animation, motion and education

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Submitted to the Graduate Design Program of the Massachusetts College of Art on May 16, 2005 in partial fulfillment of the requirements for the Degree of Masters of Fine Arts

abstract

This thesis is an exploration of human motion, education and animation, their relation to new media and each other, culminating in the creation of an animated, movement-driven, educational exhibit for the Franklin Park Zoo.

Animation, human motion and education intersect in many ways. Human motion can be better understood by rendering it through the medium of animation or analyzing it with new media applications. New media systems can be made that give the user an experience of motion. Animation can facilitate education with its flexibility and simplicity.

My interest is in making the user's movement integral to an animated, interactive, new media, learning experience. There are many benefits. Moving enhances our physical health. It also enhances our learning. Studies show that when we move, we improve circulation to our brains and we become better learners. In moving, we tap into our physical memory, which helps us with recollection and retention. When movement is part of a game, it fosters a social atmosphere. Incorporating animation to this movement/learning experience adds joy as well as clarity.

acknowledgements

I am extraordinarly grateful to have been a part of the Dynamic Media Institute at Massachusetts College of Art and to have worked with so many outstanding people. Without their help, I would have never been able to complete this thesis. Thank you!

Brian Lucid, my thesis advisor, for his enthusiasm, generosity, advice and quick responses to my many e-mails.

Joe Quackenbush, my writing advisor, for his encouragement, motivation and willingness to read.

Jan Kubasiewicz, for his honesty and ability to simultaneously confuse and inspire me.

Steve Gentile, for sharing a passion for animation.

Hu Hohn, for his intelligence and common sense.

Fred Wolflink, for teaching me about electronics.

My zoo collaborators, especially Anthea Lavalle, who gave me an amazing opportunity.

Most importantly, my family. I love you all.

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BOING! BOING! BOING! BOING! BOING! BOING! BOING! CRASH!!!!!

introduction

Ahhhh – the sounds of my childhood. Whether I was bouncing my pogo stick up the driveway or walking on stilts in the Fourth of July Parade, I was a kid on the move. Physical interactivity is at the core of my existence. I have always loved a physical challenge. Stilts and pogo sticks led to years of modern dance training where I honed my sensitivity to the nuances of human movement.

It is no surprise that human movement is central to my graduate studies at Mass Art. From the beginning, I looked for ways in which human movement could be integrated with new media applications. I created films and prototype applications that gave the user an experience of motion. I rendered movement through the medium of animated films. But what interested me the most was making interactive systems that required a user to move.

My professional pursuits also shaped the direction of my studies. For the past eight years I have taught design at the college level. I enjoy being a teacher - shedding light on a new subject and helping students to make new connections. Upon entering Mass Art, I thought that my love for teaching would manifest itself in the production of teaching tools. While my final project is actually a teaching tool of sorts, it is not like any I could have imagined.

Animation played a major role in my studies as well. Over the past three years, I produced several animated shorts using a wide variety of animation techniques. While I initially thought that animation was adjacent to my thesis research I eventually saw connections between animation, human motion and education.

Animation, motion and education: these are the core components of my thesis. In a spiraling path of creation, reflection, and analysis, my process has been about combining these elements in different ways. Eventually, I arrived at a unique area of investigation: interactive, animated, motion-based educational experiences for an exhibit space.

motion as experience

I have an innate desire to give the user an experience of motion. I love to move and, I suppose it is only natural for me to want to share this experience. When I began to express myself creatively with new media, the work I did reflected my desire to give the user a unique experience of human motion.

"I love to move and, I suppose it is only natural for me to want to share this experience."

the way i am wired

As a child, my favorite toys were ones that involved some sort of physical challenge. I owned a pogo stick, stilts, a unicycle and a juggling kit, and used them all regularly. I spent hours trying to master these devices.

Why I was so obsessed with these toys I can not explain – it is just the way I am wired. What I recognize, however is that they all require a physical output from the "user" in order to participate. The initial participation is awkward, but is eventually overcome after practice. Finally "getting it" feels terrific. Plus, engaging in these activities tends to garner the practitioner a lot of attention. I think this aspect appealed to me a little as well.

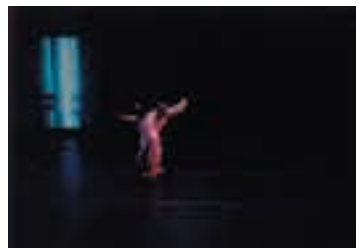
early attempts

From 1996-1998, I earned a Masters of Art at Cornell University, studying apparel design, computer science and modern dance. While I was there, my dance teacher selected me to work with him and a group of students and faculty from four other disciplines: film, art, music and architecture to discuss and do work that dealt with new media. The goal was to think about how new media could be incorporated into the existing curricula of the various disciplines or question whether it should be an entity of its own. From my participation with this group, I collaborated with a film student, creating a dance/video performance that was showcased in a concert at Cornell.

The piece began with two dancers standing in the middle of the stage. Large mirrors on the back and one side wall were exposed. An operating video camera that pointed towards the dancers also shared the stage, and a projection screen that displayed what the camera was capturing hung against the back wall. Although the camera was capturing the action real-time, because it was recording what was happening in the mirrors, the resulting projection was a disorienting, altered perspective. The distortion of the dancers depended on the location of the dancer in the space; at times the projection would display one of the dancers, sometimes both, sometimes even 4 versions of 1 dancer in different views and scales.

The choreography was designed to slowly reveal the complexities of the space. As the music began, the dancers worked their way around each other, venturing into a virtual space that was gradually revealed on the screen. The choreography remained simple. My intention was to flirt with the relationship between the virtual and real characters while highlighting the beauty of simple gestures when seen in a new context.

The first time I saw the piece in rehearsal, I honestly can say it took my breath away. It was an experience of human motion like none other.



Images of video/dance piece performed at Cornell University, fall 1997.

you are here. you will be there.

background

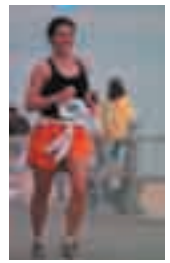
The first project assigned to us as incoming 1st year MFA design students at Mass Art was to create an interactive experience that addressed the meaning of "you are here." It was an open-ended assignment intended to reveal our potential thesis interests. The goal for my project was to give users a unique interactive experience based on the process of running a marathon by considering the many meanings of the phrase "you are here."

The phrase "you are here" is most often used to describe physical location. Frequently, a designer must show a viewer the current location within a larger space. This requires them to represent the three-dimensional physical world on a two-dimensional page or screen. The most common solution has been to present an overhead view of the area with an icon representing the viewer's location.

Adding interactive capabilities and simulating three-dimensional space has helped to create more informative diagrams, giving the user a better grasp of "you are here." For example, Edward Tufte, in his book *Visual Explanations* proposed a screen-based solution for a museum kiosk that "put the viewer into the space" by combining a 3-D diagram and real-time video. (Tufte, 1997)

The phrase "you are here" can have meanings other than describing physical location. When these are considered, richer content is found. However, to convey this content in a meaningful way, a designer can not just provide information, she must create an experience.

Museum kiosk interface design proposed by Edward Tufte



At the time, (September 2002), I was training to run a marathon. I was often thinking about running or running while I was thinking, so I naturally applied the phrase "you are here" to the process of running a marathon.

concept

Running a marathon is a rich, life-altering experience where the phrase "you are here" can have multiple meanings. In a marathon, the runner is moving through the physical world, constantly changing locations. It is an experience that has a distinct beginning and end. Therefore, "you are here" can refer to the runner's physical location. During the race, the runner also experiences dramatic fluctuations in her physical state, so "you are here" can also refer to status of energy depletion, or the amount of pain the runner feels. Emotional state is also a component of "you are here." Throughout the race, a runner experiences a wide array of emotions such as boredom, doubt, and elation.

When considering these other meanings of the phrase "you are here" within the context of running a marathon, it is difficult to represent its essence on a two dimensional screen. Even if the runner's emotional state were plot in a well designed "Tufte-esqe" chart, would it really mean anything to the viewer? In order to give a viewer an understanding of the meaning of "you are here," traditional methods of information design must be abandoned and experience design embraced.

So, is the virtual reality the solution? Current virtual reality technology allows us to simulate almost every aspect of the running experience. A system could be built in which the user runs on a treadmill for 26.2 miles wearing wires and sensors that would simulate some dimensions of the experience. However, what, then is the difference between running a real marathon and doing one with the assistance of virtual reality?

Virtual reality is not best method for creating a truly immersive experience, believes Nathan Shedroff. In his book *Experience Design*, Shedroff explains that "our sense of reality is so sensorially stimulating that it's nearly impossible to design an experience that could even approach the immersiveness of reality." He recommends building "experiences that cannot exist in reality and, therefore, sidetrack our senses with novelty and originality rather than simulating reality." (Shedroff, 2001)

Because a virtual reality experience is designed to mimic the real experience, it will not provide the user with insight into the essence of the experience. Therefore, a more appropriate type of experience for this purpose is a perceptual one. This would be a game based on the interrelated variables that define "you are here" within the context of running a marathon.

"It's often a better strategy to build experiences that cannot exist in reality and, therefore, sidetrack our senses with novelty and originality rather than simulating reality as we have beomce accustomed to experiencing it."

