Music Skill and Artifact

The pursuit of physical opportunities

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Abstract

As a musician being faced with the option to create music on a primarily digital and intangible level, I found this new digital experience to be problematic when compared to the experience of playing a physical instrument. This thesis explores this idea on a macro scale extending it to examine our everyday lives and the effects technology in the digital age have had upon us specifically in the United States. We live in a country where our jobs primarily involve sitting at a desk and working on a computer. Having once worked on farms or made a living as a craftsperson, we now find ourselves confined to cubicles or offices. Because of these shifts in both our work and home environments, we have now have fewer physical opportunities, that is, specifically the opportunities to discover, practice and use skill in a physical manner.

Seeing how the advent of digitization has threatened to remove physical opportunities from our lives, including the physical experience of playing music, this thesis explores the possibility that these experiences can be brought back by incorporating them into furniture. I define criteria from my experience as a musician and apply that criteria to furniture, creating seating that incorporates physical skill as part of the experience.

Keywords
furniture, design, seating, skill, physical opportunities, music, instrument, digital, industrialization, embodied cognition, play, work, tangible, ergonomics, technology

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This project emerged as I was thinking about my experience as a bass player. When faced with many new virtual and digital music options, I realized there is something unique about playing a physical instrument. While digital and virtual instruments strive to be easy for users of varying abilities, this ease of use leaves me unsatisfied. There is something truly special about my experience with my bass guitar. It's the many hours of practice spent learning this instrument, the muscle memory I have to incorporate, the blisters that I must endure, and the fatigue my hands have after playing for hours. All this is payment for something in return. I have made a physical, mental and emotional deposit in order to develop this skill, the ability to play this instrument. Sitting down to a computer and playing the virtual bass to achieve the same music result is really lacking value for me. So, what is it about this experience that is so fundamental to my music and to my personal satisfaction?

This project is an attempt to closely examine exactly what goes on when we engage physically with artifacts. The many hours of practice and mastery spent honing a skill endow us with a sense of accomplishment. In an age of increased demands on our visual systems and decreased demands on our physical bodies, how can this experience be reincorporated into our daily lives?

Are we missing opportunities for physical experience? One could argue that with technological advances, we are losing opportunities to discover, practice and accomplish skill in a physical manner. Over the last century in the United States we have witnessed great changes due to industrialization. Workers from the family farm moved to the factory floor. Work in the home was industrialized as appliances were introduced to remove the drudgery of domestic upkeep (Cowan 1987, 100-1). Industrialization paved the way for the dawn of the computer age. Mechanization was replaced with digitization and workers now spend the majority of their time sitting in a chair in an office typing on keyboards. As Djajadiningrat, Matthews and Stienstra note, "An overview of the historical development of commercial products in the 20th century shows how products have increasingly neglected our perceptual-motor skills, have burdened our cognitive abilities, and have lost their physical expressivity" (2007, 658).

Compounding the elimination of physical work and skill, the advent of suburbia and other products have created a culture of leisure, usually entailing time spent seated in front of the television. According to the Committee on Physical Activity, Health, Transportation, and Land Use, "Lifestyle and cultural changes, such as increases in television watching and other sedentary activities, have also played a role in reducing physical activity" (Hanson et al. 2005, 2).

Given the disappearing opportunities for physical skill, this thesis will explore how to allow for these opportunities in our daily lives by incorporating this idea into furniture.

> There may be other benefits to skill. It could, for example, be a visible reflection of health, fitness, and social connection. It could offer tactile satisfaction that reinforces other technological activities and processes… In that case, the human adjustment to technology may have itself offered a strong positive selection for skill. PETER BLEED, *Skill Matters* (2008, 156)

The Music Experience

Perhaps many of us can remember taking piano lessons as children. Many hours were spent practicing scales and playing the same song repeatedly. While the goal of piano lessons is to one day be able to play music on the piano, the experience in arriving there and the outcome itself are much more complicated than just that.

If we examine the experience of learning music we find that at its base there is something quite satisfying about our body movement yielding a sound. There is a response and feedback which comes as both tactile and auditory signals. Even if one cannot produce a song on the piano, there is still something gratifying about hitting the keys and making sounds. Perhaps one would not continue to practice and spend the required hours, days and years to learn an instrument if there were not these little gratifying auditory indicators of effort encouraging us along the way as we develop our skill.

Aside from the personal gratification of playing music, there is also something quite impressive about having the ability to sit down at a piano and begin playing some catchy ragtime tune in front of friends. To really reap all the benefits of a learned skill one needs an audience. The affirmation of others when we either fail or succeed at some task is very important to us.

The Meaning of Skill

To understand what we are experiencing when we play music, we must speak of skill. We use physical skill to place our fingers on the correct piano keys and to rhythmically deliver the proper notes. Skill has many different meanings. For the purposes of this paper, the term "skill" will be used to refer specifically to physical skills or gross motor skills. Rosenbaum, Carlson and Gilmore describe skill in *Acquisition of Intellectual and Perceptual-Motor Skills*:

> When we speak of a *skill* we mean an ability that allows a goal to be achieved within some domain with increasing likelihood as a result of practice. When we speak of *acquisition of skill* we refer to the attainment of those practice-related capabilities that contribute to the increased likelihood of goal achievement… By a *perceptual-motor skill* we mean a skill whose goal is nonsymbolic… (2001, 454).

Perceptual-motor skills are acquired through physical exploration. Rosenbaum et. al., state "… no one has ever managed to write the instructions for riding a bicycle or bouncing on a trampoline and then find the reader successfully engaging in these tasks based on reading alone. The only way to learn perceptual-motor skills, it is said, is to do them" (Ibid. 455). In order to learn to play the piano, one has to do so through physical exploration.

Children learning to ride a bike

Furthermore, Bleed adds the following about skill: “In everyday terms, skill refers to the proficiency with which activities are executed. The term brings to mind competence, ability, craft, and facility. Skillfully produced items are, thus, well made, regular and complex. A skilled person works with facility, assuredness, and a high success rate” (2008, 156).

Skill is an important and fulfilling part of our lives. Djajadiningrat, et al., describe the benefits of physical skill, stating, “Performing bodily movements and building bodily skill can be both challenging and highly rewarding, whilst we are also perceptually sensitive to the beauty and expressiveness of movement in our physical environment” (2007, 657).

Using skill to woodwork by hand or to play a sport

Physical Skill Versus Play

In the English language when we refer to the act of using an instrument to make music, we use the word "play". It is necessary to make a distinction between physical skill and play. The artifact development later described in this paper may at first appear "playful" but the goal of this work is to incorporate skill, not play. Physical skill is certainly involved in all kinds of play. For example, playground activities, sports and dance are all forms of play which incorporate physical skill; however, all play does not require physical skill nor is all physical skill playful.

