related to a product or brand image. Products can also facilitate an emotionally satisfying response in their user. This would exemplify psychophysical pleasure. Psychophysical pleasure is most commonly related to positive emotions inspired by an accomplishment. Learning to use a new computer program which helps the user expedite a task more quickly is a good example. Ideophysical pleasure refers to the pleasure derived from personal values. This could include the satisfaction an environmentally conscious user receives from using a recycled product. It also includes products that are not only cherished for their function, but for their form or beauty in the eyes of the user. As designers delve deeper into the psyche to explore product/human connections Tiger’s framework provides an emotional map.

3.2 Patrick Jordan’s User Needs
While Tiger’s four pleasure framework helps classify satisfaction and enjoyment, Patrick Jordan’s User Needs were developed to accommodate a human factors based product design platform. Using Maslow’s Hierarchy of Needs as a conceptual blueprint, Jordan builds his own hierarchy of consumer needs. It contains three levels, in comparison to Maslow’s five, but functions much in the same way. The first level must be satisfied to reach the second level, and the second satisfied to reach the third. Unlike Maslow’s disclaimer that the hierarchy may shift, and that lower levels may not be fully satisfied to begin satisfying upper ones, Jordan’s user needs follow a less fluid format.

Figure 3.3
Lionel Tiger’s Four Pleasure Framework

Figure 3.4
Patrick Jordan’s Hierarchy of User Needs

Jordan depicts his hierarchy in his book Designing Pleasurable Products: an Introduction to the New Human Factors. He begins by explaining Level 1: Functionality. “A product will be useless if it does not contain appropriate functionality... if it does not have the right functionality this will cause

30 “The most complex, formal and significant one derives from religious convictions that the most morally admirable human life is marked by abstemiousness, suffering and even martyrdom.” (ix) Tiger, Lionel. The Pursuit of Pleasure. Piscataway: Transaction Publishers, 2000.
dissatisfaction." He continues on to clarify that this breakdown is often a symptom of poor human factors application. Level 2: Usability is the second attribute that is desired by the user once the need for functionality has been satisfied. “Having appropriate functionality is a prerequisite of usability, but it does not guarantee usability,” illustrates Jordan.

The concept of pleasure (Level 3) only comes into play on Jordan’s hierarchy once Level 1 and Level 2 have been satisfied. By satisfying the third level, products become relatable, emotional objects, similar to ideopleasure described by Lionel Tiger. Jordan describes such products as “living objects” and identifies them as the new challenge for the field of human factors.

### 3.3 Application to Medical Design

In the field of Industrial Design, designing products that meet and exceed user needs are expected. As in most fields, the intrinsic value of a product varies on multiple levels, but the ultimate goal is to create appeal. By examining classical and modern theories of psychology, designers gain a broader perspective regarding what it really takes to get inside the user’s head. Only then can the victories and shortcomings of a design be identified, sending designers back to the drawing board to create version 2.0.

#### 3.3.1 Classical Theories

Earlier in the chapter we took a look at Bruce Bracken’s Multi Dimensional Self, and Abram Maslow’s Hierarchy of Needs. These long lauded classical theories embody some of the most basic yet overlooked information in the field of medical design. For example, take Maslow’s Hierarchy. Even if used in its most basic form, disregarding the fact it could vary slightly from person to person, this simple framework of needs seem to have been excluded almost entirely from most medical design. Examine a basic medical device, such as an axillary crutch. This device has been around almost as long as mankind, yet it has changed very little. Sure, the materials have become industrial, but for the most part the form has remained the same. When we compare it to Maslow’s Hierarchy it seems at first glance as if it meets most biological and physiological needs. It is after all, aiding in healing by removing pressure from the offending injury. It also seems as though it meets safety needs with its rubber feet and its adjustable frame. The real test is when we reach the next step, satisfying belongingness and love. Here is where the design falls apart.

#### 3.3.2 Modern Theories

By looking at the modern theories of Lionel Tiger’s 4 Pleasure Framework and Patrick Jordan’s Hierarchy of User Needs it is easier to understand the fatal flaws commonly found in modern medical design. In our current culture of consumerism, products have become the holy grail of wealth, status and even identity. The reason they have gained this foothold is for the simple fact that buying, using and displaying products represents pleasure. In the field of product design and development this pleasure principal is widely acknowledged, having become the driving force for creating the wide variety of consumer choices in everything from electronics to tennis shoes. As consumers, we are constantly bombarded with advertising, enticing us to ‘upgrade’ the cell phone we purchased mere months ago for the sleeker and faster model that just hit the market.

Over time, products improve to fill demand, to appease user needs, and to fulfill more of the pleasures that Tiger’s framework outlines. Brands work with manufacturers to create a sneaker that creates psychopleasure by making you think you can run faster, physiopleasure through the way it cradles your foot, ideopleasure by using recycled rubber to
appease your sustainable sensibilities and sociopleasure, because you are wearing the same shoes Michael Jordan wears. These pleasures are what excite us about products, encouraging us to part with our hard earned money. Most consumer sectors follow this model. The medical field, for the most part, continues to sit out of this race, leaving medical products and the end user alarmingly bare of any pleasure experience. “Medical science has paid appropriately intensive attention to pain. It has perfected a host of astonishingly impressive methods for preventing, alleviating or recovering from it. But pain’s opposite, pleasure, has not had such a well funded and fully-justified constituency,” expressed Tiger in his book, The Pursuit of Pleasure. Unfortunately, Tiger’s statement is astonishingly accurate.

The designer Kenneth Grange said that a guiding design principle for him is that a product should be ‘a pleasure to use’. Sounds like a pretty straightforward principal, until the question is asked, what constitutes pleasure in a field like medical equipment? In order to get a better understanding of how to provide pleasure, we must first investigate the complex relationship that people have with illness and healing.

CHAPTER 4
THE PSYCHOLOGY OF HEALING

Chapter 3 examined the classical and modern theories of behavioral psychology and theory behind human motivation.

Understanding these concepts assists in pinpointing user needs, allowing designers to create products that holistically satisfy the user on physical and psychological levels. In this chapter, the psychology of healing will be explored, revealing another dimension of consideration for medical design. By exploring areas such as comfort theory, the placebo effect, and faith healing it is easier to understand how large a role the human mind can play in helping or hindering the healing progress.

4.1 Katherine Kolcaba’s Comfort Theory
Since the days of Florence Nightingale nurses have considered comfort one of the major responsibilities to patients in their profession. Today the term “comfort” is used to signify acceptable standards of care. Katherine Kolcaba’s paper, An analysis of the concept of comfort set the standards for defining exactly what comfort means in the field of nursing. “The term can signify both physical and mental phenomena and it can be used as a verb and a noun,” and can also be defined in three states of being: relief, ease, and transcendence.

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**Figure 3.6**
Attention paid to pain vs. comfort as described by Tiger.

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**Figure 4.1**
Katherine Kolcaba’s taxonomic structure for the concept comfort.

These classes of comfort all mean slightly different things regarding therapeutic context. The first state of comfort, relief, typically occurs when discomfort is reduced or eliminated. Both comfort and discomfort can exist physically, psychospiritually, environmentally, and socioculturally as shown in figure 4.1. Relief can occur in any or all of these

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33 Kenneth Grange, MCSD, RDI, (born 1929, London) is a British Industrial Designer
categories, signaling that pain or discomfort has subsided. Ease, representing the absence of discomfort, and transcendence, a pleasurable or pleasant experience can also occur in the same areas as relief. This theory is relevant to the field of medical design not only because it is a medical theory, but because it embraces the importance of differing levels of comfort on multiple physical and psychological fields. The rubric this multidimensional theory constructs not only embraces many of the theories previously discussed, but inadvertently becomes an evaluation tool for designing medical products to meet needs across a broad spectrum. Kolcaba recognized the importance of comfort as a healing tool (like many before her) due to the strong impact it has emotionally. By examining figure 4.1 it is clear that the more boxes that are checked while evaluating a design, the more likely it is to be effective.

4.2 The Placebo Effect

In an effort to further examine the effect the mind has on healing it becomes necessary to investigate one of the most controversial and puzzling riddles in the field of medicine: the placebo effect. A placebo is a faux medical intervention, intended to lead the patient to believe he or she has received treatment when in reality, no treatment has been provided. Most commonly recognized as a “sugar pill” or inactive medication, a placebo can also come in the form of a treatment or surgery. Belief, motivation, and expectation are essential to the placebo effect. Together, they are referred to as the subject-expectancy effect. Classical conditioning and suggestion by an authoritative healer act as the triggering mechanisms.

Henry K. Beecher’s research in clinical trials opened the door to the discussion of what role the placebo plays in modern medicine. His article, The Powerful Placebo called into question the validity of its use, and the power the mind can wield when so directed. “Placebos have doubtless been used for centuries by wise physicians as well as by quacks, but it is only recently that recognition of an enquiring kind has been given the clinical circumstance where the use of this tool is essential.” Beecher asserted not only that placebos had significant, measurable medical effects, but that they were a viable form of treatment. His argument was that the placebo effect was often an unexpected part of a “real” treatment, why should it not ethically be a treatment itself?