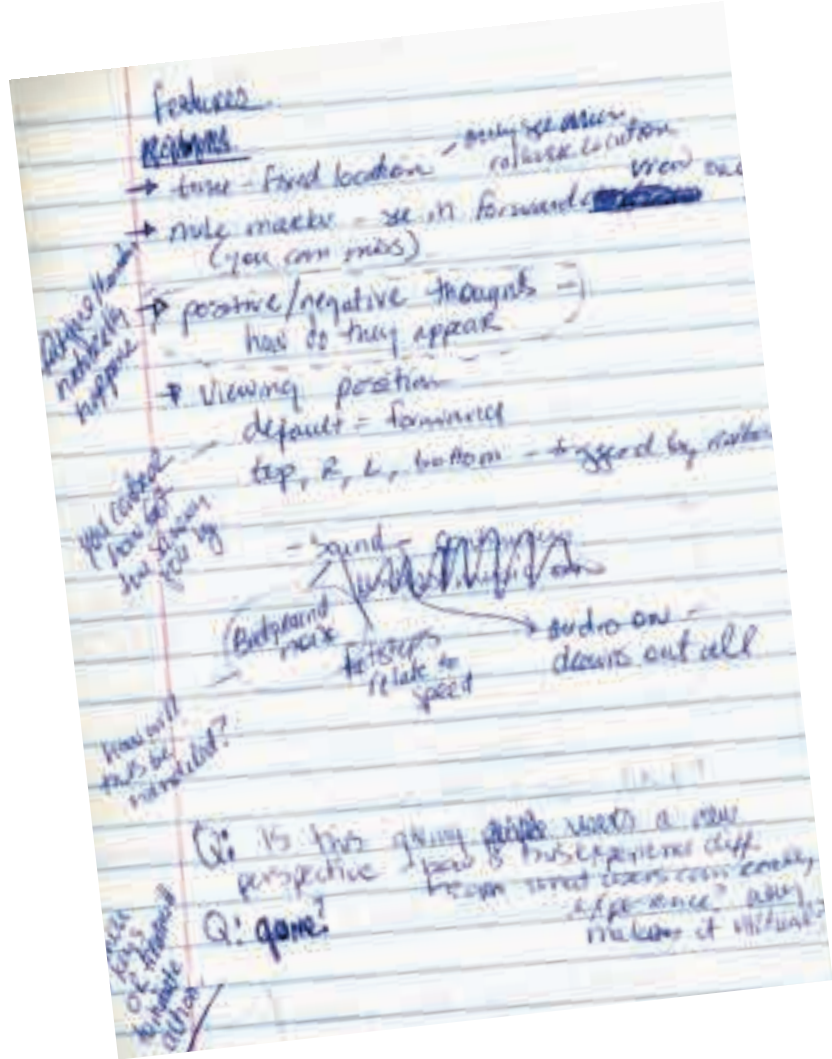
— Nathan Shedroff

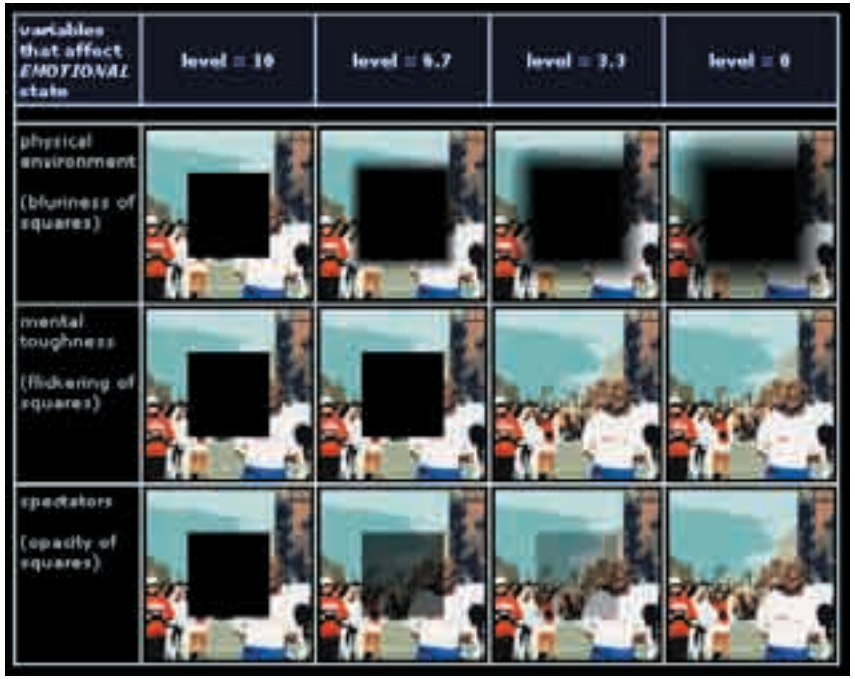
how it works

In this game, the factors that contribute to a runner's emotional and physical state affect the player's ability to progress through the course. The fluctuating factors contributing to the runner's emotional state are physical environment, mental toughness and the behavior of the spectators, the ones contributing to the runner's physical state are: physical environment, fluid consumption, pace, and weather. Some of these variables the player can control and some are random, or based on the course they choose to "run."

The experience of playing the game is similar to running a race in that the player "moves" through a course. But in order to make progress, the player has to "click away" squares that appear on the screen. Sometimes removing the squares is easy, that is when the player's emotional and physical states are at their highest. Other times it can be quite challenging. If the player is unsuccessful at making progress in the race for a given period of time, he does not finish.

What makes the squares easy or difficult to "click away" is their behaviors which correlate directly to the factors contributing to the runners physical and emotional state (physical environment, mental toughness, the behavior of the spectators, fluid consumption, pace, and weather). The emotional variables make the squares more or less visible, thus harder to click away, and physical variables make the squares more numerous, farther apart, or more sticky, which too makes them harder to click away. For example, if there are few cheering spectators on the course, (a factor contributing to emotional state), the squares become quite transparent and hard to see. If the runner gets dehydrated (a factor contributing to physical state), the squares become more numerous.





Charts illustrating the behaviors of the squares at four different levels and their corresponding variables. (Note: some can not be accurately represented in a static format.)

assessment

I did not enjoy working on the Marathon Game. For a long time, the idea remained theoretical and hard to wrap my head around. But once I decided to call it a game, it became more tangible and easier to comprehend. Defining a context for a project helps to clarify design decisions and move it forward. While I thought the marathon game was an interesting idea, not being able to build it and test it was frustrating. I would never know whether or not it was successful. Nevertheless, the merit in this project was that it got me thinking about designing experiences.

Interface design for the Marathon Game.

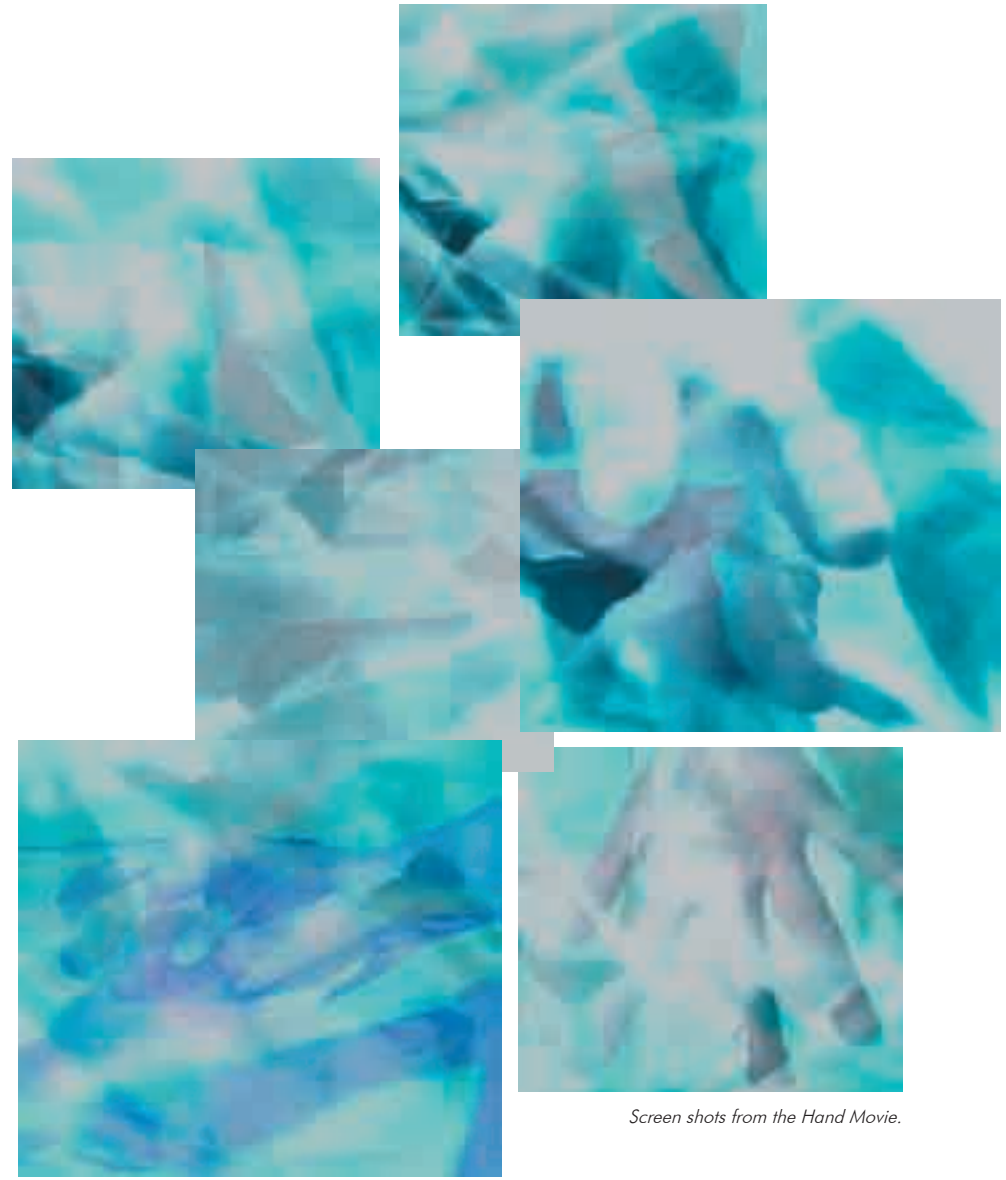
simple gestures

Another early project that dealt with the experience of human motion was my Hand Movie, a piece I made in the Dynamic Typography course. The assignment was to represent music visually using time-based media. The goal of the piece was to not only express the music visually, but to also see if simple, human gestures could take on a poetic quality.

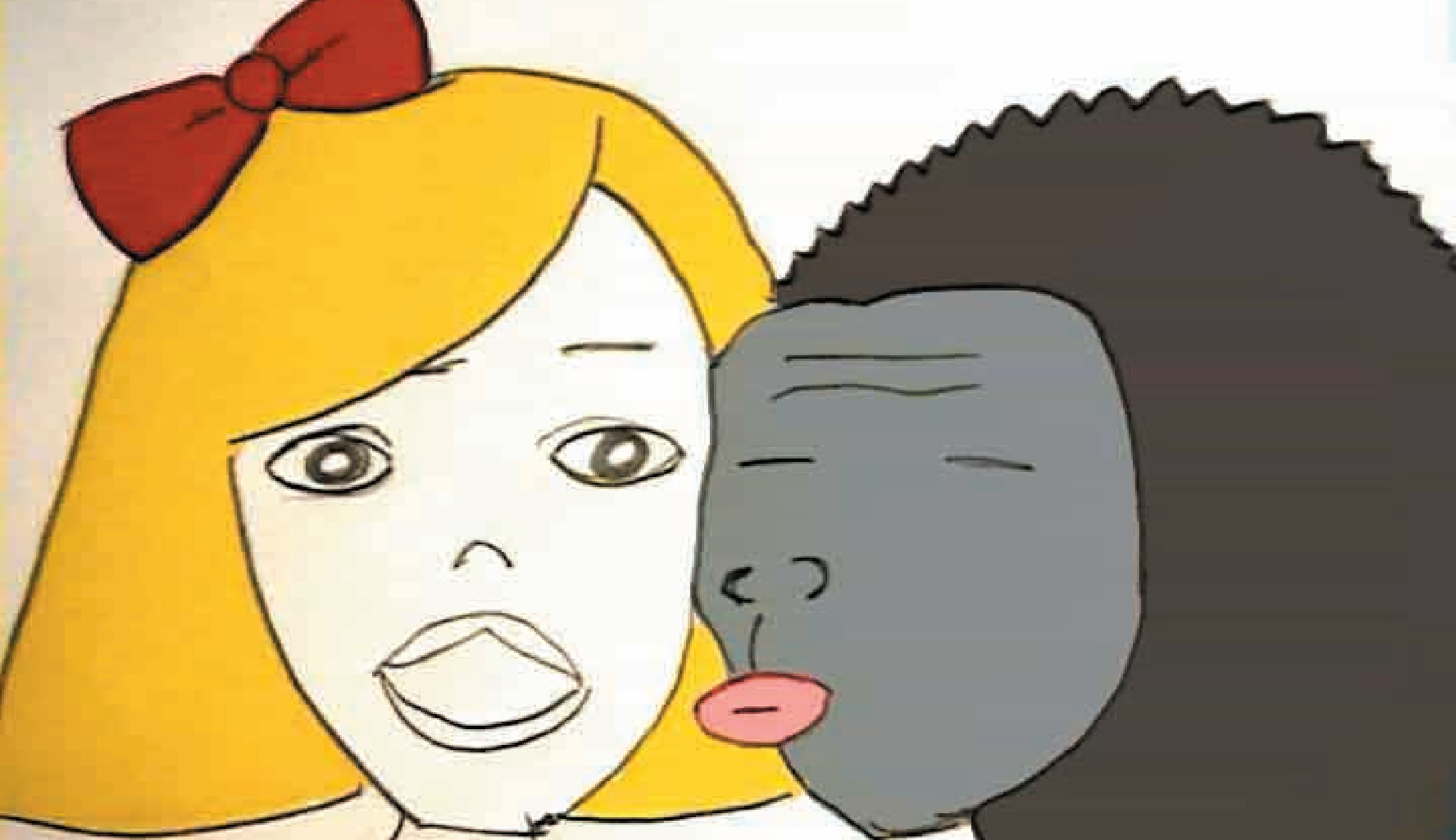
The soundtrack for the film is a short, simple classical guitar piece, "Prelude in C Minor" by Andres Segovia, and the visual language consists of video of simple hand gestures. Volume and speed changes, repetition and other musical patterns dictate the editing style. For example, grander gestures correspond with bolder phrases in the music and darker more colorful clips with louder moments in the piece. In keeping with the simplicity of the music, the color palette is limited to muted shades of pale blue.

Was I successful at accomplishing what I set out to do? I think the piece could have been stronger. The most interesting moments in the piece are those in which the visuals are abstract and the subject slowly becomes apparent. And at the end of the piece, when the music picks up, the gestures should have matched the energy. Even in a short, abstract piece, there should be an introduction, tension and resolution.

While the visual language of the Hand Movie was limited, it could have been exploited to a greater degree to demonstrate a larger range of visual possibilities. Nevertheless, there are some beautiful moments in the piece that cause even me to see a simple hand gesture in a new light.



Screen shots from the Hand Movie.



animation

Animation is a natural extension of my interest in motion. According to animation expert, Ed Hooks, "Animation is motion." In animation, motions alone can sometimes tell the story.