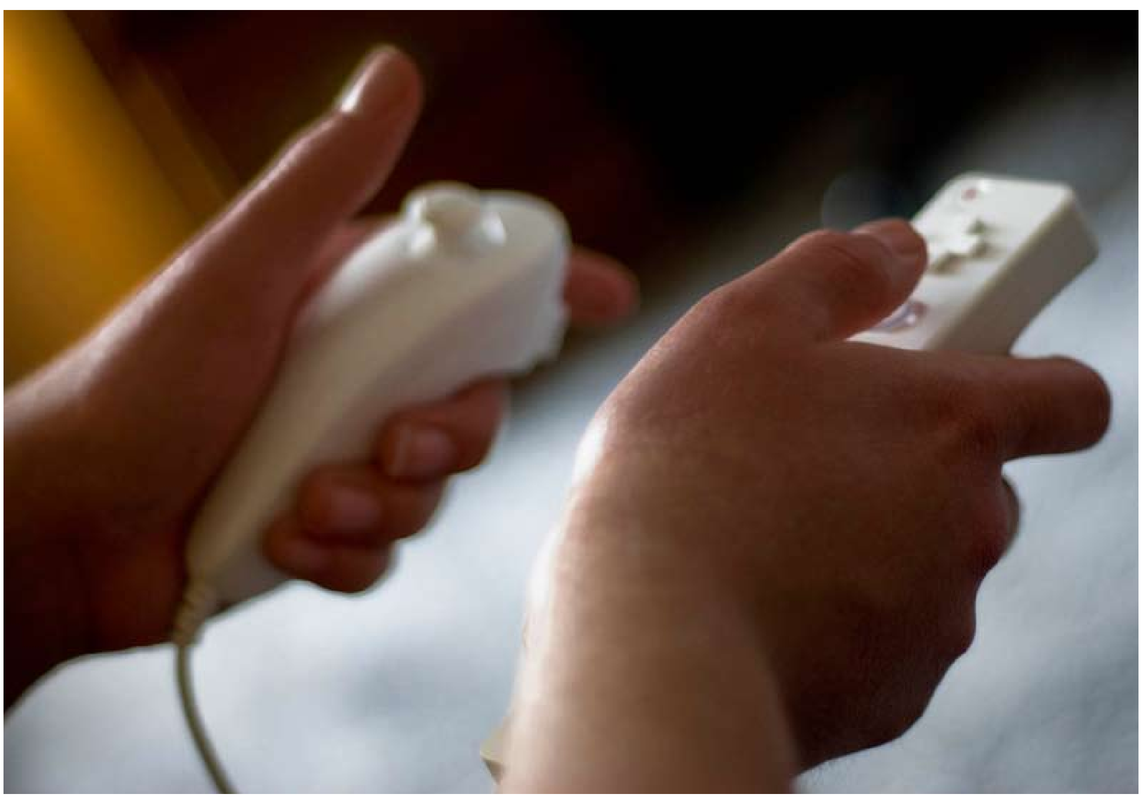
The culture in North America supports certain types of play for children on the basis that it has developmental value; it helps children to form motor skills. Children spend time on playgrounds using their bodies. They climb trees. They ride bikes, skateboards and sleds. These forms of play satisfy our use and refinement of physical skill. This kind of behavior may seem to disappear as we mature. Adults are encouraged to partake in more subdued activities like organized sports or "leisure" activities such as golf or sailing. However, there is no evidence suggesting that we no longer need to develop or hone our physical skills. The need for this kind of "play" does not disappear, but the opportunities for it change and decrease.

Children are encouraged to play to develop their gross motor skills

A recent phenomenon of play involving physical skill is the introduction of the Nintendo Wii video game system into nursing homes.

> Finally, with the advent of new interaction technologies, digital games now afford new ways of interacting that are both more natural in terms of affordances and engage the whole body. Examples of such embodied interaction devices include the Sony Eye Toy (using computer vision) and the Nintendo Wii (using position and acceleration sensing), both of which allow for an embodied, physically active way of engaging with the game content (Ijsselsteijn et al. 2007, 21).

This system, especially the bowling game, has been used as a form of physical therapy, group interaction and fitness. The Wii allows even those bound to wheelchairs to participate. Residents are able to reclaim many lost skills such as playing tennis or baseball (Forster 2008).

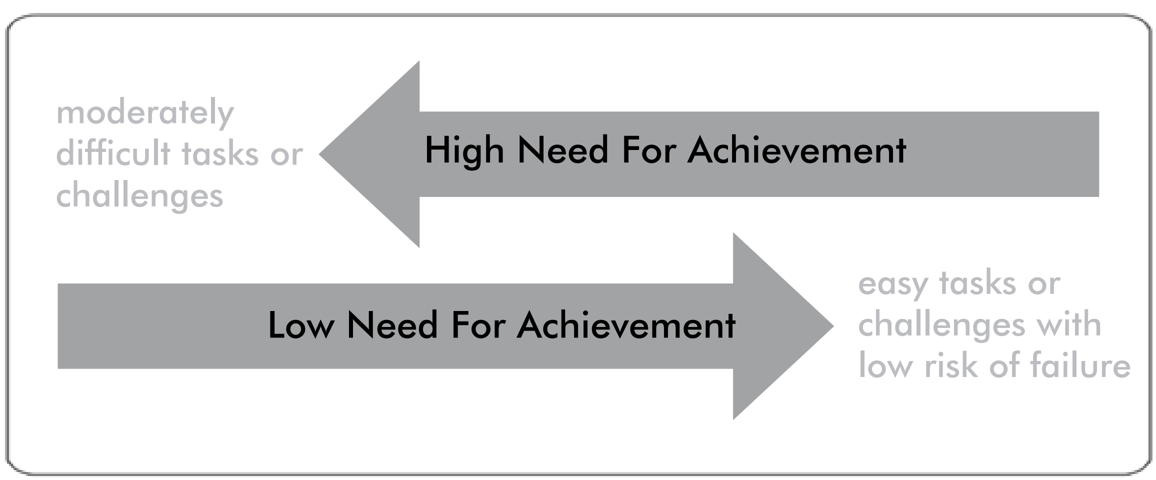


The Nintendo Wii is currently being used with great results in nursing homes

Motivation

Motivation is an important consideration involved in skill or challenge. What motivates people to take a risk or to do something challenging? Psychologist David McClelland answers this question with his theory of motivation. He specifies this as the "need for achievement," meaning one's need for accomplishment, control and skill mastery. Those people having a low need for achievement will opt for easy tasks or challenges with low risk of failure. The failure is deemed greater based on the amount of embarrassment. Those with a high need for achievement will take on moderately difficult tasks or challenges which they perceive as attainable. These people tend to be independent and to seek out challenges (Miner 2005, 52).

Anytime one is faced with a challenge, there is the possibility that it may deter one from engaging in the task. There is a certain amount of challenge musicians face initially and while many people might give up their piano lessons after a year, there are many others who continue despite the ongoing challenge. It is this selection of people that have a higher need for achievement that this thesis is targeting. It is the challenge itself that will motivate these individuals to take advantage of these opportunities to use their bodies.



2 The Loss of Bodily Engagement

Over the past half-century or longer, major technological innovations – automation and the consequent decline of physically active occupations, labor-saving devices in the home, and the dominance of the automobile for personal travel – have substantially reduced the physical requirements of daily life. COMMITTEE ON PHYSICAL ACTIVITY, HEALTH, TRANSPORTATION AND LAND USE, TRANSPORTATION RESEARCH BOARD (2005, 1)

Decline in Physical Activity

Over the last century, we have been afforded many new labor-saving products. The advent of specialization and industrialization has altered the amount of time and physical labor we expend during our day. For example, our indoor plumbing means we no longer have to walk for miles with buckets to retrieve water. It means we can live further away from water sources. It means we don't have to sanitize our water or worry about catching diseases from our water. The positive impact of indoor plumbing is obvious. We have more sanitary living conditions and we have more free time as a result of this technology. However, if we think about the loss of physical interaction during the activity of water retrieval, we see that we go from walking, carrying buckets and sanitizing our water to merely standing isolated in front of the sink in our own kitchen and lifting a handle.

Breaking down the last century, we can see the stages of contributing factors that brought us to our current state of physical inactivity. These factors are described as follows:

> The trend data reviewed in this chapter show that technological innovations, as well as broad social and economic changes, have steadily and substantially reduced the physical demands of work, home, and travel, with a modest and recent offset in increased leisure-time, higher-intensity physical activity for some sectors of the population. Long-term changes in the built environment have also contributed to declining physical activity levels. The suburbanization of the population and employment in lower-density communities and office locations have increased reliance on private vehicles for most trips (Hanson et. al. 2005, 57).

A variety of factors have encouraged a sedentary lifestyle

Not only does this combination of contributing factors affect physical activity but these changes have social and psychological implications. The combination of cars, suburbs and home entertainment has resulted in indoor isolation, which further encourages our lack of outdoor participation. Richard Sclove details a similar observation:

> …crucial social impacts often emerge from the interaction among seemingly unrelated technologies. Consider in the United States the role of automobiles in driving pedestrians away from streets – a result now reflected and reinforced materially by the elimination of front porches from homes and the creation of sprawled suburbs that don't even have sidewalks – and the complementary role of air conditioning, central heating, television, and other home entertainment devices in drawing people indoors. All of these technologies interact to weaken face-to-face social interaction at the local level. A conventional evaluation of a single technology – say, air conditioning – is unlikely to detect such combined or synergistic effects (1999).