4.2.1 Stimulus Substitution

Among medical professionals who acknowledge the placebo effect, there have been arguments over what role it plays within the human body. Some believe that the effects are purely psychological, but many assert that the effects are much more widespread throughout the body. The placebo effect creates a stimulus substitution for a drug, triggering the same effect. A person’s beliefs and hopes about a treatment, combined with their suggestibility, may have a significant biochemical reaction. Irving Kirsch, a psychologist at the University of Connecticut teamed up with Guy Sapirstein to analyze 19 clinical trials on the effectiveness of Prozac. They concluded that the expectation of improvement, not adjustments of brain chemistry, accounted for 75% of the drug’s effectiveness. This is one among countless studies demonstrating that sensory experience and thoughts can affect neurochemistry. Martina Amanzio, Ph.D. demonstrated that “at least part of the physiological basis for the placebo effect is opioid in nature.” We can be conditioned to release such chemical substances as endorphins, catecholamines, cortisol, and adrenaline. The body’s neurochemical system affects and is affected by other biochemical systems, including the hormonal and immune systems. Thus, it is consistent with current knowledge that a person’s hopeful attitude and beliefs may be very important to their physical well-being and recovery from injury or illness.

In addition to primary care and pharmaceuticals, products associated with treatment can be designed to promote and inspire a hopeful attitude. When designing medical equipment it is important to understand that the placebo effect carries through to every part of the medical treatment. A simple arm brace meant to aid in healing carpal tunnel syndrome can inspire belief in the treatment, aiding healing, or discourage the patient, leading to increased healing time or even non-compliance.

4.2.2 Expectancy Theory

One of the caveats to the placebo effect in both active and inert treatments is the belief by both the patient and the physician that the treatment will be effective.

“The physician’s belief in the treatment and the patient’s faith in the physician exert a mutually

Expectancy theory seems to be the anchor to which the placebo effect is tethered. Without the expectation a medication or treatment is going to work, the placebo effect is sure to fail. Surprisingly, if the administering physician lacks belief, the effect can fail as well. There is debate over why this happens, but the most common explanation is that the physician can pass on the doubt at a subconscious level, leading the patient to disbelieve the validity of the treatment.

Another school of thought that explains the close connection of the physician and placebo effectiveness is the “Process of Treatment” belief. Process of treatment emphasizes that the effectiveness of the placebo is caused by the individuals administering it. This includes actions such as showing the patient encouraging and positive attention, care, and affection. Dr. Walter A. Brown, a Psychiatrist at Brown University asserts that the placebo is a direct result of a therapeutic setting, inspiring a purely physical change in the patient. It is thusly the physical change which promotes healing. Dr Brown explains:

"...there is certainly data that suggest that just being in the healing situation accomplishes something. Depressed patients who are merely put on a waiting list for treatment do not do as well as those given placebos. And—this is very telling, I think—when placebos are given for pain management, the course of pain relief follows what you would get with an active drug. The peak relief comes about an hour after it’s administered, as it does with the real drug, and so on. If placebo analgesia was the equivalent of giving nothing, you’d expect a more random pattern" 44

Although not discussed in her work, Katherine Kolcaba’s comfort theory 45 echoes many of the same health benefits expressed by Dr. Brown. They both place emphasis on the importance of meeting psychological needs in patients through personal interaction and physical accommodation, making a strong case for including it as a major part of treatment.


4.3 Faith Healing

A controversial and inconsistently defined practice, faith healing is typically considered a faith based belief that can result in healing an ailment or illness. Most often, the faith is mono or poly theistic and involves prayer or other rituals to facilitate healing. In some instances, it involves a relationship between the patient and a healer, much like a patient and a physician. 46 Faith healing is widely criticized by the modern medical community, with the effects of faith healing often being attributed to the placebo effect. For the purpose of this thesis, this chapter will focus on the psychological effects of faith healing, rather than the cultural aspects.

4.3.1 Coping Systems

Aptly named, the foundation of faith healing is faith, faith in both the process of healing, and the power of the healer. This sounds eerily similar to the grounds on which the placebo effect operates. Typically speaking, individuals who opt for faith healing over modern medicine make this choice for one of two reasons. The first is sociological. It is because faith healing represents their ideals, is widely accepted or encouraged in their community, or is their only option if they choose to remain in their community. Because this decision is initiated by a social system, they probably also have a deep seated belief the faith healing will work, and they will be healed. The second reason faith healing is chosen has a lot more to do with fear than faith. The fear could be based on fear of facing the disease, fear of mortality, or fear of treatment. These patients often rationalize that what they don’t know can’t hurt them. Instead of seeking treatment they pray for deliverance, ignoring the little they have discovered about their malady.

While both of these systems of coping won’t cure cancer or mend a punctured lung, they can often create a placebo effect borne by the mindset of the patient. In an effort to cope with the situation, the individual convinces themselves that they will be okay. 47 This in turn positively affects the physical and psychological state of the body, giving it a better chance to heal on its own. The effect is only amplified when a healer is involved. The healer’s calm and confident demeanor provides the therapeutic environment which in turn calms the patient, and the experience reinforces the patient’s faith in the healing method.

CHAPTER 5
SOCIOLOGICAL IMPACTS

If understanding the psychology of the individual can improve emotional understanding, studying the sociology of cultural groups can help bring design understanding to the next level, improving connectivity between individual and experience. Medical experiences are very personal and sometimes very painful both mentally and physically. By examining how age and cultural background affects the perception of pain, illness and healing, we can understand why certain design choices can improve medical compliance in specific segments of the population.

5.1 Generational Considerations in the United States

Much like faith can impact the medical decisions an individual makes, so can generational values. When presented with a medical choice a Mature may choose a more tried and true, less effective remedy, while a Boomer will not accept anything but the newest to market, regardless of risk. Generational values are important to medical designers much like target markets are to marketers. If values are not taken into consideration, the product will not be an effective tool. This investigation of generational values will help clarify where each generation stands in values and in healthcare to better understand their specific needs.

5.1.1 Matures

Otherwise known as the Veterans or The Silent Generation, the Matures were born between 1922–1945. This generation experienced the Great Depression and/or World War II. They struggled hard financially, grappling with the changing social scene as they came into adulthood. They are characterized as being serious and conventional, expecting disappointment but working hard regardless. Women of this generation began to desire both a career and a family as more women began to attend higher education and were attracted to the perks of a duel income.

The Matures have taken better care of themselves than their children and grandchildren, shown through obesity rates. When the members of the silent generation were aged 35–44 years, 14%–18% were obese. At comparable ages, 28%–32% of the youngest baby boomers were obese. Despite this fact Matures have not had the same advantages as their children when it comes to medical care and technology. They suffered from many more childhood diseases and illnesses now considered preventable or eradicated. Less concerned with appearance than their offspring, Matures tend to comply with most medical directives such as device use. However, they are less likely to ask questions about their care and get fewer second opinions.

5.1.2 Baby Boomers

The Baby Boomers, born between 1946 and 1964, are the only generation who has been named after their parent’s fertility. Unlike their parents, they are a generation associated with privilege, having come of age during a time of prosperity and affluence. Their generation rejected traditional values, acting vocally upon their convictions. The most notable being the anti-Vietnam war protests. They believed that they were a special generation, and are recorded by historians as the first generation who expected the world to improve with time. They were also the first group who began to define generations, marking them by identifying groups with similar values and experiences.

The Boomers were healthier than previous generations, having the benefit of medical advances such as vaccines which reduced childhood diseases. Over their lifetime they have benefitted from technological developments in treating heart disease, cancer, and preventative care. While the younger segment of Boomers is still enjoying good health, the older ones are starting to face many medical complications that come with age. In 2002, 38% of younger Boomers (aged 35 to 44) and 31% of older Boomers (aged 45 to 54) used some form of tobacco. Most Boomers are overweight and a significant percentage is obese. Most do not get the recommended level of exercise. This generation has also been accused of being in denial over mortality. Many have failed to prepare for their elder care, leaving the burden on their children. Concurrently they seek out ways to ‘stay younger’ longer, such as plasticsurgery and pharmaceuticals like Botox and Viagra. This quest for youth is also reflected in the products they purchase, and as this generation continues to age, it will be reflected in the medical products they use.

5.1.3 Generation X

Generation X was originally referred to as the “Baby Busters” due to the drop in birth rate compared to the previous generation. Born between 1965 and 1980, this generation is considered a ‘reactive’ generation, typically classified by a

52 Baby Boomers and Health – US. Mintel International Group Ltd. May 1, 2004. (GN1077980)
focus on accomplishment. They are pragmatic and perceptive in nature, and are considered savvy but amoral. Reactive generations are often perceived negatively by older generations such as the Boomers and the Matures. This small generation of 46 million is nearly half the size of its elder and younger, 80 and 78 million member counterparts. Despite the fact this generation has spawned amazing technological innovation, creating websites like Google, Facebook and Amazon. Still, Gen-Xers struggle to feel appreciated.

Much like the Baby Boomers, Gen-X benefitted from increased medical breakthroughs, but were forced to fight new battles against disease. "Instead of getting free love, we got AIDS," says Douglas Rushkoff, author of 1993's GenX Reader. Xers also continue to suffer from societal health problems like obesity which result in more health problems as they age. In addition, this generation is three and a half times more likely than the Matures to postpone healthcare due to cost. They also have very low expectations for future care, and expect to have difficulty paying for insurance. If this perception perpetuates it is a good possibility that medical compliance will diminish substantially, and preventative treatments will be ignored.