I have created many animations while at Mass Art. Almost every elective course I took during my tenure pertained to it. Animation is an inherently joyous and flexible medium that is easy to create independently. It is the perfect vehicle for the type of stories I want to tell and the experiences I want to offer.

"The new animators assume direct responsibility for nearly every aspect of the filmmaking process: concept, drawing, shooting, even camera stand construction. This reclamation of creative authority contrasts sharply with the impersonal assembly-line production system of the studio cartoon industry."

— Kit Laybourne

"Animation is an inherently joyous and flexible medium."

my background in animation

When I arrived at Mass Art, my background in animation was limited. Immediately out of college I worked as a 3-D animator for a legal services company. My job was to animate scenarios and visualize the operation of products that were being disputed in a court of law. I was hired primarily because I had a background in engineering and some experience with graphics software and could therefore apply numerical data to virtual objects. While there was a component of story telling involved in this work, little room was left open for artistic expression.

When my career led me into web development, I was naturally introduced to Flash. Some of the professional web sites I made included animated Flash components. I then got a job teaching Flash. This forced me to have a very thorough understanding of the application.

Stills from 3-D animations for litigation.

the hook

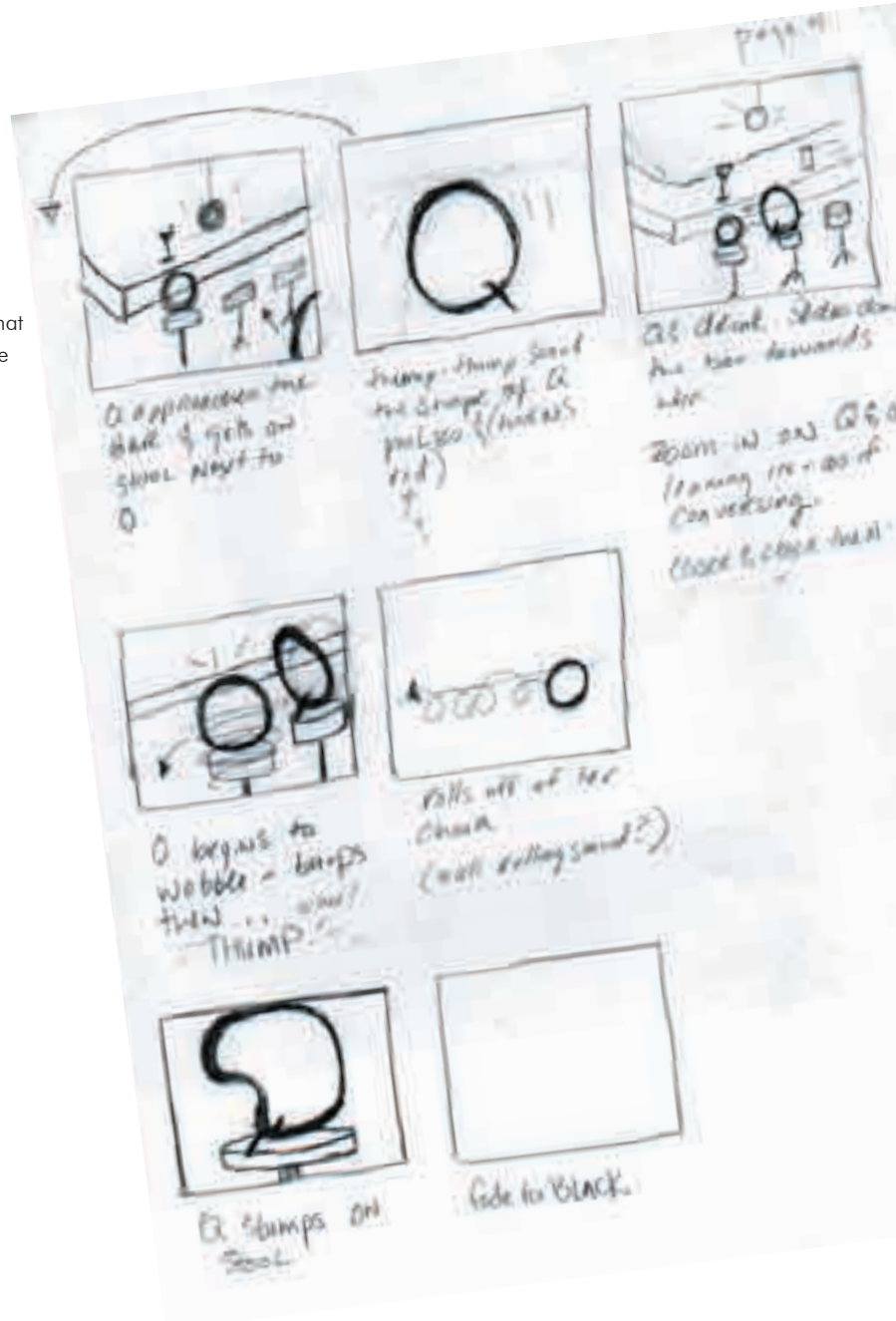
In the latter half of the Dynamic Typography course, we received our second assignment, to create a short narrative piece based on the theme, "Eureka!" I approached the project with a sense of humor and followed my own instincts with respect to look and feel, music and editing.

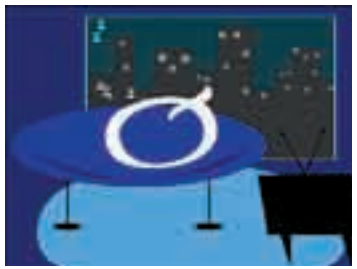
In the film, "Eureka!" refers to moment of joy when finding love after a long and frustrating search. The protagonist is the letter Q, a lonely bachelor looking for love. Throughout the film, he meets and unsuccessfully approaches each of the vowels: A, E, I and O. He becomes more and more dejected, and in his despair tries to put himself out of his misery. At the 11th hour, however, he is rescued, and it is love at first sight with his savior, the letter U.

There is no narration in the piece, just sound effects and a Motown soundtrack that helps tell the story. For example, in the opening scene when the audience is first introduced to the letter Q, we hear Al Green sing, "I'm so tired of being alone…" And, when the Q is dizzy with lust after first seeing the letter I, "Lets Get It On" plays in the background.

Because the characters do not speak, their emotions are communicated via body language. So, as the Q becomes increasingly dejected his shape grows more distorted, and whenever he is hopeful, he straightens up a bit. This is an exemplification of how motion of an animated character communicates the narrative of the story.

This piece marked a turning point in my studies at Mass Art. It was completely uninhibited, silly and totally reflected my personality, and its success gave me confidence to approach future projects in a similar manner. It was also the hook that whet my appetite to make more animated films.





Screen shots from the animated short "Eureka! A Love Story."

I'm so tired of being alone
I'm so tired of on-my-own
Won't you help me girl
Just as soon as you can

People say that I've found a way
To make you say that you love me
Hey baby, you didn't go for that
It's a natural fact
That I wanna come back
Show me where it's at, baby

I'm so tired of being alone
I'm so tired of on-my-own
Won't you help me girl
Soon as you can

I guess you know that I, uh, I love you so
Even though you don't want me no more
Hey hey hey hey, I'm cryin' tears
All through the years
I'll tell ya like it is
Honey, love me if you will

Yeah baby
Tired of being alone here by myself, now
I tell ya, I'm tired baby
I'm tired of being all wrapped up late at night
In my dreams, nobody but you, baby

Sometimes I wonder
If you love me like you say you do
You see baby, I been thinkin' about it, yeah
I been, I been wantin' to get next to you baby
Ya see, sometimes I hold my arms, I say
mmmm hmmm hmmm
Yeah baby
Meeting you has proven to me
To be my greatest dream, yeah

Tired, baby
Yeah, you don't know what I'm talkin' about
Sometimes late at night I get to wonderin'
about you baby
Oh baby, baby
I'm so tired of being alone
I'm so tired of being alone
I'm so tired of being alone...

— Al Green

why animate?

I was told by one of my animation teachers that "no accolades you receive for the work you do in this medium will ever be worth the time you put into it." I believe there is some truth to that statement. But animation still appeals to me on a number of levels.

Animation is choreography for the screen, and it is a natural extension of my love for dance. When teaching animation I often use choreographic analogies. I frequently tell my students to "surprise the audience," or "keep the movement flowing." I also have my students improvise and collaborate just as I would when choreographing.

One assignment I give my students is to create a collaborative animated music video. It is a process analogous to choreographing a dance piece. I begin by playing the selected music piece for the students and having them brainstorm a list of objects that come to mind. From these lists emerge a theme. Next, I assign each student one or more of the objects relating to the theme to animate. When these are complete, I gather them into a master Flash library and redistribute it to the group. I also break up the music into approximately ten second clips. Each student then animates the graphics in the library to their music clip.

There are several challenges in this project. One is organically transitioning the animated clips from one student to the next. Another is using the symbols created by other students in unexpected ways to keep the animation fresh and interesting. These obstacles are not unlike ones a choreographer experiences when putting together a dance.

Screen shots from a collaborative animated music video created by my students at the New England Institute of Art.

"Animation is movement. Movement is animation."

— Ed Hooks

The connection between dance and animation became clear to me after learning about famed musical choreographer of the 1930's, Busby Berkeley. I was first introduced to his work in the summer of 2002 when I took a course called "The History of Film Style". Just like the audiences of the time, I was mesmerized by Berkeley's ability to create abstract and unusual geometric patterns on screen using the human form. He was continually surprising his audience, offering them unique perspectives that could only be achieved through unconventional camera angles and absolute control over the positioning and movement of his subjects. (Zimmer, 1998)

Animation, however, offers one advantage over choreography: autonomy. Kit Laybourne, in his book *The Animation Book*, describes animation as a "reclamation of creative authority." (Laybourne, 1979) When animating, as opposed to choreographing, the animator has the ability to control all areas of production. For this reason, I am drawn to working in the medium. I can write the story, design the characters, choose the camera angles, and determine the look and feel all myself. If I were working in film or video with live actors or dancers I would not have that kind of influence. Berkeley's productions required hundreds of people to be involved. In order to make any type of production in film or video, you must almost always rely on someone else.

It is not just the autonomy of animation that appeals to me. Animation is a unique medium that lends itself to the kind of material I am interested in conveying. In general, the stories I want to tell – whether they take the form of an animated short or an interactive experience — are funny, educational and geared towards kids. Animation is the perfect vehicle for this type of storytelling.

Animation is a natural medium for humorous content. Because animated characters are created by an individual whose vision is unique, their appearance and motions are stylized and often don't reflect reality. Consider any animated character. Do their proportions and movements mimic our own? In most cases, the answer is no.

Part of the reason why South Park is so funny is that the characters are comprised of a rectangle for their bodies and an oversized circle for their heads. Their range of motion is limited to bobbing around the scenes. The characters reflect a ridiculous distortion of reality, which contributes significantly to the hilarity of the show.

It is easy to exaggerate when you are animating, either intentionally, or by your own limited abilities, and that can turn out to be funny. More than once, I have heard an animation teacher tell his class that an animator shouldn't be good at drawing. Some of the drawings of the gorilla, Little Joe, in my movie "The Great Escape," are pretty rough. In fact, I have been told that Little Joe looks more like a man in monkey suit than a gorilla. However, it is the unrealistic nature of the drawings that contribute to the humor of the piece.

The beauty of animation is that it allows us to invent characters and stories that could not exist in any other medium. "Animation is not supposed to be real life," states Ed Hooks in his book *Acting for Animators*. (Hooks, 2003) His point is illustrated in a scene from the movie, *Shrek 2* (2004), where Shrek and his cohorts are chained to the inside of a well. Pinocchio and the Gingerbread Man descend into the well to try to save them, but the well is too wide and they can not reach the side where Shrek, Donkey and Puss N' Boots are chained. Fortunately, quick witted Donkey gets Pinocchio to lie, (that he is not wearing ladies underwear) which makes his nose grow allowing Gingerbread Man to use it as a bridge to get to the trio and save them. A scene like this could only be animated because it in no way reflects reality.

While animated stories often transcend reality, the characters and scenes in an animation are often simplified versions of reality. This might explain why animated content appeals to kids. When we reduce a representation of a person, place or thing down to its minimal components we make it easier to identify with. This phenomenon is explained by Scott McCleod in his book, *Understanding Comics*.