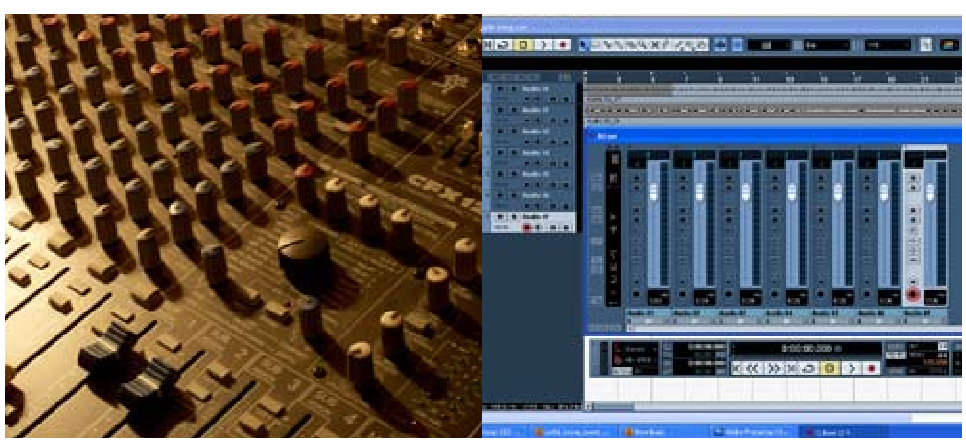
The behaviors of our daily lives are changing at the rate of technological innovation while our bodies remain evolutionarily the same. Most of the survival skills we needed 10,000 years ago are now obsolete. Specifically, it comes as no surprise that we spend more time sitting now than we did 100 years ago.

A typical work space including desk, computer monitor, keyboard and mouse.

Changes in Product Interface

Further compounding our loss of physical activity is the loss of physical engagement with the very products that are now doing the labor for us. If we focus specifically on the changes in product interface starting roughly at 1900 we find that, "… lasting until approximately the second world war, products are mechanical or electro–mechanical, resulting in heavy actions and rich feedback" (Djajadiningrat, et al. 2007, 660). Machines are controlled with levers or knobs requiring physical force to pull, turn or push. Workers operated machines which responded mechanically with sound and tactile feedback. The period following, Djajadiningrat, et al. point out:

> In the fifties, user actions become less heavy as electrically powered components replace purely mechanical switches and mechanisms. The controls no longer demand movement of the whole arm or even body. Instead, movement of the hand suffices. The number of controls – many of them analogue rotary controls and sliders – increases. Losses in the tactile feedback from the mechanisms begin to be compensated by visual feedback in the form of precision dials and scales. Design increasingly becomes driven by ergonomics and aesthetics, hiding the encased technology and therewith any meaningful functional components. Housings grow more similar and the visible movement of product components becomes limited to the control panels. The increasingly standardised controls become less differentiated and expressive in both their appearance and the required actions (2007, 660).



An example of the disappearance of physical interface: a physical mixing board shown on the left compared on the right to a digital mixer found in recording software

Finally we arrive at the stage leading up to today. The product interface has been diminished to our fingertips. Again, Djajadiningrat, et al. offer an analysis of our product interactions:

> With the rise of the micro-controller in the eighties, push buttons are favoured over analogue controls. The number of controls drops off as the one-function-per control approach is replaced by a many-functions-per control approach. Products become like miniature computers with keypads and screens, often inheriting the graphical user interface style, complete with icons and pointing devices. The repertoire of actions has become very narrow: the only action required is pushing. Movements have become very precise and take place at a finger level rather than a hand, arm or body level. Feedback is nearly all visual and provided by displays. The form of the product and the controls do not change: *form* changes are limited to changes on a display. There is no longer any perceptually meaningful link between actions, form and feedback. Regardless of function, products feature the same *display+push button interfaces*. These rely mainly on the users' cognitive skills, stretching their abilities to learn and remember (2007, 660).

One has only to think about the iPhone and its interface. Not only has the physical size of cell phones been reduced, the iPhone has almost completely done away with physical buttons altogether. The interface takes place instead on a single flat plane lacking in any tactile feedback. Your visual system is called upon instead to inform you where a button is located and whether or not you have triggered it.

This is the trend of current personal electronic products. The popularity of the iPhone has spawned many new touch-face devices such as the iPad. Summing up the transitions of interface design, Djajadiningrat, et al. state, "Product design history thus shows an increasing emphasis on cognition and a loss of appreciation for perceptual-motor skills" (2007, 660).

Phones once offered tangible feedback when the buttons were elicited

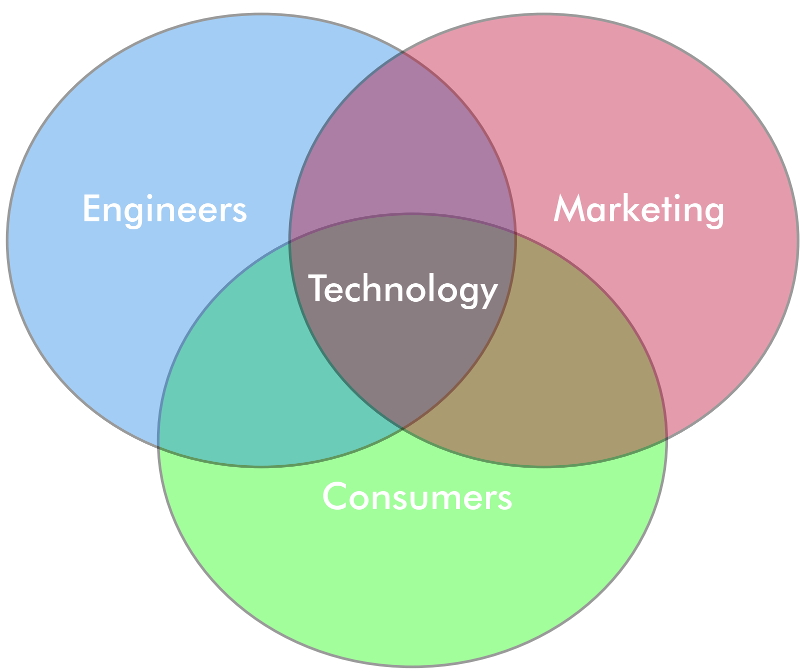
3 Technology

If we wish to understand what technology means to those who invent, tinker with, build, or just use its products, we must investigate how the aesthetic is intertwined with the practical; how the giving of meaning is related to building and making; and how work with tools or with hands may have some correspondence with musical experience. ARNOLD PACEY, *Meaning in Technology* (1999, 18)