5.1.4 Gen Y

Generation Y, aka Millennials were born between 1981 and 2000. They are also sometimes called the 'trophy generation' and are used to the 'no one loses' mentality leading to a perceived sense of entitlement. This generation has grown up with cell phones, PCs, social networking, and instant communication. They are early adopters, multi-taskers, and more culturally tolerant than previous generations. They seek instant gratification, are peer-oriented, and crave responsibility.

While it is hard to predict the medical future of this young generation, obesity is prevalent in this group, echoing the previous generation. This too predicts future health problems, unless trends shift in future years. Millennials are also beginning to encounter problems paying for healthcare as they graduate from college and are no longer covered by their parent's plans.

5.2 Racial and Ethnic Differences

In addition to the diversities of generations, understanding racial and ethnic differences are important to defining user needs. The United States has a total resident population of 306 million citizens. More than 80 million are of non-European decent. This large population provides a challenge for our healthcare system through sociocultural barriers that include individual health beliefs, behaviors, values and preferences that are unique to culture and background. In order to obtain cultural competence we must first identify the racial and ethnic differences, and consider how these factors interact at different levels within the healthcare system.

5.2.1 Breakdowns in Cultural Competence

In an article authored by Joseph Betacourt, MD, Alexander Green, MD, J.Emilio Carrillo, MD, MPH and Owusu Ananeh-Firempong, Defining Cultural Competence: A Practical Framework for Addressing Racial/Ethnic Disparities in Health and Healthcare, a objective account of the barriers to achieving cultural competence within U.S. Healthcare systems are examined. They identified sociocultural barriers at the organizational (leadership/workforce), structural (process of care), and clinical (patient encounter) levels. These breakdowns were the main causes of problems such as reduced use of preventative care, high rates of emergency use, avoidable hospitalizations and later-stages diagnosis of cancer within the U.S. minority population.
In 2002 the U.S. Institute of Medicine published a disturbing account of the true depth of how unequal treatment is when comparing differing racial and ethnic groups. They reviewed over 175 studies that identified treatment disparities in congestive heart failure, surgical treatment of lung cancer patients, medication prescribed for pain control, treatment of pneumonia and a multitude of other treatments. This article, and hundreds of others caught the attention of the medical community becoming the precursor to the burgeoning field of “cultural competence”.

5.2.2 Addressing Racial and Ethnic Disparities
Of the three major areas of breakdown in treatment mentioned by Betacourt, Green, Carrillo, and Ananeh-Frempong, all can be impacted by good design. For the purpose of this chapter, the first breakdown, organizational (leadership/workforce) will be left out of the discussion. The remaining breakdowns, structural (process of care), and clinical (patient encounter) provide important insight to designers who are trying create a positive emotional connection between an individual and an experience.

Structural breakdowns appear in a variety of forms that cause minorities to receive lower quality treatment than their Caucasian counterparts. The most insidious is the inability to communicate. In the Hispanic community language barriers present the biggest threat. Hispanic patients of medical centers that do not provide translators or employ bilingual staff and other services in Spanish are less likely to understand their diagnosis, take medication properly, and return for check-ups. They are also less satisfied with their patient-provider relationship. Language barriers are also a predominant problem for the Asian minority. This particular breakdown also impedes receiving care, billing, and scheduling appointments.

Clinical breakdowns also include language barriers but they often include other, more problematic, issues. There is currently a shortage of minority physicians who are more culturally sensitized to the needs of their patients. Conscious or subconscious biases, prejudices and negative racial stereotypes still affect the way providers deliver care. “If someone, the doctor for example, is of the same ethnicity, Hispanic, he understands the idiosyncrasies more. For example, in our country, there are certain taboos. It is more difficult to talk about private things. So a doctor of the same race will understand those things more,” commented a Hispanic patient in a 2006 publication by the Institute of Medicine. The same publication also stated that former U.S. Surgeon General David Satcher, MD, estimated in 2006 that “nearly 84,000 deaths could be prevented each year if the United States eliminated gaps in mortality between black and white Americans,” quantifying the true difference that exists in quality of care.

5.2.3 Repairing Distrust
Cultural barriers often include distrust by the minority population. Distrust is spawned by many different reasons: fear of another culture, lack of communication, or a track record of reasons teaching distrust. In the African American culture distrust is prevalent for several reasons. First, the record of care shows that the treatment has not been equivalent to what the majority is receiving. Second, there are incidents in past American history which rightfully make the African American community suspicious. Between 1932 and 1972 the Tuskegee Study of Untreated Syphilis in the Negro Male recruited nearly four hundred poverty stricken African American sharecroppers offering to provide life-saving treatment. Unknown to the subjects they received treatment that was experimental and did not benefit them medically. Treatment for the first eight years of the study was so toxic the researchers suspected it was deadly to the subjects. In 1940 Penicillin was introduced to the medical market, a known cure for the disease. Subjects still continued to receive experimental treatments, and their names were provided to local hospitals that were told not to provide medical care under any circumstances. This study, along with sterilization abuse of African American women by the white medical establishment in the 1950s and 1960s produced a deep-seated fear that continues to affect the way the African American Community views medical care today.

The fear and distrust that perpetuates in this community can only be healed over time, and with trustworthy care. America has a long and sorted history with most of its minority groups, African Americans being particularly affected. Through cultural competence the damaged trust can be


Figure 5.1 Subjects of the Tuskegee study receiving a trial treatment. (minority-health.pitt.edu/archive/00000340/ accessed June 5, 2009)

Angela Davis, Women, Race and Class (1981)
mended. Designers, as well as doctors, must be aware and literate of these cultural hurdles, informing their designs with not only medical information but important cultural information too.

CHAPTER 6
THE NEW FACE OF HEALTHCARE

In Chapter 2, we examined the current context of healthcare in the United States. By breaking down current context into four major categories we examined the topics of Unhealthy Lifestyle, Aging Population, Increase of Disease and Shift of Responsibility. It revealed a stressed population, working against a broken healthcare system. Patients must learn to navigate insurance organizations, confusing information systems and unfriendly products and environments. All of these obstacles add up to larger, long-term problems for both the individual, and for the community in which they seek service.

We also took a closer look at how the disconnects between an individual and their healthcare could be mended. The problem of missing emotional connectivity between the patient and a medical care experience impacts the general industry perception. Negative emotional experiences lower the patient’s quality of care. It makes them less likely to follow instructions and increases the amount of recovery time needed. This impact can also act in reverse. Positive emotional connections can provide the opposite and beneficial reaction of increased compliance, shortened healing time, and greater overall patient satisfaction.

Observing the emotional and psychological connection is important not only with patient/doctor interaction, but also in treatment environments and in medical products. By creating medical environments and products that have positive emotional associations for patients, results such as higher satisfaction, a better outlook, and better medical outcomes are observed. This not only makes sense for patients, but also adds up to dollars and cents from a business standpoint. Doctors have better results, word of mouth builds business, and the organization can provide for a greater percentage of the community. Insurance companies pay less when treatment is more effective in fewer visits and with less medication. They pass lower premiums down to businesses and individuals. This shift in paradigm comes full circle to provide better care at a lower cost, just by observing the emotional connection.

The intention of this chapter is to build on Chapter Two by exploring the landscape of medical care in the United States today. By looking at special medical populations and what they need to elevate their standard of living, we can better understanding what design can do to help. In this shifting time of economic downturn, globalization of jobs and political change, what can design contribute to improving the medical welfare of the society in which it resides? As product developers like Apple and Target bring design to the forefront of awareness in the consumer goods industry, will consumers come to expect design in the medical field as well? Through studying these issues and areas of expectation more closely, new opportunities for design can be discovered.

6.1 Caring For the Aging Population

As the lifestyle of an aging population shifts away from the nursing home in favor of active lifestyle communities, so does the way in which adult children deal with caring for the aging population of their parents. Their parents, who are in generation most popularly called the Matures, are being taken care of by their children, the Baby Boomers. The Boomers grew up seeing their grandparents live out their final years in nursing facilities. Resulting from this experience, many Boomers hold negative opinions of that care option, as do a large percentage of the mature population who at the same time, were visiting their parents at these facilities. “I would rather die than go into a nursing home,” commented more than a few of the Matures who participated in a focus group discussing healthcare perceptions. “Why would I put my mom in a home when I would never want to be in one myself?” commented participating Boomer Joyce Fraser, who is currently a caretaker for her 83-year-old mother. Most of the Boomers echo the same sentiments that they felt nursing homes were where people went to die, not to enjoy and celebrate their life. This mentality is hardly surprising, after looking at what they as a generation had experienced. Vietnam, the women’s movement, racial struggles and the rise of the middle class all taught them the value of freedom. As a generation they would be hard pressed to relinquish this core value, no matter what their age.

6.1.1 Mr. and Mrs. Cowan

To better understand the plight of Americans and their relationship with aging, Sam and Ruth Cowan of Covington GA volunteered to participate in two-year study. During this time (January 2006 to December 2007) their health and healthcare was chronicled. When the study began they were both 85 years old and living in their home with few home healthcare products, and with relatively little help. Married over sixty years, the couple never had children, and had very few relatives living nearby. Sam was still driving, but Ruth had given it up several years ago. They were fairly well off, having owned and operated a successful funeral business their entire adult working lives. They sold it in their late 60’s when they decided to retire and build a home in a nearby housing

69 Contextual research performed by Mariah Hay in Savannah, GA, January 16, 2008.
development. They paid for private health insurance in addition to Medicare the government provided, and spent several thousand dollars a month just to cover the costs of medication and doctor’s visits. In the initial interview, both expressed distaste at the prospect of a nursing home. “That’s where people go to die,” said Sam, “I would rather die right here.” Ruth expressed the same sentiments, but worried that their lack of family and failing health would leave them few alternatives.