Simplified visuals also facilitate learning. When I worked as a 3-D forensic animator, we used animation to clarify complex actions such as how a chair lift or a two-stroke engine works. In situations such as these, we visually edited, using color and camera position, the elements that were unimportant and highlighted those that we wanted the viewer to notice.

my animated shorts

the 10 hour movie

In my second year at Mass Art, I took an animation course (Animation 2) that allowed me to experiment with traditional animation methods. The course commenced with an assignment called "The 10-hour movie," which was so named because you were only supposed to spend about ten hours on it. The idea was to learn how to draw quickly, improvise, and experiment with different shooting techniques to build up about one minute of animated content.

I completely missed the point of the assignment when I made the required 100 drawings. I used pencil and drew a bunch of flowers in a painfully awkward and stiff style. We were only supposed to spend about one minute on each drawing, but I just couldn't draw that fast. My first 100 drawings took at least 10 hours to make.

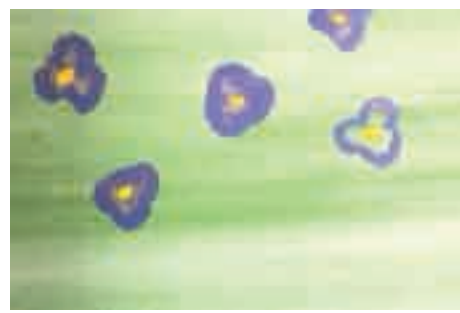
My instructor had the same response to my drawings that I already felt: too studied, too stiff. Why I had made a collection of stiff pencil drawings when I envisioned my resulting animation as lush, green and wild, I do not know. Actually, a fellow student recommended that I work in pencil because I could always add color later, digitally. Obviously, for the look I was going for, this was misguided advice. Sometimes there is no digital equivalent for an analog effect. I decided to redo my 100 drawings.

This time I made a mess with acrylic paints. Working quickly and loosely, I filled index cards with bold strokes of color. And even though I still spent too much time on each, the resulting drawings came closer in look to what I had intended.

When shooting the series of drawings, I used every imaginable technique shown in class. I shot the drawings in sequence, out of sequence, zooming in and out, at an angle upside-down and adding blur over time. I then edited the movie clips together to "Japura River" by Phillip Glass.

At the time, I was pleased with how the movie turned out. In retrospect, the drawing looks stiff. It takes a great deal of practice to learn to draw fast and loose. I am still working on it. In animation, looseness is important for creating an illusion of movement. If the drawings are too studied and stiff, the movement will not look fluid. And, if you spend too much time on each drawing, you will never finish your animation.





Screen shots from the 10 hour movie.

the 10 object movie

The second assignment in Animation 2 was to animate objects underneath the camera. While this project was less labor intensive since there was no drawing involved, it too had its own set of challenges. One of the rules was that the ten objects relate in theme. The other was that no digital transitions were allowed between the animations of the different objects; one object had to organically evolve into the next.

The subject of the film is pregnancy, and the animated characters include plastic babies, pre-natal vitamins, a book about pregnancy, a baby sock as well as several others. I also incorporated still shots of my own face.

The animation process was spontaneous and experimental, as this was also part of the objective of the assignment. In the film, pre-natal vitamins are birthed, (or defecated depending on your interpretation), by a plastic pig. They then take the shape of a flower but become engulfed by a red PLAY-DOH sphere that turns into a pregnant belly, etc…

I did not enjoy making this piece, because I do not like having to rely on pre-existing objects as elements in my animation. I prefer designing my own characters. I also do not enjoy improvising, but I do see the value in it. Improvisation is often used in the creation of dances to help generate new movement passages. Similarly, in the process of making this movie, I discovered new ways of transitioning, shooting and creating animated content.

Screen shots from the 10 hour movie.

The theme I chose for the 10 object movie was pregnancy as I was about six months pregnant when I made it.

fall 2003

the great escape

The final assignment in Animation 2 was to create a short narrative piece. For this assignment, I made a movie called "The Great Escape," about the gorilla, Little Joe, who escaped from the Franklin Park Zoo.

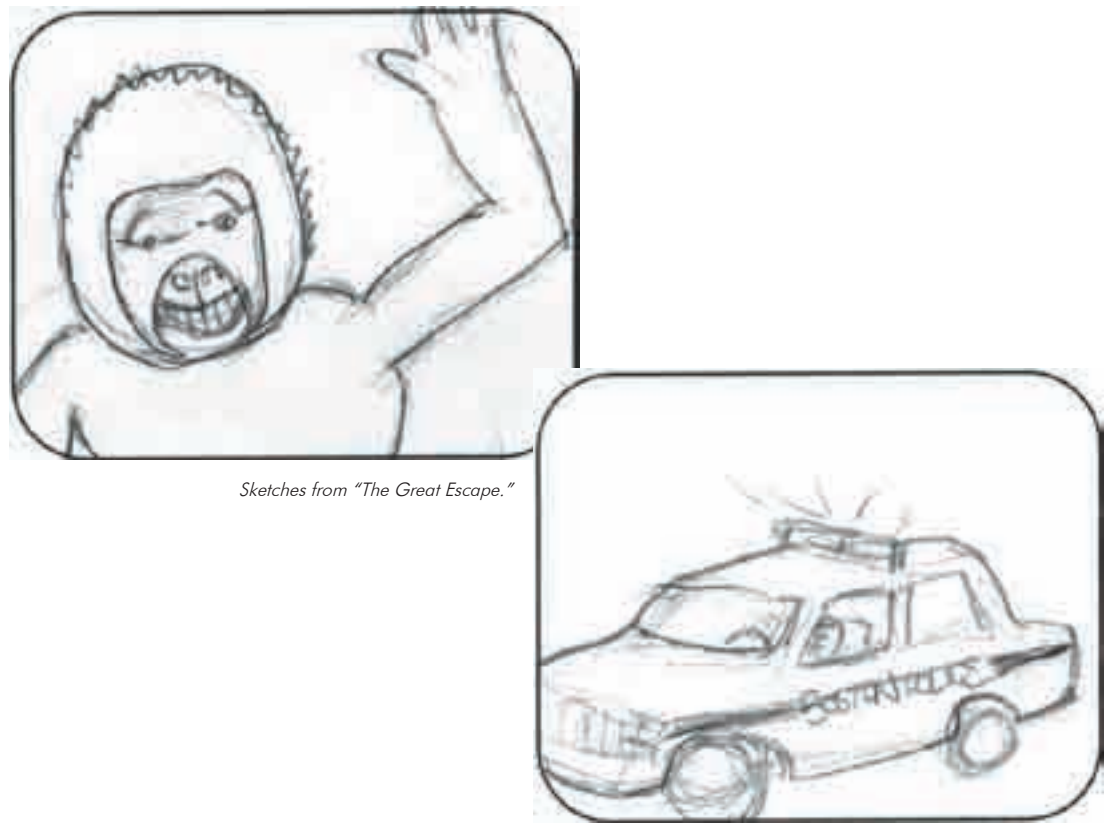
The idea behind the movie was to tell the story of the escapee gorilla from a child's point-of-view. A child's perception of this event had to have been very different from that of an adult. Telling the story from this perspective could be really funny and perfect for animation.

The first method I used to produce the narration for the short was not successful. My idea was to record my nephew telling the story and then animate his version. I spent a few hours chasing him around with an audio recorder trying to get him to talk about what happened to Little Joe. The problem was that the resulting recordings were almost unintelligible, and they didn't hold together at all as a story. My solution was to write a poem loosely based on a child's perception of Little Joe's experience and have a child read the poem.

I got the idea for the story after getting a call from my three-year-old nephew who heard about the escaped gorilla on the radio in St. Louis (where he lives). He was concerned that the gorilla might have "gotten me," so he was calling to see if I was okay.

Once I recorded the narration, I storyboarded the piece and made an animatic to see how the scenes fit with the audio. Finally, I created 300 pencil drawings, shot them, added color digitally and then edited them together. The entire process took about a month.

The film has garnered several accolades. It was featured in the New England Animation Bash, the CINEME Animation Festival, the DAM Short Film Festival and the Phoenix Film Festival. It was even screened at the Franklin Park Zoo. However, when I look at the piece now, I see room for improvement. The rendering of movement looks stiff and awkward, and the addition of color seems unfinished. Also, the direction of the scenes does not take advantage of the flexibility of the medium. A play could be staged in the same manner as the animation is presented. Animation is interesting and exciting when perspectives are altered and objects morph into each other in unexpected ways.



Sketches from "The Great Escape."

Stills from "The Great Escape."

It's Six o'clock – and the crowds are all gone.
The zoo will be quiet 'til night becomes dawn.

The hippo was snoring, the snakes' eyes were closed —
The giraffes' long necks in a state of repose.

But one big gorilla named "Little Joe"
Did not want to sleep. He wanted to GO!

All day in a cage, Little Joe wanted more!
So when no one was watching he snuck out the door.

And out of the zoo and on down the street,
Oh what would he do, and who would he meet?

His first encounter was a lady in fur.
Little Joe said "hello," but it came out as "GRRRRR."

So off he went to the park to play
With kids that had been to the zoo that day.

A cute little girl who was flying her kite,
Little Joe tried to kiss, but gave her a fright.

Joe ran away. He fled to the woods.
He had tried to be kind but was misunderstood.

But before Little Joe could get very far.
Hot on his trail was a Boston squad car.

Once back at the zoo, Little Joe was not mad.
He'd missed his mom. He'd missed his dad.

The lesson he learned from fleeing his pad
Was that humans are crazy - they're stark raving mad!

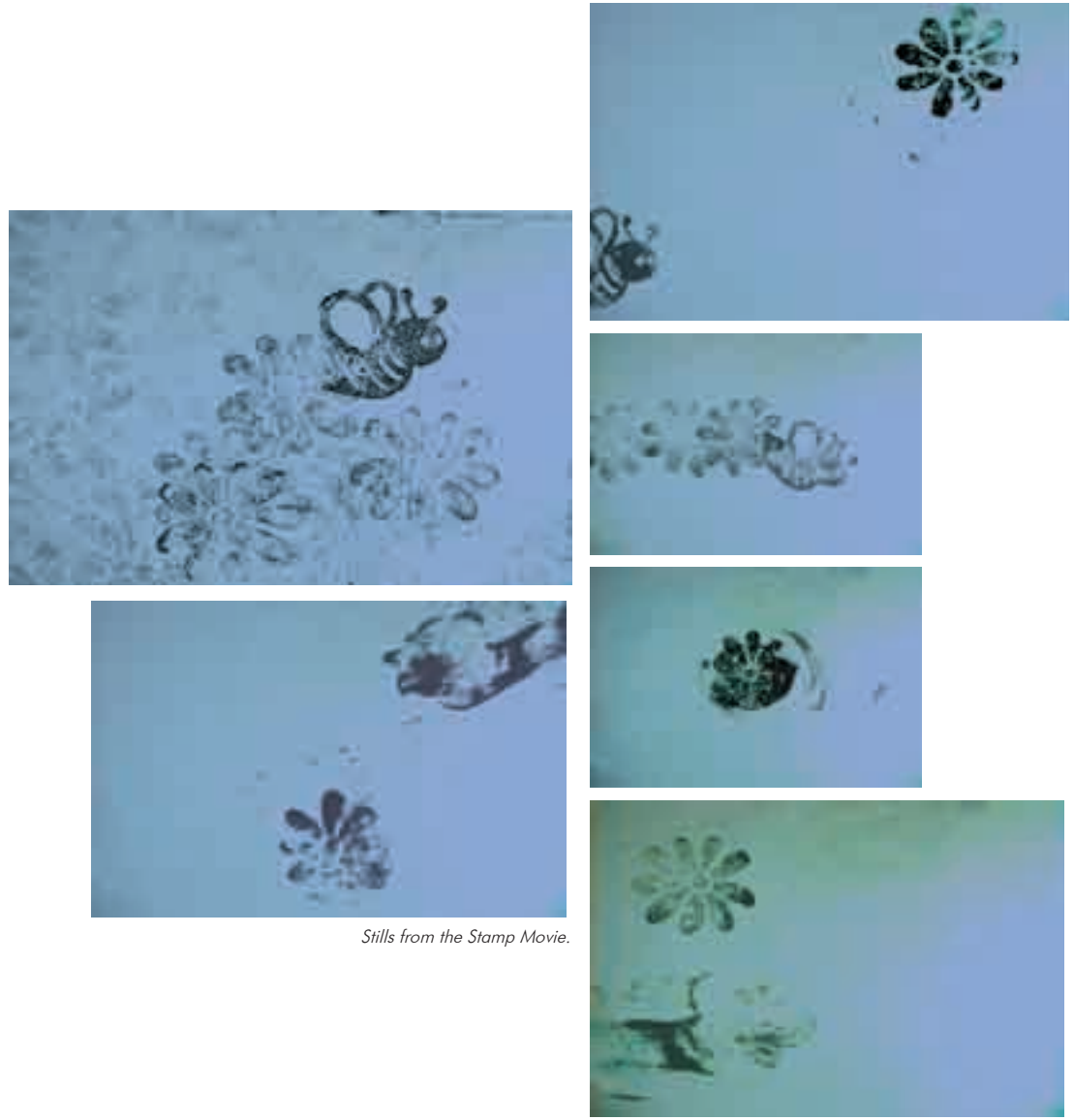
stamp movie

In the summer of 2004, I enrolled in an independent study with my Animation 2 instructor, Steve Gentile. At this point I had time to reflect on my previous work and wanted to improve my animation technique.