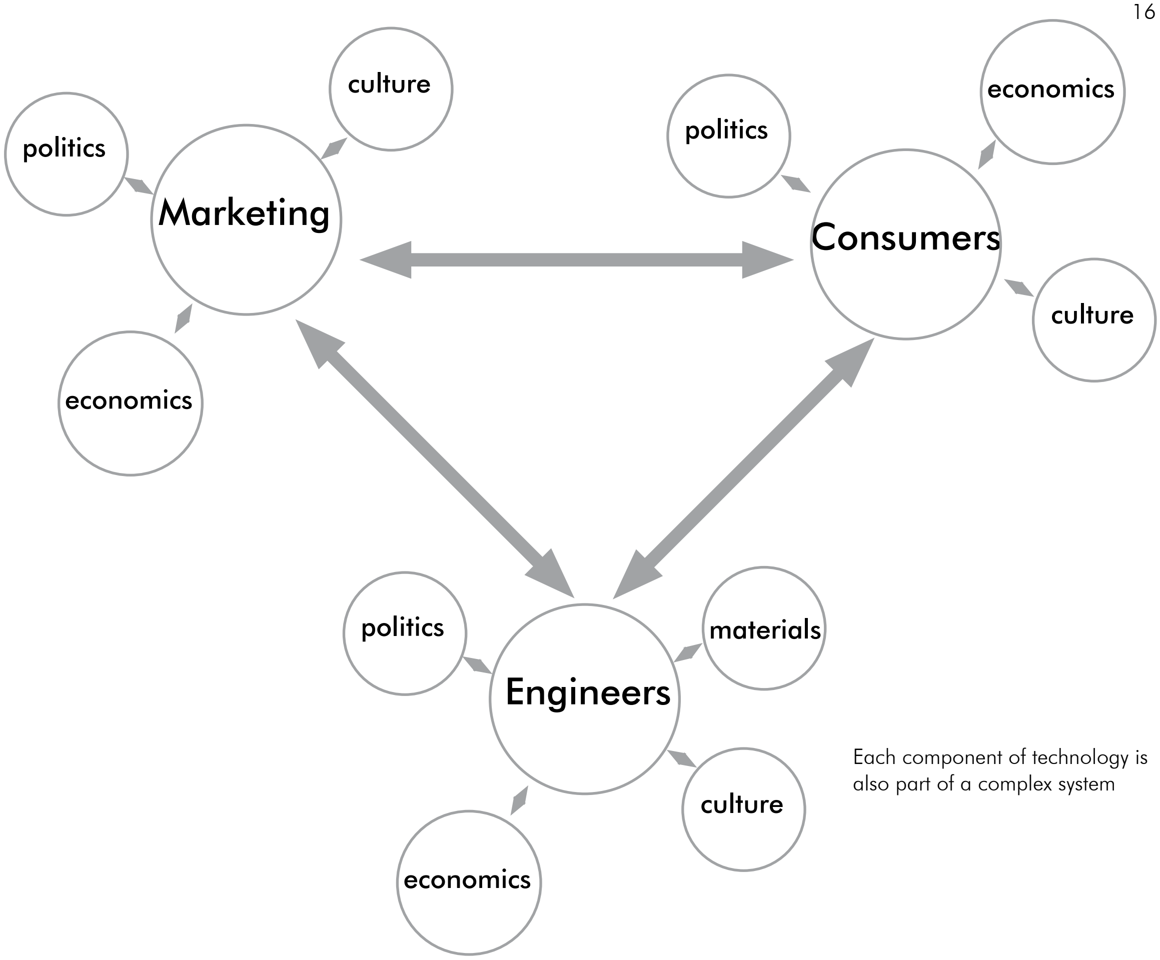
Society and Technology

To further explore these changes we need to understand what is involved. It would seem that technology has played a major role. Therefore, it would be helpful to understand technology's involvement. Taking a constructivist view, according to Wiebe Bijker in *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change*, technology is not an isolated force but like society, is a construct and "… one should never take the meaning of a technical artifact or technological system as residing in the technology itself." Bijker describes this further:

> Technology is created by engineers working alone or in groups, marketing people who make the world aware of new products and processes, and consumers who decide to buy or not to buy and who modify what they have bought in directions no engineer has imagined. Technology is thus shaped not only by societal structures and power relations, but also by the ingenuity and emotional commitment of individuals. The characteristics of these individuals, however, are also a product of social shaping (1995, 4).



Technology is the result of a complex system



Each component of technology is also part of a complex system

Artifacts are the result of this kind of sociotechnical system. We are surrounded by products which are birthed from a complex system and those products in turn influence the system. Pacey describes how personal responses and the experiences of the individual coexist with social meanings of technology. He continues by saying:

> A cook who does not enjoy the colors, textures, and scents of food in different stages of preparation never becomes skilled at the job. But the cook is also motivated by awareness of the social purpose and context of the meals he or she prepares. Similarly, inventors, engineers, and artisans may have intense personal experience of materials, or of sweetly running machines, but at the same time, they are also members of society, responding to public enthusiasms, political influences, economic conditions, and other aspects of their social environment (1999, 78).

Pacey purports that the “decisions about adopting new technology are then based on criteria of economy and efficiency, not justice and freedom” (1999, 89). We have arrived where we are by way of a complex route. On one hand, technology can be a pursuit motivated by the “pleasure and excitement in making things (or seeing and understanding how they were made)… On the other hand, there was the impulse to make life better for people: to ensure that material needs were more adequately met, to relieve suffering, and to enrich the quality of life” (Ibid. 105).

Meaning in Artifacts

If we examine these products of technology and society, we find all kinds of different meanings attached to the same object. How these meanings are created and received can help us to better understand the role of an artifact in shaping behavior. Pacey describes the change brought about by post-industrial artifacts:

> Making clothes or cooking a meal means being involved in a process, manipulating tools and handling basic materials, but an equally common experience in today's consumer society is to be confronted with a finished product of definite size and shape that has only to be plugged into an electricity supply and is then ready for use. In experience of a process, visual and tactile impressions are important for making judgments about how to proceed, and they contribute to the enjoyment and satisfaction one gains from doing the job. In experience of a finished consumer product, however, one is offered visual and other impressions that have little relation to practical judgments, but usually have symbolic meanings (1999, 81).

He goes on to explain how technology can be thought of as a communication system, "in which inventors, designers, and builders of artifacts are *senders* of messages, and consumers, users, and the public are *receivers*" (Ibid. 83). Artifacts therefore are not passive objects we encounter or use every day but they are instead full of meaning and influence. They can be read like a story about our behavior, culture and values.

An apple pie, the result of which was brought about and consumed by someone with intimate knowledge of the process and materials compared to a "ready to eat" pie which is alienated from the consumer

In the same way artifacts tell a story, they can also be used to change and influence our behavior, culture and values. Elements in our built environment have been shown to have an effect on people's physical activity. By building sidewalks, bike paths and parks, residents of a neighborhood have more opportunities for physical activity. "Opportunities to increase physical activity levels exist in many settings—at home, at work, at school, in travel, and in leisure. The built environment has the potential to influence physical activity in each of these settings. Each setting is characterized by different environmental opportunities and constraints that could affect physical activity levels." (Hanson 2005, 10)

A bike path, an example of the affordances of the built environment

4 Furniture and Ergonomics

With technological advances and the continuing increase in the time for which people sit, the problem is unlikely to diminish in importance and, even if some may harbour the suspicion that there are no ideal solutions, the search must continue. DAVID OBORNE, *Person-Centered Ergonomics: A Brantonian View of Human Factors* (1993, 83)

Furniture

As the opportunities for bodily engagement disappear we see that there are increased opportunities for sitting. If we compare the activities of the current Digital Age with that of the Pre-Industrial, we find that the one thing we do much more of is sit. We begin our day by sitting at the breakfast table, in our car as we drive to work, and then at our desk only to be followed by an evening of sitting at home on the couch. Therefore, a probable solution is to re-design this system, to create a new function for our current seating, to create opportunities for physical engagement in the very artifact that has become an enabler to our sedentary lifestyles.

Merriam Webster's Collegiate Dictionary defines furniture as "equipment that is necessary, useful or desirable" (Mish 1998, 474). This is a very broad definition yet the furniture available to the market seems narrowly defined to function to provide rest and some translation of comfort. By redesigning furniture it makes these opportunities easily accessible within an indoor environment. If these opportunities are readily available, people are more likely to partake in them.

Additionally, as we get deeper into the Digital Age, we find that artifacts are disappearing and shrinking in size. For example, with the advent of music recordings, the vinyl record was introduced. It was followed by 8-tracks, cassettes and then cds. Music is now widely consumed in purely digital form, never becoming a physical artifact. Technological advances are allowing things to get smaller and to some extent disappear. Furniture, is likely to remain an artifact which we encounter in daily. Because of this, it presents a means with which to incorporate physical experience and opportunity back into our lifestyles.

Ergonomics

When we think about furniture or any kind of physical artifact we must address ergonomics or human factors. According to *The Measure of Man and Woman*, the discipline of human factors is concerned with the physiological and psychological elements which affect human performance involving artifacts or human-made environments. Human factors is concerned with safety, efficiency and comfort (Tilley, 2002). By incorporating skill as part of the experience of seating, this might appear to subvert the concerns of human factors; however, I will present an argument below that truly person-centered ergonomics have to look deeper at the purpose of seating.

Seating includes all kinds of different chairs, stools or benches which seem to serve the purpose of rest. David Oborne examines the purpose of seats:

> Nevertheless to speculate in psychological terms, the purpose of sitting might seem to be the achievement of maximal comfort… But the human is not to be regarded only as a comfort seeker. He may have a motivation to rest, but if too much rest is given he also seems to seek stimulation from the environment. We would thus not equate maximum bodily comfort with an optimum state of sitting comfort. Our case is that we normally sit to some purpose quite unrelated to the shape and properties of the seat and that sitting, like all postural activity, is only a means to another end. In rest seats we sit for a compound of primarily social and personal reasons with the secondary purpose of 'taking the weight off our feet' while listening, conversing, looking at television, or just daydreaming while being transported from A to B. We do not seek comfort for its own sake but rather seek to attain a state which is optimal for the pursuit of these other purposes. (1993, 91)

Janet Noyes in *Designing for Humans* writes, "One of the ironies of chair design concerns the fact that the 'best design' will probably be the chair that allows us to fidget." Our bodies are designed to move and not to maintain prolonged immobility which causes restricted blood flow. We must keep moving in order to allow for blood flow and to relieve pressure on our skin and tissue. "This is exemplified by the fact that we find it difficult to stand still for more than a few seconds but can walk for hours without ill effect." (2001, 78).