Over the first year of the study their health seemed to rapidly deteriorate, starting with an infection in Sam’s toe that would not heal, resulting in several surgeries. This ailment made it difficult for him to walk or stand, immobilizing him for weeks at a time and causing depression. Ruth, who at 4ft 10in tall had long suffered from crippling back pain, took on the role of caretaker despite the fact Sam was nearly two feet taller than she, and almost impossible for her to physically support or lift. The infection in Sam’s toe caused him several subsequent falls, causing him to hit his head multiple times and resulting in several concussions and a laceration requiring stitches. Every time they had to make the trip to the ER after a fall, the doctor chided them for performing activities such as driving and walking without the aid of a walker.

Around Christmas 2006 Ruth fell ill and was hospitalized. The Doctors warned Sam that she might not survive. After several weeks in the hospital she recovered enough to leave, only to once again take on the role as caretaker to Sam. He was still not using a walker and fell again hitting his head. He was admitted to the hospital and became very ill, disoriented and angry, accusing Ruth of strange things like plotting to put him in a nursing home and having an affair. Sad and confused, Ruth was told by the doctor that Sam was suffering from Alzheimer’s, his worsening symptoms triggered by the recent series of falls and blows to the head. The doctors once again explained that Sam needed to use his walker, and advised purchasing a lift chair to help avoid falls when standing up. He was also told not to drive.

Over the next few months their nephew convinced Ruth to hire a night time in-home caregiver. Sam, who was becoming increasingly agitated and prone to outbursts from the Alzheimer’s would call the company weekly and tell them to stop sending the caretaker. Ruth would have to call them back and explain that they were not cancelling service. Ruth started driving again, for the first time in years, and also started neglecting her personal care to take care of Sam during the day when there was no caregiver. “I’m afraid to go get my hair done,” said Ruth, “because he could fall and no one would be there to help.” Ruth often expresses her exhaustion, pain, and wish for assistance. Sam, who has always controlled the finances, was neglecting bills, and refused to hire much needed help during the day. Because

Sam and Ruth had no children, no one was taking control to help them, and they didn’t want any other relatives to interfere. Sam purchased the $800.00 lift chair, but it sat in a corner of the room unused. It was poorly made and incredibly uncomfortable, despite the large price tag. It was the only option he had to buy through Medicare. Ruth hated it because it is unsightly, and she had worked so hard to decorate their home.

Sam and Ruth are an unfortunate example of aging matures who, like many aging Americans, are afraid of losing their freedom, looking infirm, and being pitied. They are reluctant to use any of the home healthcare equipment because they think people will perceive them as old and infirm. They also avoid getting the daily help they need because they feel like they will be giving up their freedom. Now that Sam is sick, and Ruth has become the primary caretaker she feels alone, and is fearful of what will happen tomorrow. Because Sam and Ruth feel so negatively about their options for home healthcare and home healthcare products, they neglect making decisions and using the available products that would potentially help them.

6.1.2 Retaining Freedom

US News and World Report made Taking Care of Mom and Dad, A Boomer’s Guide their cover story in their November 27, 2006 edition. They highlighted a boomer named Jeanne Erdmann who took on the responsibility of caring for her elderly mother after her father passed away. “Erdmann is one of 19 million Americans caring for someone over the age of 75, typically a parent or a grandparent who may or may not live with them... Historically, older adults have lived on their own, with their children or in nursing homes. Today's seniors, however, face a rapidly expanding array of housing choices.71 As choices expand for the Matures and the new generation of older Americans struggle to retain freedom and dignity, the number of “informal caregivers” continues to grow. Informal caregivers are people who are giving care and assistance on a daily basis such as the above-mentioned adult children or other relatives. These caregivers often provide care around the clock. “The day in and day out wears you down.” Erdmann says. She had been taking care of her mother for the past six years and noted the steady increase in care requirements.

The most common reason for this type of living situation is to find the desired balance between having the assistance required, while maintaining as much freedom as possible. While this balance can also be found in assisted living, it requires a major uprooting and change. “People want to be where their family and friends are,” says Elinor Ginzler for

AARP. She explains that senior’s personal lives; relationships and activities are just as important, if not directly linked to their sense of freedom.

6.1.3 An Alzheimer’s Epidemic
Another shift in the way aging is treated is in understanding illness that can affect caregiving. Alzheimer’s disease, which affects the brain, most commonly diminishes mental capacity, memory, and changes personality. Once these patients were locked away in psychiatric hospitals, they are now treated with pharmaceutical solutions to delay the spread of the disease, and often remain with their immediate family. Newsweek featured a section titled Caregiving and Alzheimer’s as their cover story June 18, 2007. “A man is sitting next to her. She knows his name is Frank but that is all she knows... she doesn’t remember that they have been married nearly 63 years and have raised two daughters.” This is the sad and tragic truth for Alzheimer’s patients. Due to increases in standards of living and improvement of medicine the average length of life has continued to grow, helping many Americans live well into their eighties and nineties. One of the down sides of this evolution is that Alzheimer’s tends to hit this age group the hardest. “Alzheimer’s currently afflicts more than 5 million Americans and 70% of them live at home, where they are cared for by many millions of sons, daughters and spouses... By 2050, the number of Americans with Alzheimer’s and other dementias could soar to 16 million,” reports Newsweek. These staggering numbers have the potential to devour the entire budget of Medicare several times over. “It’s a coming crisis in healthcare,” says Harry Johns, president and CEO of the Alzheimer’s Association, whose own mother had Alzheimer’s and died in April. The human cost is crushing, says Johns: “It’s emotionally, physically and financially draining.” Although Alzheimer’s is not the only disease that renders an individual incapable of caring for themselves in their senior years, it can be the one that offers the fewest choices in terms of care options because of the level of care they require.

There are very few products that address this disease directly. The same goes for the market of home health care products, which many of these patients require to accommodate living at home. Most products are unsightly and often difficult to use, resulting in making the users feel infirm, a constant reminder they have lost their independence and their health. These feelings are the same emotional connection that is missing in healthcare products and environments (as discussed in Chapter 2). The difference is that in home healthcare products the patient can never shake the negative emotional connection. Unlike a doctor’s office or hospital, it is in their home, living with them 24 hours a day. The psychological effects of these home healthcare aids is often to the detriment of the patients who will avoid using them, or feel depressed from the constant reminder that they need them.

6.2 The Design of War
The war in Iraq has been taking a toll on America’s health for the past six years. Since 2003, soldiers have come home suffering from injuries like Post Traumatic Stress Disorder (PTSD), Traumatic Brain Injury (TBI) and loss of limbs. As doctors and technology struggle to treat this growing population, there is one designer who has helped make some of these soldier’s lives a little more normal. Dr. Hugh Herr, a double amputee who lost his legs at 17 years of age in a mountain climbing accident, was recently one of six Americans to receive the prestigious Heinz Award for Technology, the Economy and Employment from the Heinz Family Foundation for his work with prosthetics and orthotics. “Herr is helping improve mobility and enhance the quality of life for many physically challenged people around the world.”

Herr is currently a professor at the Massachusetts Institute of Technology’s (MIT) Media Lab, having graduated himself with a Master’s in Mechanical Engineering at MIT and a PhD in Biophysics from Harvard University. He is the holder of numerous patents including the Computer Controlled Artificial Knee, The Active Ankle-Foot Orthosis, and the world’s first Powered Ankle-Foot Prosthesis, that combines the principals of muscle mechanics, neutral control and human bio-mechanics. “It mimics the elegance of nature,” explains Herr, “where muscle-like robot assistance releases...

73 Caregiving and Alzheimers, Newsweek, June 18, 2007, pages 54-62.
74 Campus Life, Millersville University, Fall 2007
three times the power of conventional prostheses to propel the body upward and forward into walking.” Herr predicts that within 10 years, leg amputees will be able to run faster than people with biological limbs. Herr’s products are not just lofty creations, but are available for public consumption. In the November 12, 2007 issue of Time, Herr’s Powerfoot One was featured as one of the best inventions in the field of healthcare for the year 2007. Available for purchase summer 2008, the Powerfoot One is battery-powered and helps create a natural gait for the user through microprocessors and environmental sensors.

6.2.1 Designing for Everyday Life
Prosthetics to replace legs and feet are exponentially better than they were several years ago, but prosthetics to replace the arm and hand offer few functional options. “The hand can open and close and you can rotate the wrist, but you can’t do those simultaneously” explains Jonathan Kuniholm, who lost his right arm below the elbow serving as a marine in Iraq. “Even the simplest action, picking up a pitcher and pouring water, becomes a tedious multi-step process,” says Kuniholm, who often reverts to using his hook out of frustration.

Because fitting a prosthetic can be so tricky, both for the physician to adjust and for the amputee to adapt, the person being treated requires a high level of care. Much like older Americans who need special products and environments to maintain a high quality of living, amputees often need the same type of home healthcare support. Both the elderly and the disabled often experience the same frustration with the lack of freedom they have to care for themselves. They can no longer use the same types of products, or live in the same environments with the ease they once had. Without a new set of products that adapt to their special needs, home can feel like a prison, as the rest of the world becomes a place they can no longer navigate without assistance.