The Stamp Movie and Animal Studies 1.0 are two short films that focused on the representation of motion. The Stamp Movie is an animation created solely from handmade linoleum block stamps and about 700 sheets of paper. The two characters are a bee and a flower.

The movement is fast and jittery as the animation was to be shot at 30 frames per second, i.e. one drawing for every 1/30th of a second of animation. Typically animations are shot at either 12 or 15 frames per second. It was part of the objective of the assignment to experiment with animating for a very high frame rate. Shooting at different frame rates helps an animator get a sense for timing and how much one drawing should differ from the next.

After I shot the first 500 sheets, I edited them together to make a short movie. The most interesting animation occurred about 350 frames into the movie. It was at this point that I had grown thoroughly tired of stamping and started getting messy. I was smearing the stamped images, twisting and distorting them, and this made for much more lively animation. This project illustrated that creating the illusion of movement can't be done by displaying static images in succession; the images themselves must be dynamic. I returned to my stamping project and created a few hundred more stamped images, this time trying to keep them as dynamic as possible. Finally, I added music and edited the piece together.



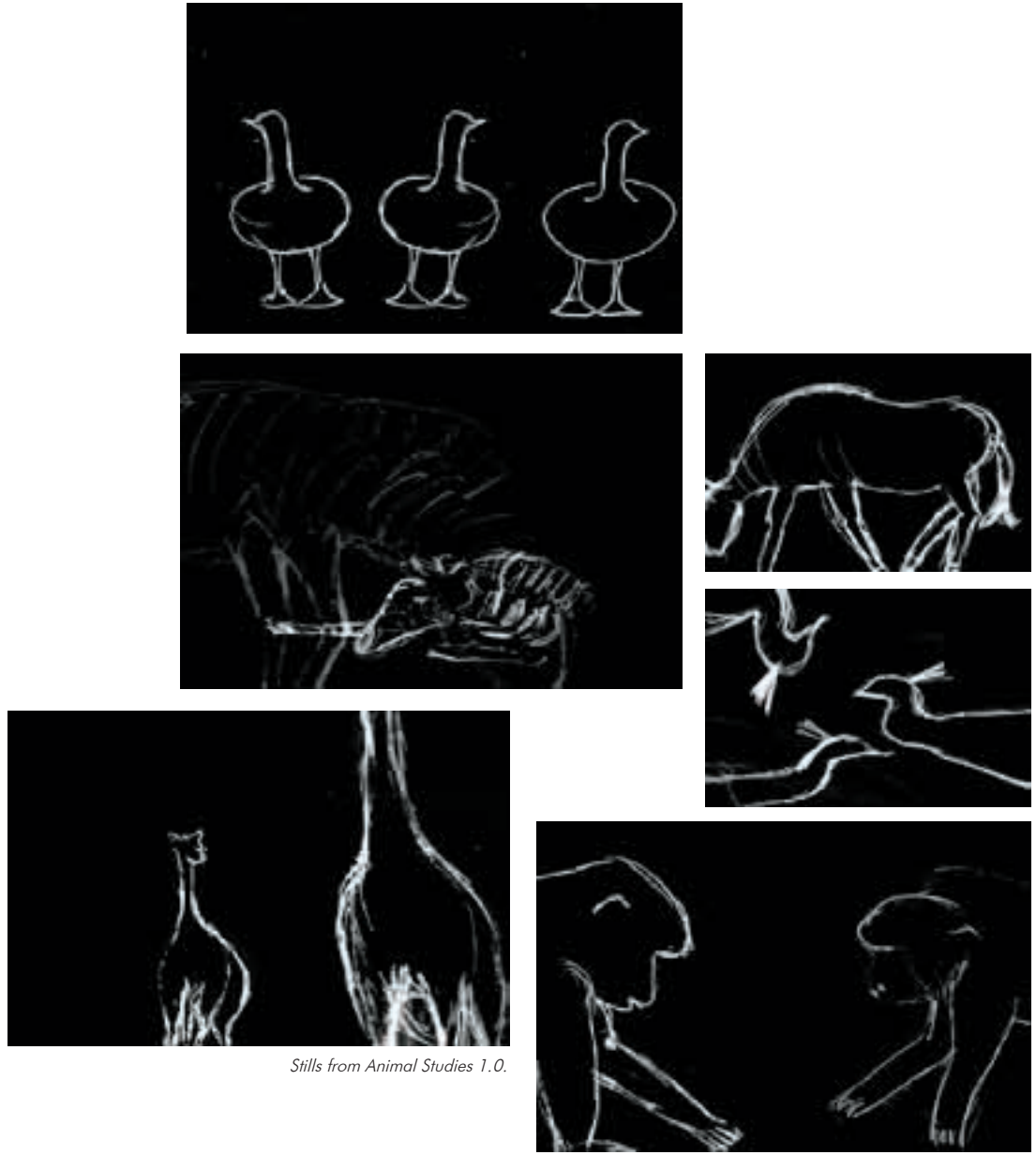
Stills from the Stamp Movie.

animal studies 1.0

The short, animated film, Animal Studies 1.0, evolved from a rotoscoping exercise. Rotoscoping is a process of creating animation by drawing frame-by-frame from film or video. It is done either for educational purpose (as in my case) or when the animator wants a character to move in a realistic way. I drew frame-by-frame from video I captured at the zoo, which resulted in about 400 drawings of zebras, gorillas, giraffes, birds, peacocks, and ostriches. I shot all of these drawings, reversed the colors (in PhotoShop) to make the images white lines on a black background, and then edited the movement sequences together to music to make a short piece.

While I am now pleased with the final piece, in the process of drawing, I questioned whether the images I was making were even going to be usable. I had been trying to draw quickly, so some of the sketches looked so crude they hardly resembled animals. When I shot the drawings and made them into short movies, I was amazed at how realistic the movement appeared. This project demonstrated that, when animating, it is not the quality of the individual drawing that matters, it is the sum of the images as a whole.

I told my animation teacher, Steve, that I wanted to make my characters' motions more realistic. He told me that the best way to improve your rendering of motion is to observe and recreate. Since, at the time, I suspected my final thesis project might involve animals, I went to the zoo and observed animals in motion.



Stills from Animal Studies 1.0.

true tales from the ER — an animated documentary

True Tales from the ER is an animated documentary, which is an animation set to real audio. This genre of animation has gotten much attention recently due, in part, to the popularity of Robert Smigel's animated shorts, "Fun with Real Audio" on Saturday Night Live. In his shorts, Smigel uses audio from sources such as TV interviews with celebrities and then animates to the audio with a liberal artistic license.

Smigel's films are funny because the audio was made without the intention of it ever becoming a soundtrack to an animation. It is the juxtaposition of the reality of the audio and the fantasy of the visuals that make this genre of animation interesting and often very humorous.

Another brilliant example of animated documentary is the Oscar winning animated short "Creature Comforts" by Nick Park. Park collected audio by asking children to talk about what life is like for an animal in the zoo and interviewing elderly people about life in a nursing home. He then applied this audio to his animated zoo animals. The voices of the subjects are matched cleverly with the different animals. For example, audio sampled from a dramatic, elderly Brazilian man is spoken by a lion and a young girl's timid voice comes out of a colorful little bird.

In my film, "True Tales from the ER," the audio source comes from an interview with emergency medicine doctor, Michelle Finkel. Dr. Finkel works in the Emergency Room at Massachusetts General Hospital. Her workplace stories are unbelievable, and hilarious on their own. Adding animation could only make them funnier.

Still from a Robert Smigel "Fun with Real Audio" animation.

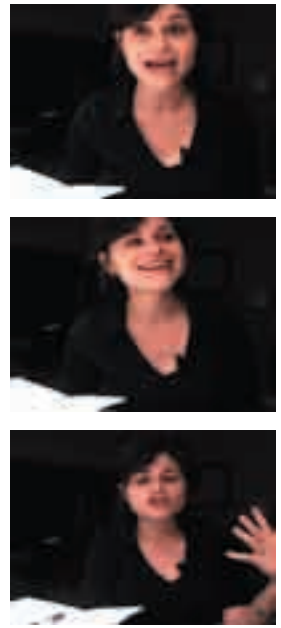
Still from "Creature Comforts" by Nick Park.

Recording Michelle telling the stories and editing them down to the bare essentials was challenging. I recorded her in two sessions, but I ended up using none of the second session. After I recorded the first session and tried editing it, I thought that I needed some filler material in order to give the piece context. So in the second recording session, I told Michelle what I needed her to say. Inevitably, it sounded forced and stilted and completely lacking in the spontaneity of the first session. This proved that the best audio for animated documentaries must be generated with out the intent being known.

My solution to the context problem was to provide it visually. Instead of having Michelle introduce herself and explain what the stories were about, I animated an ambulance speeding down the road in the opening scene to clue the viewer in to the subject matter.

It was difficult deciding what stories to keep and how to sequence them. I kept stories that had the most interesting visual potential and weren't too obscene. Also, I didn't want to open with the most shocking and stomach-churning tale so I ordered the stories in an attempt to "warm the viewer up." The resulting track was about 3-and-a-half minutes long.

I had an interest in creating an animated documentary since I made "The Great Escape," when I had initially tried to chase my nephew around with an audio recorder and get him to talk about Little Joe. When I expressed interest in trying again, my animation teacher, Steve asked me, "well, who do you know that can tell a good story?" The first person I thought of was a friend, Michelle Finkel, who works as an emergency medicine doctor at Massachusetts General Hospital. Her stories are legendary.



Images of Dr. Michelle Finkel telling her tales from the ER.

"Maybe the pretty doctor will let you spank her after the intubation."

— woman to her husband in the Emergeny Room at Massachusetts General Hospital

Deciding how to animate was also difficult. Depicting every story literally was not an option. For one, the material is a bit crude and sexual. And secondly, animation is more interesting when it is not a literal interpretation of the narrative. So, I added an element of fantasy to the story telling. For example, when Michelle is given a compliment that she has "brains and beauty," I chose to convey her imagination. At that point in the film, Michelle turns into a slimmer, sexier bikini clad version of herself. I found that some of the non-literal interpretations of the content I came up with simply didn't work. But, by creating an animatic before animating, I was able to eliminate unsuccessful sequences.

This short film was the most labor intensive I have made to date, but I am pleased with the results. Compared to my earlier films, movement passages look more organic and the drawing appears loose. In this piece, I am taking advantage of the plasticity of the medium. It feels more imaginative and free from a literal representation of the narrative then my earlier work.







Stills from "Tales from the ER"

human motion and new media

"All you have to do is go to your local arcade,
stick $20 a day into a Dance, Dance Revolution machine,
play the games and you'll be thin in no time.
Take the incredible DDR diet."

— Eric Kjellman's DDR diet, as espoused on www.ddrfreak.com.

what is human motion and new media?

You see a figure from a distance and although you cannot make out the individual's features, you can immediately determine the approaching person is someone you know. Our natural, everyday movements are unique; they distinguish us from others. They are our signature: incredibly varied, yet distinct and instantly recognizable.