Observations of people in seats reveal that movements occur often. There are several reasons for this. Oborne explains this:

> "When seated in a chair the individual will gradually experience the build-up of pressure in the lower thighs, due to compression fatigue, and of muscular fatigue caused by the need to maintain a particular static posture. Slight shifts in posture will help to alleviate such sensations, rather in the way that slight changes in the direction of blood flow or the secretion of the sweat glands help to alleviate the build-up or loss of heat in the body. Such a homeostatic model, therefore, leads to the possibility of measuring the 'discomfort' of seats, by observing postural changes— or fidgets."(1993, 46)

Seating Observations

Criteria

Given David McClelland's theory of motivation and my own personal experience as a musician, I came up with a set of criteria for the creation of physical opportunities. The criteria are as follows:

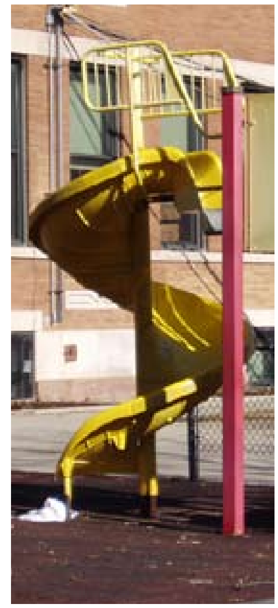
1. The physical opportunities, because they are intended to invite one to use his or her body, must involve gross motor skills.
2. These opportunities must provide a challenge that is deemed by those with a high need for achievement as moderately difficult to attain with some risk.
3. With practice, the user will improve and the goal will become easier to attain.
4. The opportunity should have an open-ended quality to it, meaning, the goal can be redefined and made new again, that there is also a creative element to it. For example, bicycles were designed as a means of transportation. However, riders have taken bicycles to extremes performing incredible feats at the Gravity and X Games. I doubt the original designers probably ever imagined what users would be capable of doing with the bicycle.
5. The goal and motivation of the user will be the affirmation of others and the act of actually "sitting", but not necessarily resting.

Playground Studies

Because I am trying to incorporate physical skill in furniture, a good place to look for inspiration is a playground. Playgrounds are designed to assist children with their development of gross motor skills while they play. Climbing, jumping, balancing and sliding are all physical activities which playground equipment afford. I visited several playgrounds and collected various images of playground equipment and design.

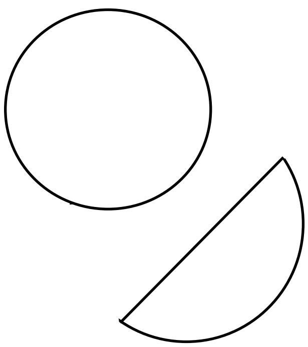






The study of playground equipment allowed me to summarize the following physical opportunities.

Rotational balance



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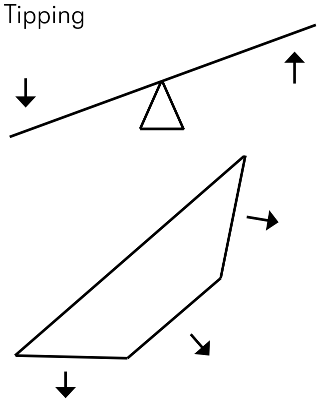
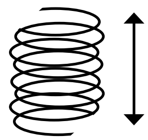
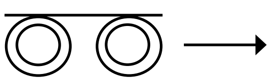