6.2.2 Losing More than a Limb
Senior Times correspondent Michael Weisskopf knows that frustration after losing his right hand when his humvee was attacked in Baghdad in 2003. “The loss of my writing hand launched an assault on my self image. If I couldn’t be a reporter, then who was I?” wrote Weisskopf in his book Blood Brothers, which graphically chronicles his physical and emotional transformation. He goes into detail about his difficulty with the pain, the surgeries, and the emotional turmoil of losing a limb. On top of it all is the final emotional bullet, trying to deal with his new prosthetic limb, and failing miserably.

December 10th marked the passing of a year since my injury. I knew I’d never regain what I had lost of my penmanship, tennis, home repair, lovemaking, freedom from pain and dexterity. Even putting on a tie remained a challenge, one fraught with danger. Rushing to a TV appearance a few weeks earlier, I tried to tie a knot in the backseat of a taxi. I gripped the short end with my prosthetic hand, which began to spin uncontrollably, almost strangling me before I managed to extricate myself.

75 Campus Life, Millersville University, Fall 2007
After many frustrating tries at finding the right realistic prosthetic, and years of struggling with operating the mechanisms, Weisskopf has resigned himself to wearing his “Captain Hook” style prosthetic, which he says has enough dexterity to pick a dime off the floor, unlike the clunky realistic counterparts that aren’t much good for any more than sitting there and looking pretty. In his book, Weisskopf also describes his rebelling against the “hook” and his need, emotional need, for something that looked like a hand, something that wouldn’t alarm people any more than they needed to be when he walked in a room. As Weisskopf describes the decision he is forced to make between appearance and mobility it begs the question, why not both? If technology has come so far that they can make a useful prosthetic that looks alarming, and a not-so useful one that is realistic, why can’t one be made that is useful, doesn’t have to look like a hand, but is friendly to both the user and the observer. It seems that this has been done already for leg amputees. There are prosthetic legs that more closely resemble robotics, with beautiful brushed steel curves and touches of steel blue and cherry red. Why not do the same for arms and hands?

In a society so in tune with aesthetics, so alert to the next electronic gadget, so attracted to newest automobile, why do we settle for mediocrity in the products that are enabling and life sustaining? Is it these products that need aesthetics and appeal the most. By stepping back and taking a look at the need that lies behind these products and the impact good design could have on older citizens, caretaking children and individuals with any sort of mobility problem, it begins to shift the perspective on where effort needs to be focused. A fusion of contextual research, human factors, and emotional consideration should be given to every walker, prosthetic, arm sling, and product that has the potential for causing embarrassment, shame and depression. By creating products that are useful, usable, and beautiful we are enabling, propelling and boosting individuals that are trying to overcome obstacles. Instead of reminding them that they are struggling, why not create something that is a joy to use. Much like Hugh Herr’s prediction that his prosthetic leg will eventually surpass the ability of a human one, designers should strive for the same in all of their products. In the field of home health care, which is behind the design curve, extra care and effort needs to be given to provide some relief for those who need it every day of the week.

CHAPTER 7
CREATING EMOTIONALLY ENGAGING DESIGN

7.1 Addressing the Current context
In Chapter Two we reviewed how the state of health and healthcare stands in the United States today. Antagonists like an unhealthy lifestyle, an aging population, increase of disease and the shift of responsibility punctuate the healthcare landscape leaving us with startling statistics like a 64.5% adult obesity rate and a baby boomer population shift which threatens to bankrupt the social security system. These trends, combined with generational expectations of care, demand changes in the medical industry in order to maintain and raise the level of care that currently exists.

The large and aging baby boomer generation represents the first wave of change as their privileged and vocal generation generates a demand for products that meet their healthcare needs, but don’t fit the mold of a typical medical product. OXO brand products are a good example. They were originally designed to meet the needs of individuals who had problems gripping conventional kitchen tools (typically suffering from arthritis), but embodied the sleek design and quality of a high-end product that appealed not only to disabled users, but to savvy household chefs everywhere. It is this type of universal design and marketing that is absent in the area of medical products, leaving a demand without a supply.

7.1.1 Understanding Healthcare Challenges
Very few companies have understood the complex and widespread demand for products that meet medical needs but do not look like a “medical product”. This seems like a relatively simple concept but is overlooked time and time again as the medical manufacturing landscape remains relatively unchanged. Part of the reason for this stagnant climate could be history repeating itself. When the lineage of even the simplest medical devices is traced back to decades past, the form and function has been remarkably unaltered. For example, look at the standard axillary crutch on the market today, compared to an axillary crutch from 60 years ago.

80 www.obesity.org/subs/fastfacts/obesity_us.shtml
The apparent absence of change in both form and function is abundantly clear despite the wealth of knowledge gained over the last century on both the physical and psychological medical fronts. With the advances in science and research why have devices such as this one not undergone a radical makeover? I assert that though this problem exists for a multitude of reasons, it can be summarized with the simple statement; that comfort and aesthetics have been left out of the equation while the medical community has focused solely on alleviating physical pain, completely ignoring the psychological component of healing.

7.1.2 Disconnects in Perception
One result of the medical community’s focus is a perceptual disconnect from the feelings of the patient. The perception of medical care is sterile, harsh, cold and impersonal. In section 2.3 the definition of the word sterile is outlined showing two definitions:

2 b: free from living organisms and especially microorganisms
2 c: lacking in stimulating emotional or intellectual quality

The medical community perceives the first as the definition that applies to them, but the patients perceive the latter, thusly establishing a clear difference in perception. This difference seems small, but as we shall see, is just the beginning of the perceptual chasm which affects all areas of medical care. The emotional impact on the way a patient relates to medical visits, medical facilities and medical equipment is one of hesitation and resistance. “I always make sure I am really sick or really hurt before I go to the doctor’s office because I really hate going,” explains Joyce Fraser when I interviewed her about her medical experiences.

was not the only interviewee who expressed reluctance to seek medical care. Out of over 60 people I interviewed 58 said that they would avoid medical treatment if possible, and often have anxiety over visits even though 55 of them had full medical insurance coverage at the time of the interview.

7.1.3 Medical Device Design Disconnect
The sterile disconnect continues into medical devices, used both in healthcare settings and in the home. For the purpose of this thesis, the home healthcare items will be the focus, as these products are used in the home, affect everyday life, and are a constant reminder to the individual of their ailment. I assert that these products cause the most emotional angst to the individual as they disrupt everyday life in numerous ways. In Chapter Three the idea of psychological user needs are discussed in regard to psychological theories such as Maslow’s Hierarchy of User Needs and Tiger’s Four Pleasure Framework. They outline basic human needs and psychological relationships that must be satisfied for emotional health. After comparing home medical devices, crutches for example, it is obvious that they fail on so many levels. In Maslow’s hierarchy crutches seem to meet the two bottom levels (Biological + Physiological and Safety) but when the third level (Belonging + Love) is missed due to the social implications of using the devices, the application to the first step is called into question. Because it has been shown that psychological health directly affects physical health, would not the lack of belongingness and love cause biological and physiological needs to suffer?

In addition to not meeting emotional needs these devices often lack the provision of comfort to the user. To return to our example of the auxiliary crutch, I found during my series of medical interviews the design lacked comfort for every user. “I duct taped towels around the armrests. My underarms were so sore it was almost as bad as walking on my sprained ankle” remarked one interviewee. “I had blisters on my hands from the grips, and my wrists hurt really bad,” remembered Kim Davis, who decided that after three days on them she would rather walk on her fractured toe. The issue of physical comfort goes hand in hand with psychological comfort, proving the disconnect a holistically frustrating

83 www.m-w.com/dictionary/sterile (access 6.12.08)
84 Interview of Joyce Fraser by Mariah Hay in Savannah, Georgia. Conducted 4.10.07.
experience for most patients, often leading to non-compliance, such as Davis chose.

7.1.4 Universal Design & Value Engineering
Another caveat to the emotional/physical disconnect is the concept of universal design and value engineering in products, whose manufacturers have decided that it a good idea to make a slightly adjustable product that best fits 35% of the population, partially fits another 40% and rarely fits the smallest and largest 25%. Universal design is often described as designing to accommodate the most number of people. OXO Good Grips brand mentioned earlier serves as a shining example for a well crafted embodiment of this concept. The Aeron Chair by Herman Miller (figure 7.2) is also a perfect example. Bad examples are innumerable in medical design, as many products (like axillary crutches) have few adjustable sizes for the wide range of users, of both genders, they must accommodate.

Value engineering is another factor that often contributes to the one size fits most problem in medical products. The traditional definition is improving the value of a good by either adding more features for the same production cost, or manufacturing the same product for less money; thusly creating or ‘engineering’ value. It is a businesslike way of explaining, ‘make a product as cheaply as possible.’ While value engineering helps keep the cost of consumer goods low, if taken too far it can also negatively impact the design and quality of a product. In most markets of consumer goods, customers can choose how much they want to spend and what quality of item they need. In regards to home healthcare equipment, the choices are greatly diminished, sometimes leaving a user with only one or two options, both of low quality. Value engineering can be especially insidious as insurance companies are often involved in the payment of goods, choosing to pay for the most inexpensive products, sending companies to strip products of design and quality in order to be competitive.