Human motion is complex and difficult to fully comprehend. However, new media can aid our understanding. Over one hundred years ago Eadweard Muybridge utilized the new media available to him (photography) to try to understand human motion. His series of still photos taken at fast shutter speeds provided new insight into the nature of human movement. While we now have more sophisticated tools, our analyses can be more comprehensive. One example is Visual 3-D, a software package made by C-Motion that allows researchers and clinicians to analyze human movement. With this software, movement can be seen from multiple angles independently and simultaneously. Specific points on the body can be tracked as well. (www.c-motion.com)

The organic nature of human motion is a highly valued attribute, as researchers have not yet discovered a means of generating it artificially. Digital creators appreciate this quality and use motion capture systems to collect human motion. They then apply the human motion data to virtual characters to give them life-like characteristics.

An Eadweard Muybridge movement study.

At the end of our first year in the program we were encouraged to identify a potential topic for our thesis investigation. At this point I had just started doing some animation in my elective courses, but I considered it a side interest and not part of my real thesis work. So, in May of 2003, I declared that my area of interest was human motion and its intersection with new media. The working title of my thesis was "Human Motion + New Media."

New media has a broader range of uses relating to human movement then just analysis and capture. Many different systems have been created that channel expressive movement in other formats. For example, with Teresa Nakra's "Conductor Jacket," depending on the way the wearer moves, different qualities of music are generated. In Joe Paradiso's "Stomping Ground" both music and visuals are created based on how users move in the space. (http://www.immersionmusic.com, http://web.media.mit.edu/~joep/SpectrumWeb/captions/Carpet.html).

When considering the connections between human motion and new media, it is impossible to ignore the work of choreographer, Merce Cunningham. He is a strong advocate for using new media tools in the choreographic process. For the past fifteen years, Cunningham has relied on the software, DanceForms to make all his new works. This application allows him to explore movement possibilities that his octogenarian body can not perform. It also facilitates seeing movement passages in different combinations from different angles. Merce Cunningham even uses new media to transform the nature of the dance medium. For example, one project he is currently working on is an entirely virtual original dance piece. In this piece, "viewers enter a virtual hand-drawn world in which abstract dancers perform a full and completely new Cunningham work." (http://www.merce.org, http://www.charactermotion.com/danceforms/)

A virtual dance installation by Merce Cunningham.

The Stomping Ground at the MIT Museum.

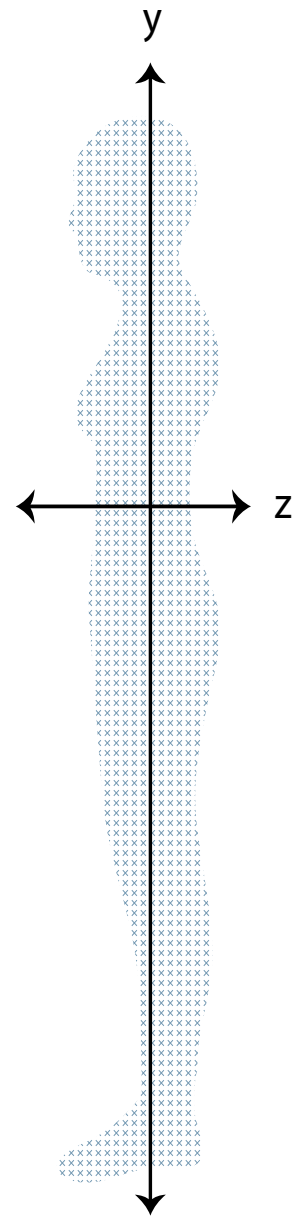
why was i interested?

Investigating human motion and new media was a natural extension of my thesis work in apparel design at Cornell. Through my research, I learned that the human body is the most complex three-dimensional shape known to exist. Fortunately, I was just dealing with the human body as a static form. For the purpose of designing apparel to fit on bodies, this type of analysis was appropriate. But, after completing this study I was curious about how this complex form, the human body, moves through a three-dimensional space.

I studied modern dance for years, so I am well aware of the near infinite movement vocabulary humans possess. When choreographing, I often felt overwhelmed trying to create expressive movement using my own body, remembering it, teaching the movement to other dancers, and then coordinating multiple bodies in multiple locations moving in different ways. Limited time, limited people, and limited space were always competing factors in my creative process. Before I was aware of applications like DanceForms, I imagined that new media tools could be used to help. On one occasion I even took still images of dancers in different positions and edited them together with music in an attempt to visualize a dance piece.

My professional experience also piqued my interest in human motion and new media. As a forensic 3-D animator, my job was to recreate past scenarios so that a jury could more closely scrutinize the shape and movement of the elements on screen. We would often apply real movement data to these scenarios so that the movement of the virtual object mimicked reality.

There is a great deal of learning potential using this type of an analysis. For example, we could set up "impossible scenarios" such as one in which audiences saw how an object moved from two different perspectives simultaneously. This type of "privileged viewpoint" gave a viewer an entirely new insight into how an object moved. Could this analysis be applied to human motion? Were there disciplines for which this would be useful?



3-D body scan.

survey of the landscape

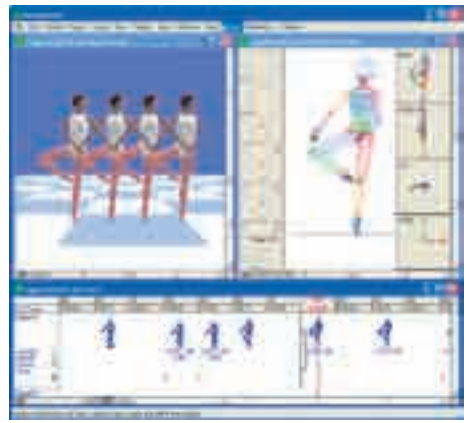
At this point in my process I thought that my final case study would be some type of motion analysis tool for choreographers or physical therapists. I am a practical person and I wanted to make something useful. Knowing now where I have ended up, I thank God I didn't go down this path.

Before executing any case studies, I felt it was imperative to survey the landscape of existing new media tools used to record, analyze, compare or teach human motion. Human motion lies at the core of many disciplines: occupational therapy, physical therapy, kinesiology, anthropology, choreography, dance, dance pedagogy, animation and ergonomics. Yet, in each it plays a different role. For example, occupational therapists and physical therapists are concerned with the range of a patient's motion as a means of assessing well-being. Kinesiologists study motion to improve an athlete's performance. Movement instructors must be able to communicate essential components of a movement so that a student can learn the proper way to experience the exercise. Animators must understand motion too. When applying movement to a virtual character, the animator must know how humans actually move so that she can choose to mimic or exaggerate it.

Many tools already exist within the different disciplines that allow users to record, analyze, compare and teach human motion. Currently there are applications available to help athletes and trainers analyze movement for performance enhancement. SportsCAD is one such software package is geared towards amateur and professional athletes. (www.sportscad.com)

Software is available for dancers, choreographers and dance researchers that facilitates creating and archiving dance pieces. One is a Laban notation writing and storing application developed by researchers at Ohio State University that allows users to digitally record dance pieces. (http://www.dance.ohio-state.edu/labanwriter/) Another, the Isadora system by Troikaranch, is a software system that assists with the choreographic process. (http://www.troikaranch.org/isadora.html)

Tools for motion study in the fields of occupational and physical therapy as well as anthropology are less sophisticated. Analysis of video seems to be the primary method. Perhaps there is potential for the development of a movement analysis tool geared towards these disciplines.



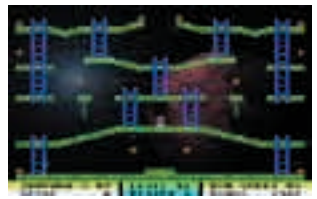
Screen shot of DanceForms.

Screen shot of SportsCAD.

conclusions from the survey

Clearly there is a need for motion analysis, archiving, teaching, and recording tools in a variety of disciplines. Perhaps existing systems could be improved. If I pursued this objective, I might find a unique niche and create something useful. The problem was that I simply wasn't moved.

After I completed this survey, a colleague pointed out that I neglected to consider one realm in which human motion and new media intersect: video games. Many current video games require movement as a means of interaction. There are virtual reality games based on sports. There are also a whole breed of games that require the user to move, yet they are not derived from any real-life experience. Like my Marathon Game, they are perceptual experiences. These games intrigued me the most.



I had a lot to learn about video games. I had not been to an arcade since the 1980's. I have never owned a home video game system. In fact, I don't think I had even played a video game since we had Jumpman on our Commodore 64.

dance, dance revelation

background

I began to research video games in the summer of 2003 when I enrolled in a video field production course at Emerson College. In that class, we were given an assignment to create a 10-12 minute video about a particular subject. I decided to "document" the phenomenon of the video game "Dance, Dance, Revolution," currently one of the most popular movement-based video games.

"Dance, Dance, Revolution," (DDR), is a dancing game with a very simple premise. First, the player chooses the music she wants to "dance" to. Then, she carefully watches the screen, placing her feet in the appropriate spots on the platform at the right moment according to the arrows she sees. For each level she reaches, the music and the arrows move faster, and her feet must follow accordingly. Stepping accurately is challenging, yet some players take the game to a new level, adding their own flairs (turns, jumps, arm gestures, etc.) between the required steps.

DDR has a huge following. There are over 2000 machines in arcades around the country and a number of different versions of the game for home use. (http: //www.ddrfreak.com) Devotees meet in arcades for tournaments or just to show off their latest moves. Some players even host DDR parties in their homes . DDR's cult-like following and its obvious difference from typical video games made it an interesting subject to document.

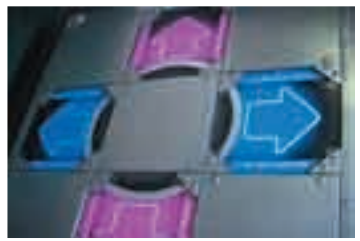
process

When making a documentary, which comes first: the footage or a script? How can you write a script if you don't know what you will discover? And, how do you know what to shoot if you haven't outlined it in a script? Even experienced documentary makers could not answer this question for me.

So, I began this project by researching my subject, reading many articles and statistics about current video gaming practices. Information on the subject is available on many children's advocacy sites such as http:///www.childrennow.org and http://www.kidsource.com. Some of the figures were startling. According to one study, American youths currently spend as many as 20 hours per week playing video games (about the same amount of time they spend watching TV). Another study found that of the top 70 selling home video games, 89% were violent in nature. (http://www.childrennow.org)

Clearly, kids love playing video games, but excessive gaming can be problematic. Recent episodes of youth violence, such as the school shootings in Paducah and Columbine have been attributed by parents of the victims to extreme exposure to violent video games. (Laidman, 1999) Also, hours of inactivity, sitting alone in front of a screen with a hand-held controller, can lead to obesity and depression. Excessive gaming can also be deadly. Last year, a 14-year-old boy sat on his knees for ten consecutive hours playing video games and developed a life threatening blood clot. (Computer game teenager gets DVT, 2004) Dance, Dance Revolution seemed to be the antidote to these problems; it is a physically demanding, social, non-violent game.

Web sites devoted to DDR helped me scout out shooting locations. These sites were primarily operated by fans of the game, and on them players discussed the new releases of DDR, favorite songs on the game, new arcade acquisitions and DDR tournaments. I observed instances of tournaments being talked up and players challenging each other to come out and compete. From the on-line discussions I learned of a DDR tournament occurring at the Fun Palace in Fall River, Massachusetts. The tournament was small and haphazardly organized, and shooting was challenging, but I was able to get some material. I later filled in holes with additional footage from the arcades at North-



Stills from DDR documentary

"What would the world be like without DDR?"

— posting on www.ddrfreak.com

eastern University and Jillian's, a restaurant in Boston.

Only after researching my subject and shooting some footage was I able to write a script. The script had numerous iterations. I realized that making a documentary is a cyclical path of researching, shooting, analyzing, writing, and editing. My process went around in this circle at least three or four times. The script evolved as I learned more about the subject.

The editing style of the documentary needed to reflect the energy of the game. However, I don't believe that I ever really captured it. Time constraints and technological mishaps prevented me from achieving the polished finished project that I had envisioned.

I never returned to this project because it had already served its purpose. In making this film, I learned a great deal about the technical and theoretical aspects of video production. In the future, I will never shoot video without a tripod, lights and two sources of audio. I will also better prepare my subject so that I get the sound bytes I am looking for. An important lesson I took from this project is that the process of making a documentary must be flexible. While a script is necessary to help guide what content must be gathered, it can only be written once some research and preliminary shooting is done.

findings

Dance, Dance Revolution is unique among the physical game genre because it doesn't try to mimic a real physical experience. Instead, it is its own experience, one that is pretty simple in concept; move your feet according to the directions on the screen. Perhaps this is where DDR gets its strength.