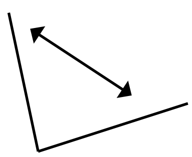
Hopping



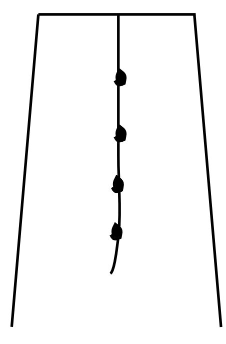
Motion



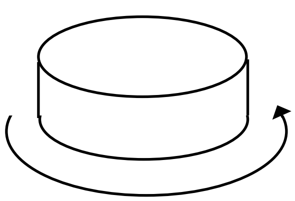
Pushing



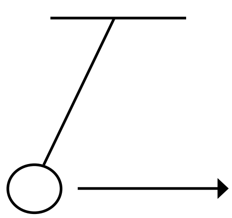
Climbing



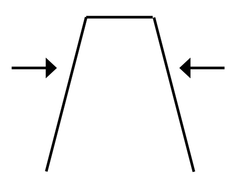
Spinning

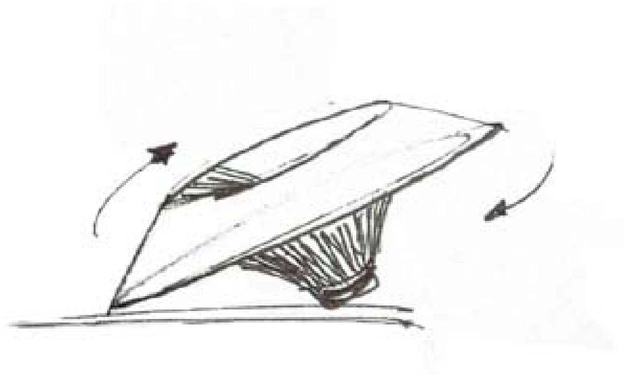


Swinging



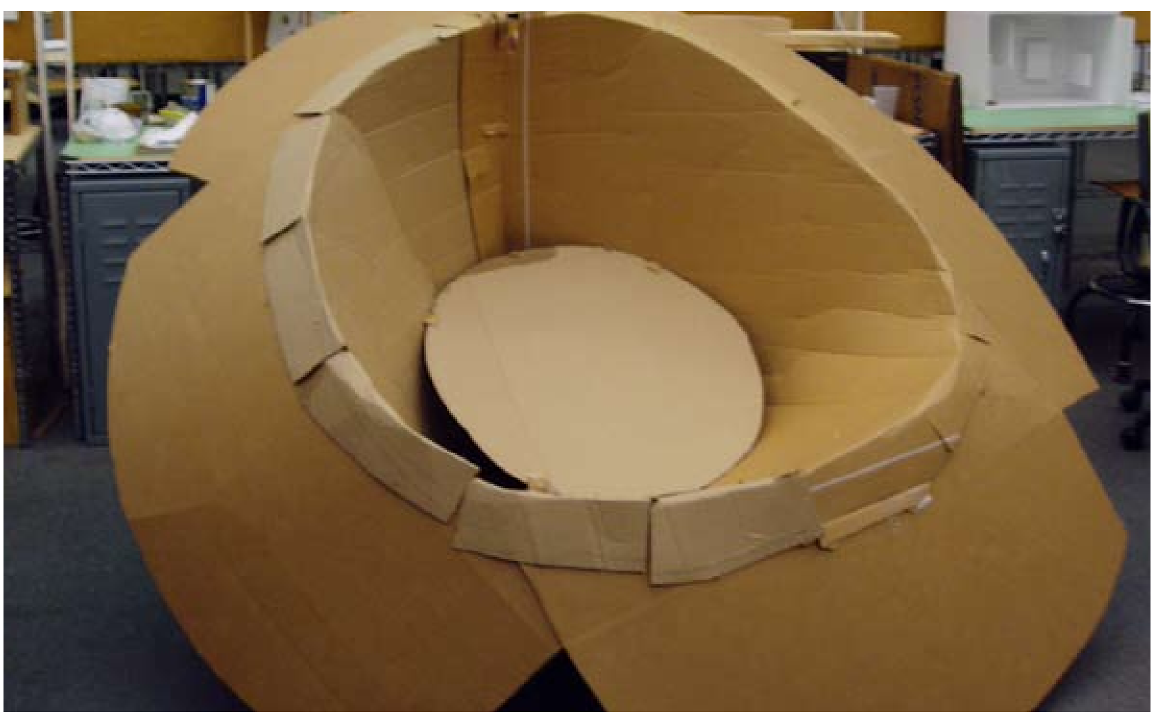
Clenching





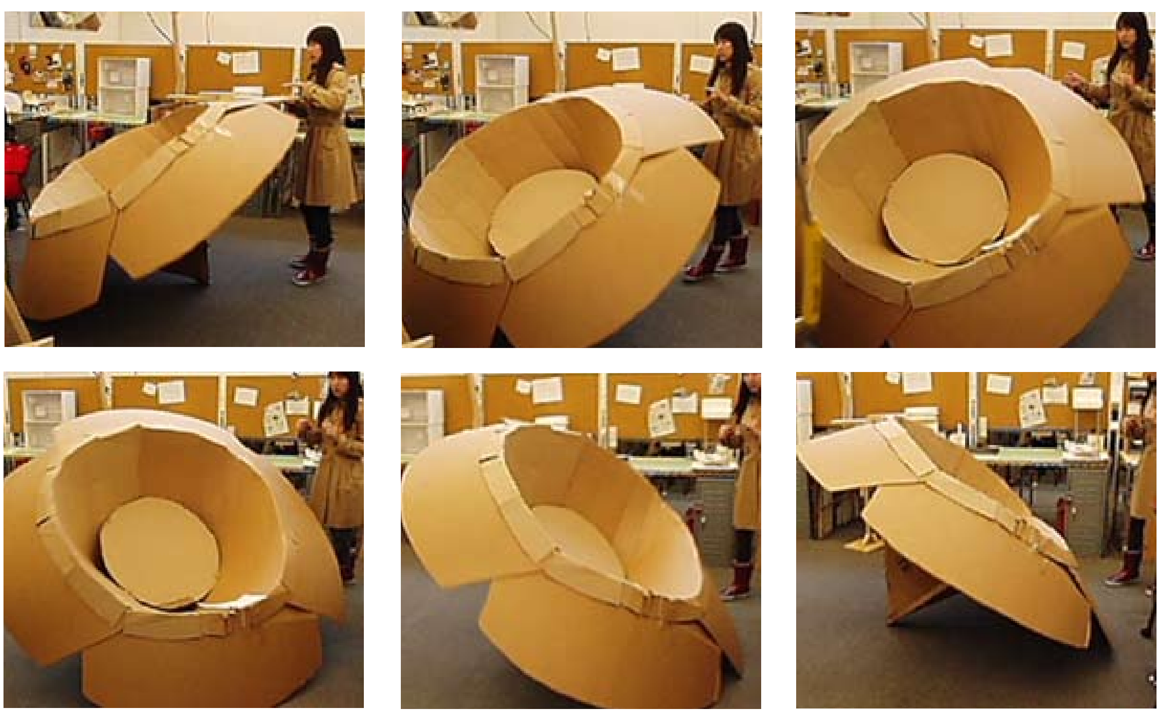
Documentation of Process

Using the physical opportunities inspired by the playground equipment, the process began by trying to integrate these opportunities into seating. This "works-like" model was the first of many models. Because this project was dealing with something large enough to support a human body, the models would need to be both three-dimensional and in full scale.



The idea for this first attempt was that it would be able to roll entirely around. The user would sit in the center and would have to use his/her entire body to control it.

Below are images taken from a video showing the movement as the piece was able to roll completely around. The model was put together with cardboard so that, at the very least, it would provide a sense of the dynamics. It was not strong enough to support a person's weight so it was not tested by a human body.

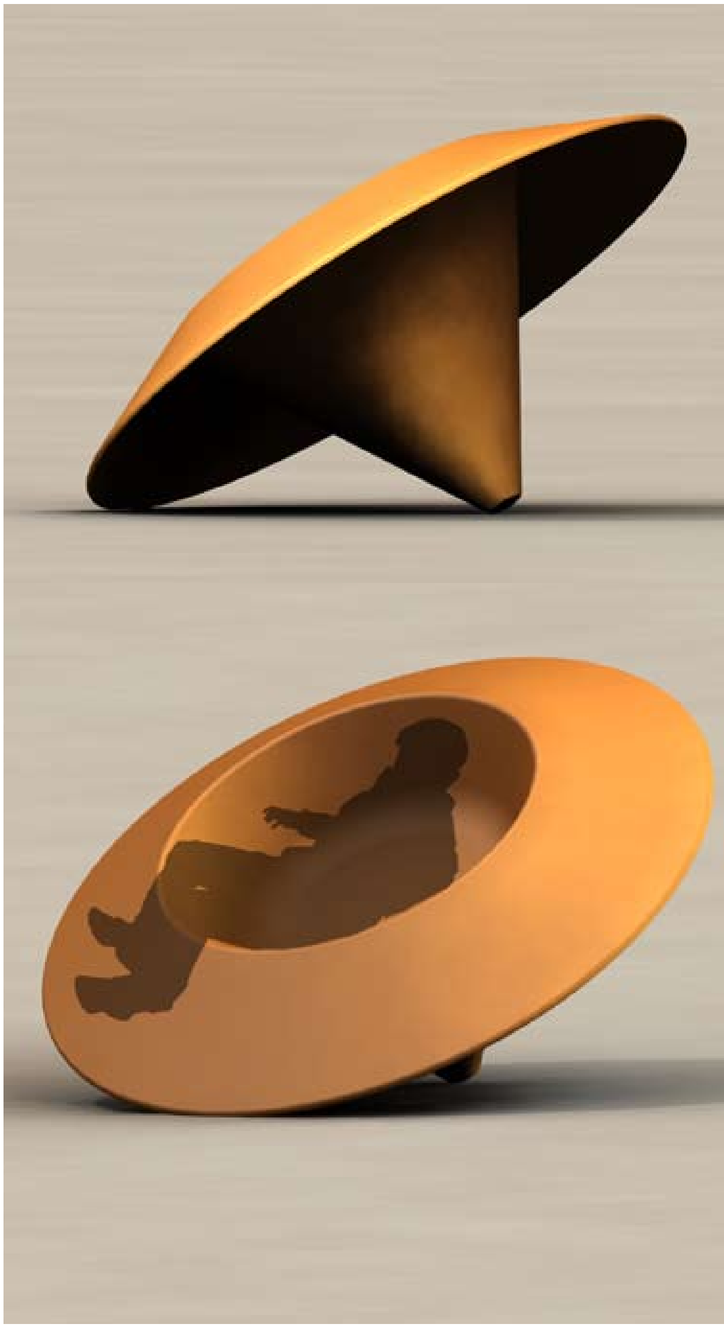


These renderings show how one would sit and use the seating. The users should be able to roll the seat entirely around with their bodies. With practice and developed skill, one would be able to control it and eventually master it.

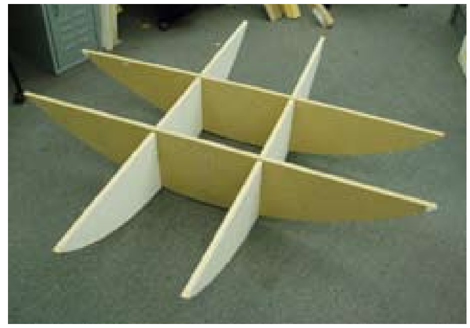
Feedback and Analysis

This piece would have needed a large room or area to accommodate the rolling action. It had great instability and thus the need for balance.

After receiving feedback and from my own observations, this piece was decidedly overwhelmingly large. It seemed that it was an overcomplicated attempt, however, this piece had possibility. Because it was not tested, one could only surmise that it met the criteria. It required gross motor skills to use it. It provided a certain amount of challenge with some risk. With practice one could improve their control. The opportunity was fairly open-ended. The goal would be the affirmation of others as you develop control.



Solidworks rendering showing how it would be used

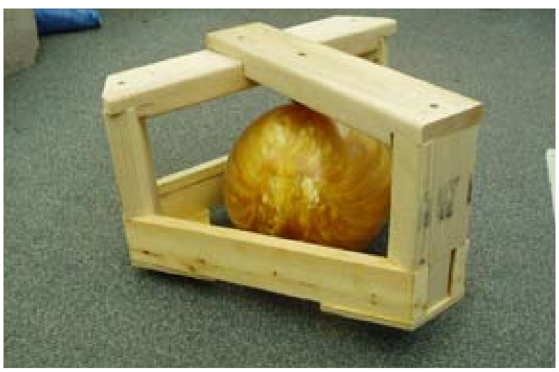


Continuing with the theme of using an unstable base in order to require balance, this next model was built from wood so it could be tested. This attempt ended up being too stable. It was also too large for seating but made an interesting platform to stand on. It could rock in multiple directions but also had points of equilibrium, especially right in the center.

Solidworks rendering

Building on the idea from the previous model, this next process began with a basic "seat" which could be attached to different kinds of bases. Knowing it would be attached to an unstable base, the seat was built to be low to the ground to have a lower center of gravity, giving the user more control. A rounded base similar to the first model was first attached to this seat. This time it was much more unstable. This one had no point of equilibrium and was so unstable that it was dangerous to use. It would tip back and possibly cause the tester to hit his or her head on the floor. Because of its extreme instability and high risk of injury this iteration really did not apply the terms of physical skill as defined in the criteria. The intention was to incorporate some risk but not make the challenge in avoiding the risk so great that it became too daunting to attempt.