7.2 Meeting Psychological User Needs
In Chapter Three the psychology behind user needs was examined through classic and modern theories. Psychology and human need have been inseparable in regard to deciphering what drives human behavior. The classic theories of Bruce Bracken’s Multidimensional Self Concept Scale and Abraham Maslow’s Hierarchy of Needs were explored to understand the complicated nature of user needs. Modern theories like Lionel Tiger’s four Pleasure Framework and Patrick Jordan’s User needs were also added to provide a more specialized viewpoint, reflecting changes in the field of psychology of the past few decades.

By exploring these theories it becomes apparent that connecting the user to the product in a positive emotional way is imperative to aiding the healing of a patient. It also becomes apparent that in regard to medical device design, human factors are just a starting point. It is not enough that a pair of crutches serves the goal of relieving a hurt foot from supporting weight. A user must experience comfort, enjoy the aesthetics and tactile elements and be sociologically accepted to meet emotional goals. In order to identify the users emotional needs let us examine how we can apply the classical and modern theories to the special needs of medical design.

7.2.1 Applying Classical and Modern Theories
By starting with Maslow’s Hierarchy of Needs I revised a simple reverse pyramid to show a medical design hierarchy of needs. The pyramid is reversed to place emphasis on the importance of subsequent design choices after the base need; human factors, is met.

Human factors is at the bottom signaling that this need, although the smallest, must be met before the other needs can be addressed. Human factors represent the base purpose of the device. For example: a crutch helping the user to walk without putting pressure on the leg. Next comes the integrity of the product. This represents not only the safety and structural security, it also represents comfort; one need that is often left unaddressed in many medical designs. After that I added emotional connection. This includes addressing all psychological user needs, as addressed in Chapter Three. This is followed by sociological, as addressed in Chapter Five. Once all of these needs are met the biggest challenge of medical design can be achieved: a product that satisfies all user needs and can achieve maximum healing potential. This product

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would be a design equivalent to an iPod; loved, coveted, accepted, and enjoyed. It would elevate medical products from cringe worthy to celebrated.

Modern theories can be translated much in the same way. While Jordan’s user needs fails to address psychological and social needs in the depth that is needed for this translation, Tiger’s Four Pleasure Framework will translate well, showing the four major pleasure areas.

This framework translates Tiger’s original four pleasures into four pleasures that must be achieved in a medical product. These are based on a combination of Tiger’s and Maslow’s observations and include four important areas: emotional connection, product integrity, comfort and support, and social acceptance. Unlike Maslow, they place equal emphasis on each component, showing that for a design to achieve comfort; all four areas must be addressed.

7.2.2 Points for Design Application
By researching classical and modern theories and applying them to the needs of medical design I have created a framework of points for design application of home healthcare medical devices. It combines the needs of the user on a social, psychological, emotional, physiological and aesthetic level.

Figure 7.4
Lionel Tiger’s 4 Pleasure Framework translated into a 4 Pleasure Framework for Medical Design

This framework translates Tiger’s original four pleasures into four pleasures that must be achieved in a medical product. These are based on a combination of Tiger’s and Maslow’s observations and include four important areas: emotional connection, product integrity, comfort and support, and social acceptance. Unlike Maslow, they place equal emphasis on each component, showing that for a design to achieve comfort; all four areas must be addressed.

Figure 7.5
New hierarchy of user needs in medical design

Figure 7.5 depicts my hierarchy of user needs in medical design. This hierarchy shows three levels of user needs and the correlating level of comfort they achieve for the user. The circles on the left side contain user needs the patient would most likely understand at a subconscious level. The user would not necessarily be able to articulate enjoyment of the product. They would however, most likely use the needs on the right side to describe their experience. The bottom level shows the basic comfort need of relief is met when the medical design meets the physiological and functional needs of the user. The physiological (subconscious) needs include the product’s sensory and tactile experience. The conscience counterpart would be functionality, the most basic building block of design. The second level shows the user needs that must be met to attain the comfort level of ease. The subconscious needs that would be met are ideological, such as values and aesthetics. On the conscience side the product must embody usability, the second component to creating excellence in a product. The top level of the hierarchy is the most important in medical design, as shown by the apportioned size. This level allows the user to attain the comfort level of transcendence. This is done by meeting the subconscious sociological needs and the conscience psychological needs of the patient. An excellent medical design would climb the hierarchy to meet all needs, providing not only comfort and enjoyment, but facilitating the most favorable situation to provide healing.

Much like Maslow described his hierarchy of needs, this hierarchy of user needs is a flexible model. I realize that 100% of the needs on the first level will not be met to be able to create a design which embodies partial percentages of needs on the second and third levels. While meeting 100% of needs
Engaging with Users in a Meaningful Way

While following the hierarchy of user needs in medical design is useful, it is only a framework to creating the most effective outcome in a product that supports healing. In order use the hierarchy effectively, the levels of needs must be interpreted in a manner that engages users in a meaningful way. Each need must be examined in relation to the product and the population to actively seek what this need truly embodies in the user’s relationship to it.

In the same way, a current product can be evaluated for redesign by using the hierarchy. For this example I continue with the case study of the modern axillary crutch.

I have assigned compliance values in the form of percentages in Figure 7.6 in order to identify the deficiencies in the design. On the first level of comfort, relief, the compliance is greatest, but still lacking. I gave the design a 95% in functionality because on a base functional level, its succeeds at its goal, removing weight from the foot/leg. I deducted 5% for non-compliance, as it is up to the individual to correctly lift the appendage while using the device. On the other hand, physiological only scored a 35% for not satisfying other physiological needs unrelated to the function. Aesthetics are lacking, materials are visually sterile, the design creates other physical maladies in the user such as overextension of the wrist, and damage to the nerves under the arm with extended or improper use.

The second level, comfort, shows even less compliance with the user needs. Usability receives only 55% for several deficiencies. The hand grip is difficult to re-position, the design occupies both hands at all times to use, and the design language encourages the user to place weight on the tops of the crutch when doing so will cause damage to the axillary nerves under the arms. Ideological needs are only met in the sense that the device meets hygienic expectations but fails on all other levels. The third and final level of user needs is completely absent from this design, and it fails to meet any sociological or psychological needs.

This example is unfortunately typical of design in many medical devices. Because this product fails on 4.5 out 6 user needs on the hierarchy it results in poor performance for facilitating healing. In this particular case study, the product can cause more medical problems for the user over a few short days of use, creating an even greater lack in comfort. I cannot come to any other conclusion other than this product poorly facilitates, and has a high risk of causing negative emotional and physical side effects. By examining this design closely, using the hierarchy of needs, it is easier to understand what user needs are neglected and where the opportunities are for success in a re-design.

Design Approaches

There are volumes of theories about how best to design products, what approaches to use, and what types of user needs should be addressed. In Chapter Three I chose to highlight Patrick Jordan’s User Needs in figure 3.4. His simple and intuitive chart shows three levels to meeting user needs in design: functionality, usability and pleasure. Under the premise of designing general consumer goods, I completely agree. In most instances meeting these needs will help the product meet and surpass the needs of the user. On the other hand, designing for healing products requires several more considerations.

Most consumer products are simple and straightforward. Buy

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this blender, it performs X functions, and it looks nice sitting on your kitchen counter. For the most part, comfort plays a very small role in the design (compared to crutches) and subconscious user needs like physiological, ideological, and sociological are also less important. The user might purchase the blender because it is a brand they believe in or their friends might envy, but at the end of the day, they do not have to use it to walk to the bathroom or maneuver out in public. The usability and functionality become the most important needs. Will it chop, blend, and last me the next ten years? Medical devices are used in a more frequent, intimate, and sometimes public manner. This is why Jordan’s chart alone is not enough.

The heuristics model shown in Figure 7.8 was created to be used by a designer to evaluate designs, during and after creation. The column on the right side is available to assign the percentage the product achieves. This percentage is best ascertained through user testing and contextual research. I tested this model by evaluating three categories of healthcare devices used outside of the home: arm slings, walkers, and crutches. I used a test group of 35 adults, non-medical professionals from the ages of 20 to 56 to gather data based off a ten point Likert Scale\(^2\) in order to derive the final percentages for each product (see appendix for results). I then used these percentages to create simple bar graphs which show the success of a complete product category at a glance, as modeled in Figure 7.9.

This group of evaluations served as a test to understand the effectiveness of this heuristics model on simple physical support devices used outside of a medical setting to meet the everyday needs of the user. After examining the results the model has proved effective and consistent in evaluating products in this area of medical design. It provides a strong quantitative feedback which is easy to understand and simple to use in comparative evaluation. However, that is not to say the model is without weaknesses. The greatest obstacle to try and overcome is taking qualitative data gleaned from contextual research and user observation and translating it to quantitative data, as used in the Likert Scale. This area is the most venerable to the subjectivity of the designer, and I would express caution towards non-bias when this information is being recorded and translated from one form to another.

### 7.3.2 Design Psychology

The human psyche is complicated. The U.S. Bureau of Labor

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\(^2\) [http://core.ecu.edu/psyc/wuenschkl/StatHelp/Likert.htm](http://core.ecu.edu/psyc/wuenschkl/StatHelp/Likert.htm) (accessed 8.19.09)
Statistics states that in 2006, 166,000 psychologists were working in the U.S., and project 191,000 to be in jobs by 2016. The psychologists work in clinical, counseling, organizational, and private settings, trying to decipher people’s problems, feelings, habits, and discontentment. Although there are few psychologists who make careers of analyzing design, it is important for designers to employ psychology in their designs. It is even more important when designing medical equipment.