DDR has become a phenomenon, breaking many of the stereotypes associated with video gaming. It provides a physical challenge to the player, as well as a social outlet. My subjects shared stories of improved fitness levels and weight loss. I also heard about relationships that had formed from a shared love of the game.

My exposure to DDR inspired me to try to make a physical, interactive computer game. I was not looking to break any new theoretical ground with the game I built. I simply wanted to make a physical, interactive game that fostered social interaction, much like DDR.

Stills from DDR documentary.

"You have to be able to not care if you look stupid while playing because you tend to."

— DDR player

memory game

concept

In the fall of 2003, I took a course called Advanced Interactive Media Project. It offered me an opportunity to build my first physical, interactive computer game.

To begin to define what the game would be, I made a list of requirements.

- Must be simple enough to actually be built.
- Must be easy to understand.
- Must appeal to a variety of age groups.
- Must require the user to interact in a physical way.
- Must inspire social interaction.
- Must inspire creativity
- Must be flexible to allow different people to use the device in different ways.
- Must be fun. The user should want to return to it.
- Must allow the user to get better at it the more he/she does it.
- Must not be space specific. Could be set up in a variety of locations.

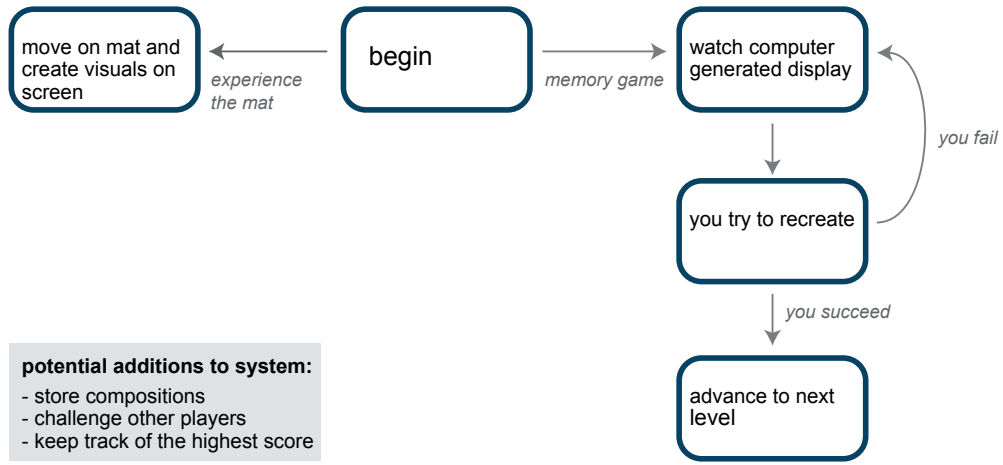
After much deliberation, I decided to build a memory game inspired by the toy, "Simon," I played as a kid. Simon was a thick plastic disc, about 4 inches thick and about 1 foot in diameter. It had four large buttons on the top surface, red, green, blue and yellow. Each button generated a tone and illuminated. To begin the game, Simon played a tone and lit the corresponding button. Then it was the player's turn to press that button. If the player was correct, Simon replayed the first tone and light, and added a second tone and light. The user had to then respond by repeating what Simon did. As the player progressed, the memory challenge got more difficult. Although the game was very simple, I remember that it was fun and addicting.

Simon game, circa 1978.

My concept was similar to Simon but had two different modes of operation. In one mode, users simply build audio/visual compositions on the screen based on the way they step on a mat. In the other mode, the game is a memory challenge. The computer produces sounds and visuals and the player tries to recreate it.

Like Simon, my memory game requires a specific, unique input device. Unlike Simon, my input device has more buttons and needed to be built at a large scale so that users could activate the buttons with their feet. The design of the mat is circular with two concentric rings. Both the inner and outer rings are subdivided into six segments. The inner ring segments each correspond to different geometric shapes and single tones, and the outer ring segments correspond to colors and looping beats. When an outer ring segment is activated, the color and beat remain until a different one is activated or the current one is deactivated. To deactivate the color/beat the player must step on the outer ring segment corresponding to the one that is currently active. When the user steps on an inner ring segment, a single tone and an animation comprised of the corresponding geometric shape are activated, but only for the amount of time that the user steps on that spot. The circle in the center is a non-interactive space from which the user can trigger active areas in the rings.

memory game :: system architecture



potential additions to system:
- store compositions
- challenge other players
- keep track of the highest score

Prototyping with a paper mat.

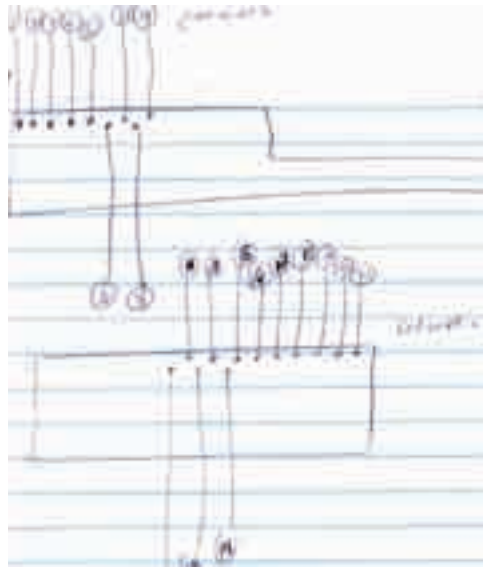
process

To code the application, I worked with twelve keys on the keyboard. Each one corresponded to the twelve different segments of the mat. This allowed me to test the applications without having the mat built. In building the mat, I needed just one sensor in each ring segment to trigger one key on the keyboard.

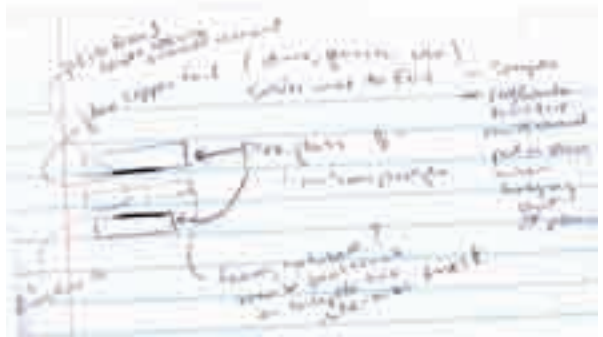
Fabricating the mat required understanding how a keyboard works. Each key press is made by a connection of two wires. Inside a keyboard there are two sets of these wires. For explanation purposes, call them, wires A-J and 1-7. If the combination of wire A and wire 1 generates the letter "Q," then wire A and wire 2 might yield the letter "W." Finding the desired keys requires experimentation, touching the different wires soldered to the wires inside the keyboard circuitry.

Once I found the keys I needed, I extended the two corresponding wires and attached aluminum foil squares at the ends. I then taped the two foil squares to opposite sides of a sponge with a hole in it. The idea was that when the sponge was compressed, the foil plates would touch, a signal would be generated and the desired key press produced.

To complete the mat, I enclosed my sponge sensors in vinyl. I stitched together two pieces of vinyl in a pattern that produced the twelve pockets in two concentric rings. Because this was my first attempt at building such a mat, I was advised to work at a smaller scale. The resulting mat was about a foot-and-a-half in diameter.

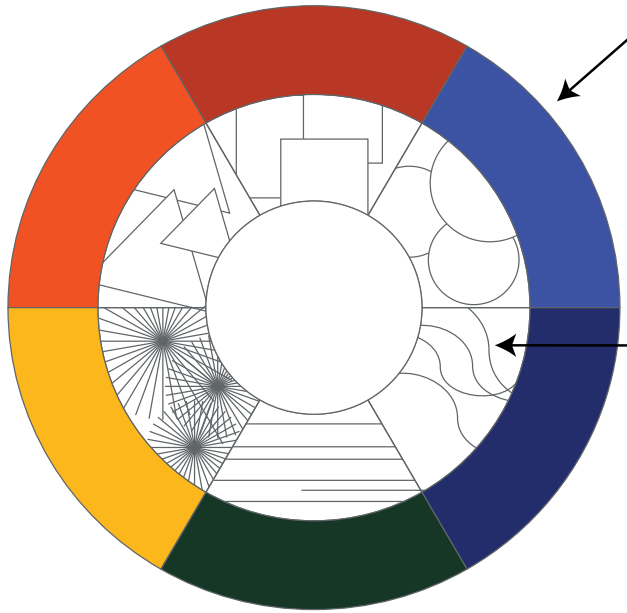


Decoding the keyboard.



Original plans for mat sensor construction.

how the mat works :: mat mode



outer loop

visuals: solid color
sound: loops.

rules:
1) Only one loop/one background color is shown/played at once.
2) Pressing twice on same color stops the loop.
3) Stepping on a different section in the outer rim changes the loop and background color to

inner loop

visuals: simple shapes
sound: tones

rules:
1) More than one tone/geometric shape can be played at a time.
2) Tone /geometric shape played for as long as the user holds keeps pressure on the spot.

assessment

Making the mat at a smaller scale turned out to be a wise decision, as this mat was not very functional. The problem was that the materials I used simply weren't durable enough for the type of pounding a mat would endure. Even when pressing the sensors with my hands, the sponges did not "bounce back" fast enough. The foil also deformed and the wires were everywhere. Although the mat was unusable, the process of producing it prepared me for making the next version.

Feedback on my project was lukewarm. "Wasn't I just imitating DDR?" I was asked. That was certainly not my intention. This project was about learning how to work with the technology that would be the basis for future case studies. I wanted to make more computer based movement-driven, interactive experiences, because I saw potential for them beyond entertainment and a simple memory game.

Screen shots from the Memory Game.

input device

After I finished the memory game project, I had many more ideas for case studies involving interactive mats. But, to use and test them, I needed a functional mat — one that overcame the deficiencies of the memory game mat.

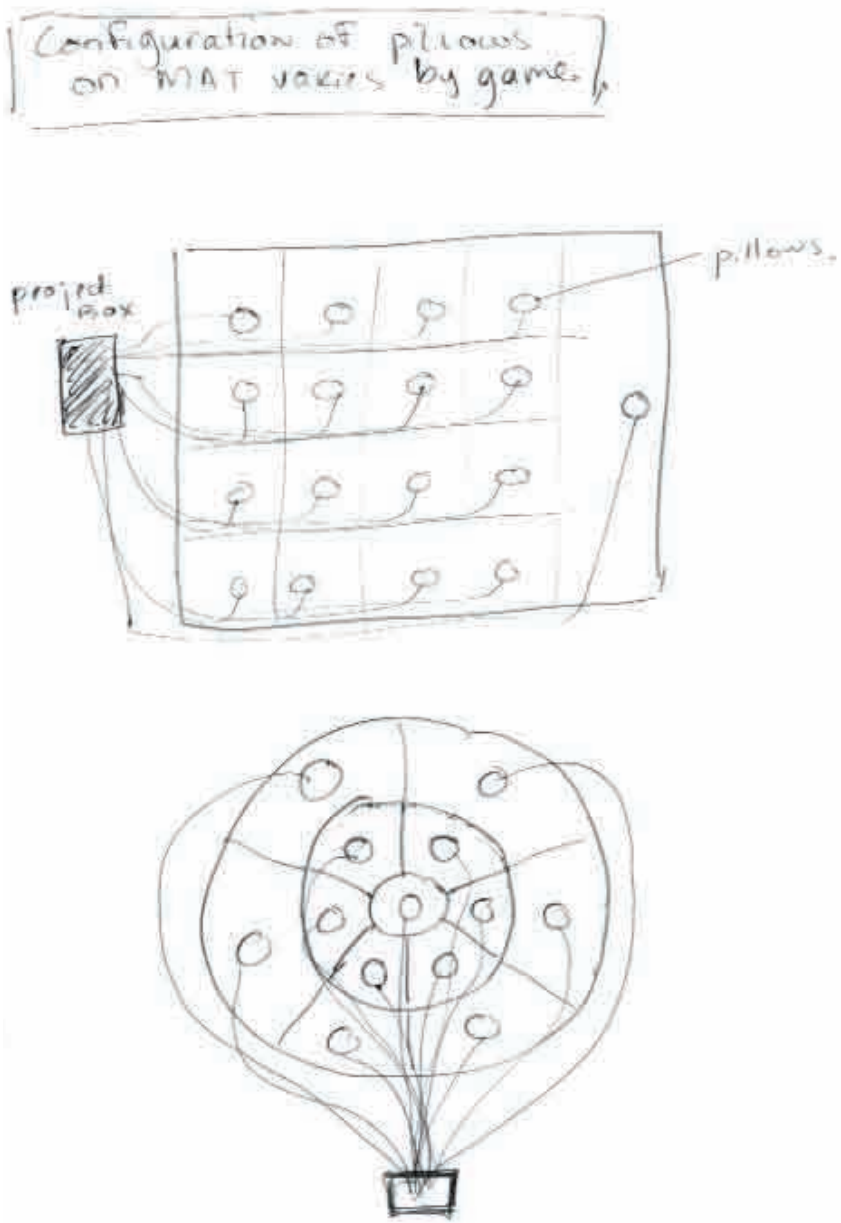
The memory game was simply unusable. It was not built to scale, and the materials were not durable enough to withstand the constant pounding of users' feet. Also, the wires were such a confusing mess that I could not tell if I had wired the mat correctly and thus couldn't get some of the sensors to work.