This base was so unstable I had to attach stabilizers in the back to prevent the tester from tipping straight back and hitting his or her head on the floor.



Further extending the idea of a rounded base, this next model was built around a bowling bowl. This would require balance and also provide motion. The holes of a 16-pound bowling ball were plugged with an epoxy resin so that it would be a consistently solid sphere. The bowling ball was then cupped using ball casters much like a computer mouse ball. Ball casters were also necessary on the bottom corners to allow movement otherwise the corners would get caught on the floor and impede the overall motion. Additionally, a back rest was added to provide lower back support to lean against to help assist with balance.

Feedback and Analysis

The pictures below are stills taken from video footage. The bowling ball stool worked best on hard surfaces. The user was able to spin the stool and roll around on the floor with some practice. One observation was that the user had to use her hands to have better control. This model met all of the criteria. It required gross motor skills in order to use it. It provided challenge which was moderately difficult with some risk but with practice the user could gain more control over the "seat". There was definitely room for more creative use giving it an open-ended quality. The goal of actually being able to control its movements should gain the affirmation of others. The "seat" was not very restful since it was dynamic and because of its instability, movement would always be part of the act of sitting. The user would constantly have to implement physical skill.



Jumping from the rounded base, the next model was built on the idea of balance using cantilever mechanics. This model was to be a resting point with support that was indirect and unstable. The user had to hold the "stool" in place in order to initially access the seat because it could not stay upright on its own. Once seated the user would have to exercise a certain amount of daring and trust in putting his or her weight onto the seat. The user then had to continue to use his or her legs to remain balanced while the brunt of his or her weight would be held by the seat.

Feedback and Analysis

This idea was abandoned after testing as it did not have the qualities of the criteria. The possibilities were limited. It did not have an open-ended quality to it. There was not room for skill to be developed to accomplish much more than just sitting. Overall, it lacked the qualities to really provide motivation and interest in the user.

Inspired by skateboarders, the next idea tried to bring an element of rolling and balance to the seating. This first iteration was an attempt to create three different planes, each having a set of wheel casters which could roll a variety of ways. The seat could be tipped back and balanced at different levels and rolled around. It was built low to the ground to have a lower center of gravity.

After some testing, the initial feedback received was that it was too stabile and the wheel casters did not roll very well. The casters did not provide the kind of dynamics needed. A decision was made to curve the back of the seat to remove stability. Because the wheel casters would still create a plane between four points, rollers were installed instead. These first rollers were made from PVC pipes. The curved back was a definite improvement because it created more instability which would therefore require increased balance. However, the rollers made from the PVC pipes did not roll very well and a better roller was needed.

Feedback and Analysis

Out-feed rollers were used for the final "works-like" model. These are stainless steel rollers which spin on a bearing axel. These rolled much more smoothly. Consequently, this final iteration was both unstable and required balance, yet, it was able to be controlled with practice. The rollers also allowed for overall motion. The user could roll the seat along the floor. This seat was more open-ended and there were certainly more possibilities given the right user. The goal for the user would be the affirmation of others. This model was dynamic and movement was fairly constant so rest was not the end result or goal of this model.

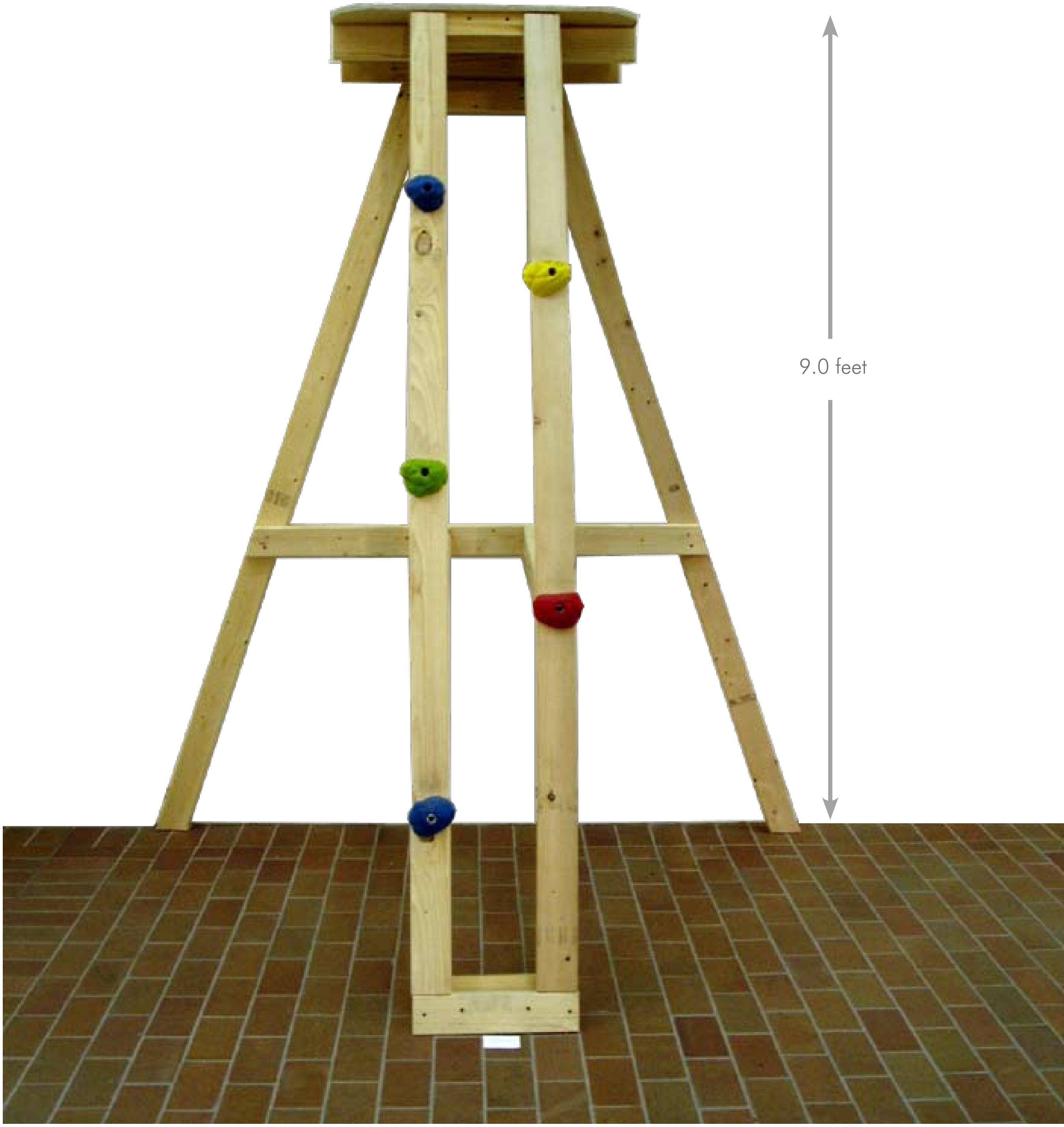
The final model was a departure from the other models. This model required physical skill in order to achieve a restful perch. In contrast, the other models required physical skill for the duration of the act of sitting.

In this model the skill of climbing was incorporated into the seating. This model was composed of a platform built atop a structure approximately nine feet high. The structure leaned back against a wall to provide support.

The model was developed first with the basic structure followed by the means by which one would climb to the perch. Additionally, in order to meet the physical opportunity criteria, specifically attainment of a goal, I decided that the descent should not be more difficult than the climb up. Because the seat at the top would be the obvious achievement or goal, the climb up would have to be equally as hard or harder than the climb down.

Having decided on artificial rock climbing hand holds, these were placed on the front ascending vertically straight up. After testing this it became apparent this was not ideal for several reasons. The first was that the center structure got in the way of one's legs while trying to climb up. Also the steep pitch of the hand holds, 90 degrees perpendicular to the floor, was too difficult to descend.

The hand holds worked much better on the front support structure shown in the picture to the left. These alleviated both problems. The pitch from the floor was approximately 70 degrees. This made the ascent and descent much more manageable. People were more willing to try it.


9.0 feet

Feedback and Analysis

On the previous page are still images taken from a video. With practice the ascent and descent were more easily accomplished. Getting down was about equally as difficult as getting up. This model was located in a design studio space and participants were eager to try it. This model produced more interest than any of the other models. The platform on the top created a space for reading a book or working on a laptop and became a retreat from the hubbub in the studio.