In my hierarchy of user needs in medical design (figure 7.5), user needs include sociological, ideological, physiological, psychological, usability, and functionality. Unlike many design approaches that place most of the emphasis on usability and functionality, this hierarchy gives those needs a lower weight of importance. Because designs for healing are so personal, pervading our everyday routine, they also have the ability to affect us in emotionally painful ways. As designers, we must recognize that these products demand special attention, requiring psychological investigation, to fully understand what impact it has on a user. How will it make the user feel to wear, carry, and been seen with a product? Will it cause shame, discomfort, pity, or cause mobility problems? Will this result in depression, illness, secondary injury, or non-compliance? If the answers to any of these questions are ‘yes’ then the designer must remember that this will impede healing, perhaps negating the usefulness of the device. By using my hierarchy of user needs it helps to bring these issues into consideration, aiding the design, and in turn, the end user.

CHAPTER 8
A NEW DIRECTION FOR MEDICAL DESIGN

In Chapter Four the depth of the role the mind plays in healing was probed. Katherine Kolcaba’s Comfort Theory, the placebo effect and faith healing were all carefully examined to understand the power of believing in healing. It was revealed that the act of simply believing can strengthen the effectiveness of any treatment, whether active or inert. It is this phenomenon which leads me to question why medical products are not designed to promote such belief in the treatment. Why are medical devices treated as artifacts of illness, not tools of healing?

8.1 Changing the Definition of Disability

The Americans with Disabilities Act describes disability as “a physical or mental impairment that substantially limits one or more major life activities.” Webster’s defines disability as a condition. “1 a: the condition of being disabled.” Descriptors impairment and condition impart a negative connotation. Words like ‘suffer from’ spring to mind. They inspire sympathy, pity, and for some people, distain. Why do we have these negative associations? How can we change them into positive ones? In this chapter I will talk about how products and product association can impact this type of change through positive association and perception.

8.1.1 Disability: Defined

When the average American hears the word disability they think of two types of maladies: a physical handicap such as loss of, or loss of use in an appendage, or a mental/developmental handicap like autism, attention deficit disorder, or bipolar disorder. In interviews I conducted with more than sixty people, over 75% named a physical disability first, when asked to define what they thought of when they heard the word disability. 90% of those who name physical disability first, also named the first disability they thought of as a wheelchair. Interesting, considering a wheelchair itself is not a disability, but it has become the literal symbol for disability in the United States.

If the concept of disability has not been associated with a condition or impairment, but with a product, it means that the product itself has control over how disability is perceived. It also means that because the word disability inspires feelings of pity and sympathy, representing the product the disabled is forced to use. When it comes to defining disability, the product and the designer have the power to reshape what people think and feel when they hear the word ‘disabled’.

8.1.2 The Power of Association

Association is a powerful tool. The wrong association for a political figure can end a career; the right association in networking can yield a job. Associations, perceptions, and beliefs can influence the stock market, bolster morale, and justify war. They also can alter the way we treat others, the way we perceive abilities and even the way we heal. If placebos work because they are associated with treatment and wellness, then negative associations with medical devices can have the opposite effect, impeding healing. The real question is what would happen if the negative association was reversed, and suddenly products that aided the disabled were positively associated? Would the word disabled still apply?

In January 2008 Oscar Pistorius, a double amputee sprinter from South Africa was denied from competing in the 2008

93 http://stats.bls.gov/oco/print/ocos056.htm#outlook (accessed 7.15.09)

94 Americans with Disabilities Act of 1990 - ADA - 42 U.S. Code Chapter 126

95 http://www.merriam-webster.com/dictionary/disability (accessed 7.16.08)

96 Interviews conducted May 2007 through July 2009 by Mariah Hay.
Beijing Olympics. The decision was made by the International Association of Athletics Federations (IAAF) who found that "mechanical advantage of the blade in relation to the healthy ankle joint of an able bodied athlete is higher than 30 percent." Pistorius had been declared to have advantage over other athletes because he used carbon fiber prosthetic feet. He had been declared super human.

Pistorius is remarkable not only because he is an amazing athlete, but because of the new association his story brings to the word disabled. For the first time, someone who is considered disabled is faster and more powerful than someone without disability. Not only that, but his prosthetic medical devices are viewed as desirable, inspiring awe and perhaps some jealousy instead of pity. It is this association, the association of empowerment, the perception of 'cool' that embodies what is needed in all areas of medical device design. Wheelchairs, prosthetics, canes and walkers everywhere will no longer be avoided and dreaded, they will be healing devices that are relatable, elevated to inspiring healing and pushing the boundaries of what is possible through design.

8.1.3 Shifting the Paradigm
If the Americans with Disabilities Act describe disability as "a physical or mental impairment that substantially limits one or more major life activities," then does it still apply to Oscar Pistorius the double amputee? Do the prosthetic devices that help him run faster than the fastest legged athlete just become one more product in a world of products that make our lives better? If you look at how the paradigm shifts around the situation it is interesting to note that Pistorius's carbon fiber legs seem to fit in the category of high-performance athletic gear, not as an assisting medical device. They are cool, like an iPod. They assist performance, like the high-tech swim wear that Olympic athletes sport. They are sleek, and impressive. They inspire confidence in the user, and those around him. They do something that no other medical equipment has done before. They cease to be seen as medical equipment.

Figure 8.2
Oscar Pistorius, a double amputee sprinter pictured with his carbon fiber prosthetics.

8.2 Changing the Definition of Medical Products

Medical products are typically perceived as sterile, ugly, cumbersome and often difficult to use. Ask anyone who has had to navigate in an arm sling or on a pair of crutches and they will tell you that it was not a pleasant experience. Even worse is the social reaction when you take the equipment for a spin around your family, friends and strangers. This perception also has a long history which has deeply embedded the association of medical equipment with disability, but as Oscar Pistorius's sprinting prosthetics show, changing the definition of what a medical product is can be done.

The following axillary crutches are some design work I completed during my research into what is needed in medical design. I am going to use them as case studies to illustrate how the new hierarchy of user needs and heuristics can be useful in creating and evaluating medical designs.
The axillary crutches in figure 8.4 were designed based on the new hierarchy of user needs and heuristics introduced in Chapter Seven. The highlights of this design include improved human factors at the wrist, underarm and against the body, eliminating pain for the user. The crutches still retain the traditional form language but encourage the user to operate the crutches properly through design cues. The materials have been updated to not only provide a more satisfactory sensory experience, but to also communicate an athletic brand awareness. To put them to the test I compared the final product against the user heuristics I developed:

The design meets the first level of comfort with flying colors. Unlike the traditional crutch, the new design provides a comfort-conscience experience, including positive sensory elements, such as neoprene. The functionality is much better, still speaking the design language of a crutch, but with design cues for correct use.

The second level of comfort also provided high marks, as the design meets ideological and usability needs of the user. In the third level of comfort the standard of design follows through on meeting most needs well, although the scores do decrease in a few areas such as social, and self-actualization. Although the crutch succeeds in many important psychological areas, breaking social reactions is very difficult. A healthcare aid like a crutch still has deep-seated connections to the general population, still inspiring pity, and other negative emotions. This in turn impacts self-

Although this design did not reach its full potential, the design changes were enough to take a large leap in the right direction. It not only met the basic needs of the user, it met the complex emotional and social needs as well. It also shifts perception in the correct direction, joining the ranks of medical design that is desirable to use, instead of simply necessary.

8.2.1 Medical Product or Performance Equipment

In order to flip the perception of disability, it is important not only to re-design the product, but to also change the association of where that product comes from. Because of the nature of most medical products, medical stores also carry the same stigma the products themselves embody: sterile, boring, unexciting.

This kind of environment does not inspire the purchaser, or instill any excitement or faith that the product they will be purchasing will provide a healing or therapeutic experience. It
does promote a begrudging purchase by the patient who was instructed to procure a medical device they don’t really want. This unfortunately leads not only to a negative mental outlook that slows the healing process; it can also lead to miss-use or noncompliance because the user would rather not use a product they dislike.

If these products were designed to meet the standards of the Hierarchy of User Needs in Medical Design I presented in Chapter Seven, it would be more fitting that they be marketed as lifestyle products or high performance equipment. They should be associated with health, not illness. What industry to better associate such products with than athletics. By associating a medical product with a familiar concept of health, such as athletic equipment, it would do several positive things. First, the consumer would begin their journey to purchase the assigned health aid with the same association any user would make with other athletic gear, a purchase in the hopes of enriching their health. They would find the interesting and well-designed product in a higher-end setting, such as the setting of an athletic store. They would be assisted by a knowledgeable clerk who would show them what they need and how to use it. They would leave the store feeling excited and equipped to use their new product to help them function on a normal level. In short, they leave feeling like this product will help, not hinder.

8.2.2 Turning to Athletic Manufacturers

Like most retail stores in the United States, the athletic store is designed to sell the consumer a specific group of items; goods to assist in active activities and sports. That is one of the main reasons why the athletic store is a perfect place to sell many healthcare items that are used in everyday life: they should be designed to assist an active lifestyle. Besides the fact that these healthcare items should be associated with health, an athletic connection would promote even more confidence in the user. Attaching an athletic brand would make the consumer product connection all the stronger because of the inherent familiarity.