Some people who tested it thought it was not challenging enough while others found it too challenging. There were some people who were not willing to try it at all while others were very enthusiastic about attempting it.

This "works-like" model met the criteria. It required gross motor skills in order to use it. It provided an attainable challenge with some risk. With practice the users got better at reaching the goal. The final concept would have adjustable hand holds to allow the user to create new challenges with different climbing patterns. The goals for this model were both the affirmation of others and the restful perch at the top where a user could relax and to have a place to him or herself.

Final Concepts and Iterations

Summary of Work

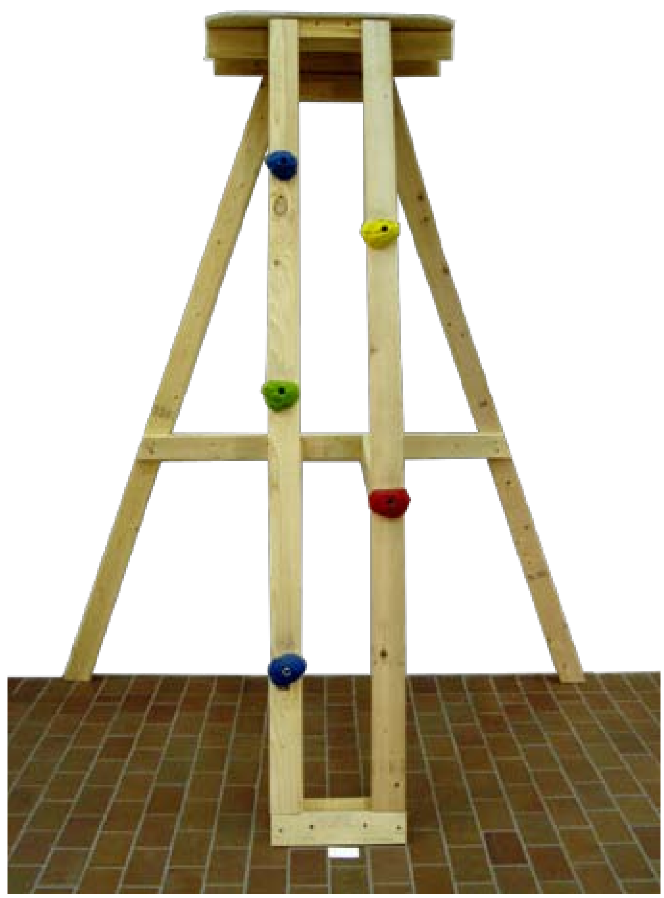
There were three models that met all of the physical opportunity criteria. For the final concepts, each "works-like" model was developed into final iterations. Digital models were created and rendered in the CAD program Solidworks. The following pages will show a translation of these "works-like" models into a final idea and a possible current context each one might fit into. One limitation of this study is the lack of final models to test in an existing context. The digital models of the final iterations are conceptual. Additionally, when these models were created, the context for these pieces may not currently exist; this idea is explored more thoroughly in the final conclusion.

Models That Meet the Criteria

- requires gross motor skills to use
- has perceived challenge and risk but is attainable
- practice leads to goal
- open-ended potential
- goal is affirmation of others and use of "seating"

Bowling Ball Model

Climbing Model



Curved Roller Model

Bowling Ball Model

Curved Roller Model

Climbing Model

Social Implications

When this project first began, it was hard to pinpoint exactly how to recreate what I considered to be the important elements of my experience of playing an instrument. Not all musicians have the same experiences, and so this project was shaped around something very personal. However, there are other experiences that share similar opportunities for physical skill such as skateboarding, bicycling, dancing or golfing. Another element shared by these activities is that they tend to develop around a social group. Skateboarders feed off of their audience of other skateboarders. They challenge and affirm each other as they do tricks. There is an underlying blend of competition and support. Those same qualities are present when musicians play music in a band. Band members may challenge each other towards greater individual musical accomplishment than an individual may challenge him or herself. While any of these activities can be performed independently in an isolated setting, the optimal experience occurs when performed with others. The group exists to offer feedback. The audience facilitates this experience as well. This social dynamic also emerged as I worked on my models. This social aspect is important but is beyond the scope of the current study.

Related to this social aspect of physical skill opportunities, some people were willing to try the models with an audience while others were more likely to try them alone. In contrast to the bowling ball model and curved roller model, the climbing model was different in that observers only had to see the user in the perch as it was evident the user arrived there by way of climbing. The accomplishment was apparent without having an audience during the climb.

Spacial Implications

Because I was working in a large studio space the size of the models was not inhibited by architectural features of the average home or office. While my initial intention was to create these pieces for a work space such as an office or studio, I didn't want to limit the project. These pieces could exist in either the home or office. What is interesting to consider are the effects these would have on the architecture of a home or office and how that in turn might affect the social dynamics of said space. Because a large open space would be required for these pieces, the only places that would currently be suitable would be a loft-style space. However, what if a home or office was designed to accommodate this kind of furniture and in turn what effect would that architecture have on the family or work dynamic?

How might our lives change if we redefined our furniture and our work spaces?

Embodied Cognition

Relevant to the physical experience developed in this project is the term e*mbodied cognition*. This can help explain the implications of what this project is trying to accomplish. While a relatively new idea, it may change the way we view our bodies and minds.

Contrary to Descarte's idea of mind-body dualism, embodied cognition unifies the mind and body thereby allowing for the notion that we *think* with our bodies. When we use our bodies we are exercising our cognition. This idea of embodied cognition is distinct from physical exercise. While the goal of physical exercise is physical health (i.e. calorie burning and/or muscle building), the goal of physical skill varies given the challenge of the task at hand. Embodiment is about the *experience* of using our bodies to perform a task. "At the center of phenomenology is the notion of embodiment, and the basic themes should be by now familiar: embodiment means not just having, and acting through, some physical instantiation, but recognizing that the particular shape and nature of one's physical, temporal and social immersion is what makes meaningful experience possible" (Anderson 2003, 124).

As Paul Dourish puts it, "Embodiment is the property of our engagement with the world that allows us to make it meaningful." He goes on to say, "Embodied Interaction is the creation, manipulation, and changing of meaning through engaged interaction with artifacts" (2001, 126). The experience of playing music on my bass guitar is entirely different compared to the experience of playing music composed and played on my computer. My interaction with my bass guitar requires me to be engaged with the artifact in an entirely different way than with my computer keyboard and this may be due in large part because my mind and body are one.

As humans we cannot negate the importance of our bodies. We have the same bodies we had thousands of years ago, though, the evolution of our daily lives and activities has increased at an exponential rate. Anderson notes:

> Against the Cartesian claim that we are radically distinct from animals, uniquely possessed of a soul and its attendant powers of abstract reason, EC maintains our evolutionary continuity. We, like all animals, are essentially embodied agents, and our powers of advanced cognition vitally depend on a substrate of abilities for moving around in and coping with the world which we inherited from our evolutionary forbears. (2003, 126)

I know that when I am brainstorming or working out a problem, especially as a designer, I need to be actively moving, walking or using my hands to craft something. How many of us tip our chairs back, spin in our chairs or get up and walk to the office water cooler to try to get our minds moving as well?

Reviewing the aforementioned implications through the lens of embodied cognition, we can see just how important the need for physical opportunities is. Sitting rigidly at an office desk inhibits our brain processes. If everyone at a work meeting were sitting on a bowling ball stool would they be more likely to be engaged and in the moment rather than seated passively thinking about their weekend plans? Would employees be more productive and creative? Would job satisfaction go up? Again, a weakness of this thesis was the inability to test finalized models in a current context.

Final Thoughts

As designers we are focused on people. If good design is human-centered then we must understand what it means to be human. Humans have specific physical, social and emotional needs. More products are emerging which involve virtual and socially-isolating interactions such as video games, PDAs (personal digital assistants) and smaller hand-held computers. As designers we have an opportunity to create artifacts which fulfill more than just a need for entertainment and escape.

Furthermore, understanding the importance and meaning of one's physical body and the experiences it allows ought to be deeply embedded in human-centered design. Our physical bodies are capable of much more than a run on the treadmill at the gym. We are capable of vertical snowboard tricks on a half-pipe, shredding a guitar solo or holding the Crane Pose in yoga. As designers, when applying ergonomics and human factors, we should be aware of underlying human potential and human needs.

All other images not listed here are the creation of the author.

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