Athletic brands position themselves by endorsing athletes. For instance, Nike has a long history of sponsoring household names like Tiger Woods, Lance Armstrong, Mia Hamm, Michael Jordan and Pete Sampras. If you twisted your ankle and had to use crutches wouldn’t you want to use the same ones Tiger Woods does? Customers already have loyal ties to the brand, creating a whole new sector of sales opportunities. Large athletic manufacturers are also well equipped to launch a new line of products, having the marketing channels and manufacturing capabilities already in place. All they need is a great design team and they are ready to start producing. Professional sports connections are also a plus, as sports medicine settings are a great place to begin launching products.

CHAPTER 9
CONCLUSION

Caring for our health is one of the most important parts of life. As children our parents worry over vaccinations, check-ups, and dentistry. In school it is part of our general education. As adults we place value on jobs which provide health insurance that will take care of us and our families. And as we age, the need for good healthcare only grows. The purpose of this thesis was not only to examine the way healthcare impacts us today, but to contribute valuable research and insight to the design community as a whole. I wanted to emphasize the importance of the connection between the mental consequences a product can have on a patient, and the physical results which directly impact the way we heal. It is my goal to change not only the way we design, but the way we approach designing medical products to help healing, promote an active lifestyle and are a benefit, not hindrance to those who use them.

By using the hierarchy of user needs in medical products, designers can understand the complexity of a medical device compared to a normal consumer good, and design to fit the needs of the population the product will be serving. This not only benefits the user by meeting their needs and facilitating faster healing, it benefits the community as a whole by generally reducing non-compliance, repeat visits, re-injuries and an assortment of other symptoms currently suffered by the medical industry. By shifting the paradigm of how medical products are viewed through new associations with health through athletics, disability can be re-defined, and new markets are opened, all with the result of changing the association of medical equipment from one of illness to one of health.

In 1948 the World Health Organization stated:
Health is a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity.98

Over 60 years later we are still struggling to meet this holistic approach, but as Oscar Pistorius has demonstrated, it is possible. His story is proof that there is hope for change in the way we view health and disability. It is now up to us as designers, to shift the paradigm through the way we view creating medical products.

By using my hierarchy of user needs in medical design as a guideline during design and the extended heuristics model as a framework to evaluate and process contextual research of products in development and on the market, the designer is better equipped to meet the needs of the end user. By using a holistic approach that addresses both mental and physical needs of the individual, the benefits trickle down to the greater medical community as a whole, by speeding healing time, improving compliance, reducing repeat injury, and reducing visits. By addressing these issues facilities can accommodate more patients, insurance companies pay less and can reduce premiums, and government programs spend less tax dollars overall.

Through my research and testing, I found the heuristic model to be an effective tool for providing strong quantitative feedback which is easy to understand and simple to use in comparative evaluation of simple home healthcare devices. While not fool-proof against subjective evaluation when translating qualitative information to quantitative information, designers are reminded to be careful during interpreting contextual research. Despite this weakness, I am confident that my hierarchy of user needs in medical design and heuristics model provides a clear roadmap to understanding the complexity and interpreting information that can be used to create home healthcare products that help, not hinder the user, in a mental, physical and emotional way.

Direction for Further Research
Although this thesis provides a comprehensive analysis and valuable heuristics model there is still work to be done. It is my personal goal to continue the development of my medical hierarchy of user needs in medical design and the heuristics model to a third and more detailed abstraction, providing a more comprehensive quantitative analysis for the user, be it design or medical professional. I will likewise continue to evaluate the heuristics model against medical products that are used outside of the medical setting (as seen in Appendix). I will also expand this comparison to healthcare items that are used in the medical setting. My hypothesis is that my

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**CONTACT**

Mariah R. Hay is a Communications and Industrial Design professional with a passion for medical design. A Pennsylvania native, Mariah completed her B.A. in Studio Art and Arts Management and Administration at the College of Charleston in 2004. This thesis concludes her work completing her M.F.A in Industrial Design (awarded August 2009) at Savannah College of Art and Design. Over the past five years Mariah has simultaneously served as Director of Communications at Georgia Regional Hospital at Savannah (Savannah, Georgia) and Product Development Coordinator for Briggs and Riley Travelwear (Hauppauge, NY). In addition to these tenures, Mariah received an internship with St. Joseph/Candler Hospital (Savannah, GA) performing medical design research, and has been awarded a special recognition by the Department of Human Resources of the State of Georgia for her work on managing two facility re-design projects at Georgia Regional Hospital at Savannah. She has also had the pleasure of collaborating on a facility re-design for the day surgery unit at St. Joseph/Candler. She currently resides in Savannah, GA, and can be reached at mariahhay@gmail.com.
DESIGN and our Health: The Link Between Comfort, Aesthetics, and Healing

Presented by Mariah Hay October 5th, 2010
Man wearing heart monitor, Minnesota
Photograph by Michael Nichols

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EMOTIONAL RESPONSE > Understanding Social Norms
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ster·ile
   –adjective 1a. free from living germs or microorganisms; aseptic: sterile surgical instruments.

   –adjective 2c. Lacking in stimulating emotional or intellectual quality.

Merriam-Websters Dictionary
"The condition of being disabled."

- Merriam Webster Dictionary
Over 75% named a **physical disability** first

Of those, 90% named a **wheelchair**

**When did a product become a disability?**

_Contextual research conducted January 2006- June 2009_
“I rebelled against the hook. I had a need, and emotional need for something that looked like a hand, something that would not alarm people when I walked into a room.”

- Michael Weisskopf
PSYCHOLOGY AND USER NEEDS > Classic and Modern Theories

- Biological and Physiological
- Safety Needs
- Belongingness and Love
- Esteem
- Self Actualization

Psychological (Accomplishment)
Ideological (Values)
Physiological (Sensory)
Sociological (Relationships)

Maslow's Hierarchy of Needs (1943)
Maslow's Hierarchy of Needs

- Biological and Physiological
- Safety Needs
- Belongingness and Love
- Esteem
- Self Actualization

Breakdown creates breakdown. Seemingly Pass.
“Medical science has appropriately intensive attention to pain. It has perfected a host of astonishingly impressive methods for preventing, alleviating, or recovering from it. But pain’s opposite, pleasure, has not had such a well-funded and fully-justified constituency.

<table>
<thead>
<tr>
<th>Physical</th>
<th>Psychospiritual</th>
<th>Environmental</th>
<th>Sociocultural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relief</td>
<td>Ease</td>
<td>Transcendence</td>
<td></td>
</tr>
</tbody>
</table>

"The physician's belief in the treatment and the patient's faith in the physician exert a mutually reinforcing effect; the result is a powerful remedy that is almost guaranteed to produce an improvement and sometimes a cure."

-- Petr Skrabanek and James McCormick
PSYCHOLOGY AND HEALING > The Placebo Effect
Hugh Herr’s Powerfoot One mimics biological muscles, and has been named one of the best inventions in healthcare for 2007 by Time Magazine.
CREATING EMOTIONALLY ENGAGING DESIGN > Addressing Current Context
Creating Emotionally Engaging Design

Psychological Needs

- Maslow's Hierarchy of Needs
  - Biological and Physiological
  - Safety Needs
  - Belongingness and Love
  - Esteem
  - Self Actualization

- Medical Design Hierarchy of Needs
  - Human Factors
  - Product Integrity
  - Emotional Connection
  - Sociological Connection
  - Product Achieves Maximum Healing Potential
## Level of Comfort / User Needs / Heuristic Evaluation

### Physiological

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Needs</td>
<td>User feels protected and unthreatened</td>
</tr>
<tr>
<td>Sensory</td>
<td>User enjoys tactile and sensory experience</td>
</tr>
<tr>
<td>Physical</td>
<td>Product does not cause pain and provides support in activity</td>
</tr>
<tr>
<td>Competence</td>
<td>Product is able to accomplish task it was designed for</td>
</tr>
<tr>
<td>Capability</td>
<td>Product communicates purpose effectively</td>
</tr>
<tr>
<td>Control</td>
<td>User controls product easily</td>
</tr>
</tbody>
</table>

### Psychological

<table>
<thead>
<tr>
<th>Usability</th>
<th>Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Values</td>
<td>Product embodies assumed integrities of user</td>
</tr>
<tr>
<td>Ideals</td>
<td>Product meets principle goals of the user</td>
</tr>
<tr>
<td>Relatable</td>
<td>Product has familiarity for user</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Product optimizes energy required to use</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Product allows user to easily accomplish purposed task</td>
</tr>
<tr>
<td>Communication</td>
<td>Product visually communicates purpose and function</td>
</tr>
</tbody>
</table>

### Ideological

<table>
<thead>
<tr>
<th>Transcendence</th>
<th>Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>User feels accepted by others when using this product in public</td>
</tr>
<tr>
<td>Family</td>
<td>User feels accepted by family when using this product at home</td>
</tr>
<tr>
<td>Belonging</td>
<td>User feels positively about product being part of everyday life</td>
</tr>
<tr>
<td>Actualization</td>
<td>Product meets full potential of user needs</td>
</tr>
<tr>
<td>Esteem</td>
<td>Product provides user with a positive feeling of emotional well-being</td>
</tr>
<tr>
<td>Accomplishment</td>
<td>Product provides user with a better quality of life</td>
</tr>
</tbody>
</table>

### CREATING EMOTIONALLY ENGAGING DESIGN

Engaging in a Meaningful Way
Oscar Pistorius, a double amputee sprinter

Representing South Africa, denied 2008 Olympics by the International Association of Athletics Federations
“Health is a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity.”

- World Health Organization, 1948
Thank you!