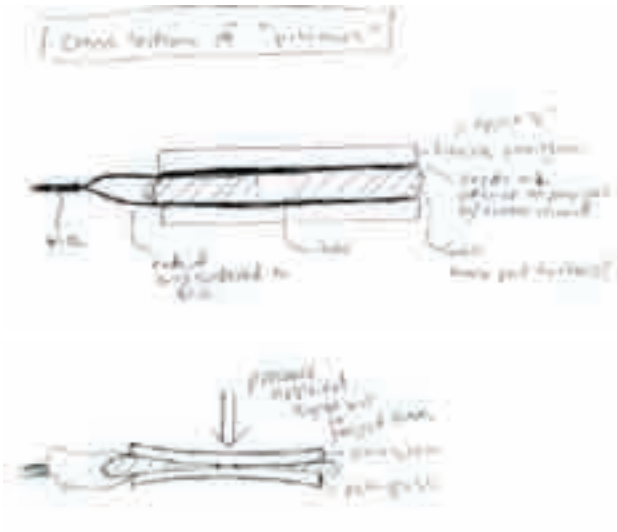
The configuration of the memory game mat was another problem. It was comprised of two concentric rings of six sensors. While that design suited the memory game, it might not have worked for future applications. I decided to build a new mat, functional and versatile enough to accommodate a variety of applications.

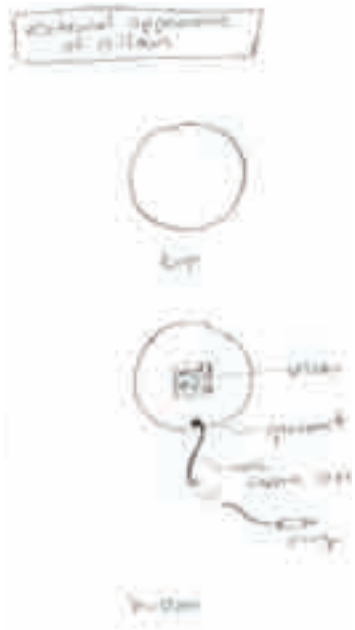
Mat for the Memory Game.

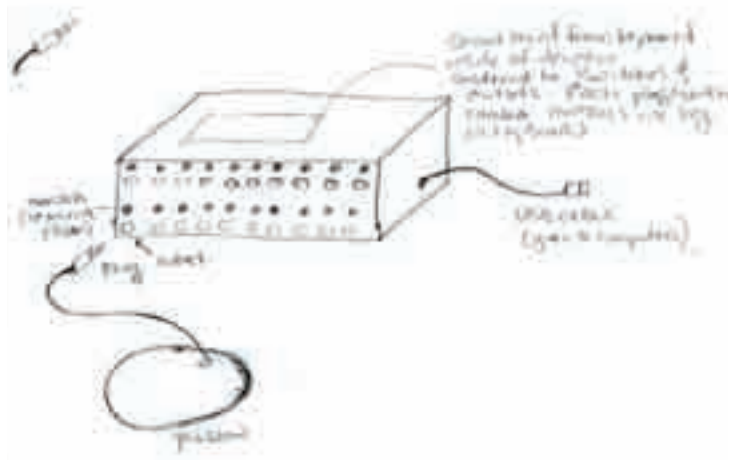
the theory of the pads

When making the Memory Game mat, I had painstakingly sewn the two pieces of vinyl together in a pattern that yielded a number of "pockets" for my sponge sensors. Afterwards, I realized that if I stitched the vinyl together around each of the sensors and then assembled the separate pieces together, the mat would have been easier to make. These "pillow sensors" could then be arranged several different ways to accommodate a variety of applications.









Sketches for reconfigurable mat and project box.

mat construction

The next version of the mat was designed to be reconfigurable, comprising of sensor pillows that had to be durable and reliable, so I called in the assistance of my father, a master craftsman/designer/engineer/inventor/problem solver and self-described executor of other people's projects. Looking for advice, I sent him drawings of what I was trying to build. We quickly discovered that the sensor pillows were more difficult to make than either of us had anticipated. After experimenting with a number of different materials and getting inconsistent results, the sensor pillows evolved into a heavier, more industrial version of what we originally had in mind. The issue arose from the material between the contacts. It was either too thin and the charge passed through without any external force or it was not compressible enough and even with external force no charge passed through.

Less pillows and more giant buttons, these mat components turned out to be sturdy little pieces of hardware. They are essentially a sandwich of wood and foam with a bolt and spring running through the middle. They are about 8.5" x 8.5" x 3" in size and upholstered in bright blue vinyl. A cable with a stereo plug end hangs out of each big blue button to allow them to be plugged into a project box. This project box plugs directly into the computer.

Fred Wolflink, an instructor at Mass Art, assisted me in the construction of the project box. He offered his services after seeing the mess I had made with my memory game mat. Fred helped me decode a keyboard circuit board, solder it and connect it to the stereo plug jacks in the project box. Each jack on the project box corresponds to a key on the keyboard and the box is clearly labeled so it is readily apparent. The giant blue buttons can now plug into any of the jacks in the project box and when connected to a computer, trigger a key press.

After making 20 of these giant blue buttons, my father informed me that project quota was over for the year.

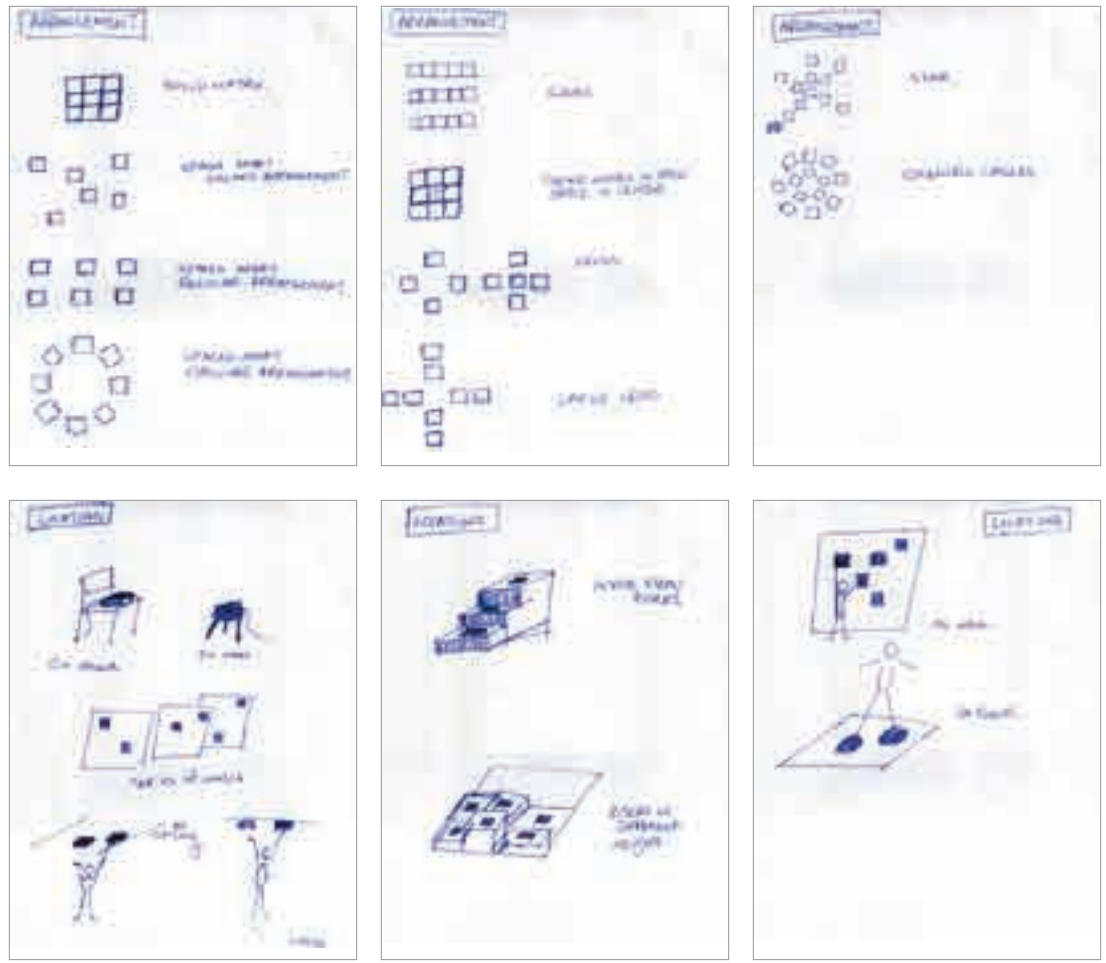
Completed sensor pillow.

assessment of mat

The new mat hardware works well. What the giant blue buttons may lack in elegance, they make up for in functionality. They withstood pounding from many different users. Because the buttons are quite thick and users could lose their balance, I built a platform in which the giant blue buttons "sink in."

The resulting mat has limitations. In order to capture users' full movement, you can't just look at where they moved their feet. People move with their whole bodies. In other interactive experiences cameras, lasers, RFID tags and radio waves are used to track users' movement and are able to obtain more comprehensive movement data. The interactive experiences I am interested in creating, however, don't necessitate the subtleties of such systems.

Even though my mat is simple, I see plenty of potential for interesting physical interactive experiences using it. To better understand what could be done with the mat, I brainstormed many ways the mat components could be placed and triggered. I generated pages of sketches and referred to them when trying to define interactive activities in later case studies.



Sketches of how the mat could be used.

mat poetics

What might the ideal mat be? It depends on the content. In some movement-driven applications the designer makes the input device as non-apparent as possible. This is because part of the experience is figuring out how the system works. For example, in Joe Paradiso's "Stomping Ground", users explore the space, observing how the system responds when they jump and wiggle in different ways. (http://web.media.mit.edu/~joep/SpectrumWeb/captions/Carpet.html)

In my applications, exploration of a space was not the goal. Instead, the user has a distinct objective. For example, in the memory game, the user's goal is to mimic the patterns made by the computer. To do this, the user needs to be aware of how to control the system. My mat needed to be more like the DDR mat, where the active spots on the mat and their functionality is obvious.

Unlike the DDR mat (used for home play), my mat is not as portable, durable, sleek and compact. The form of the DDR mat is appropriate for a game that is set up and taken down in different locations. My mat did not need to have this ability. Rather, it lends itself to being set up in one configuration for a while and then used later in a different way.

DDR is about moving quickly and creatively, and the sleekness of the DDR mat works well with this content. It does not require a great deal of effort to activate a hot spot on the mat. This is a necessary quality when quick movement is needed. In my mat, the giant blue buttons take effort to compress, and when doing so, they produce a mechanical sound. The style of the blue buttons reflects the lighthearted content and cartoon-like rendering style in my applications.

Even though a mat is basically a keyboard on the floor, using the mat transforms the experience of interacting with a computer. It removes someone from a passive position to an active one. This brings the user out of their comfort zone. For most people, it is not embarrassing to be seen moving a mouse around in a seated position. Forcing a user to jump up and down puts them in a potentially uneasy situation, akin to learning how to jump on a pogo stick or walk on stilts. Initially the experience feels foreign but it can be addicting once the user achieves a level of success. For a spectator, this can be fun to watch.

DDR mat for home play.


FRANKLIN f

an animated, movement-driven, interactive learning experience

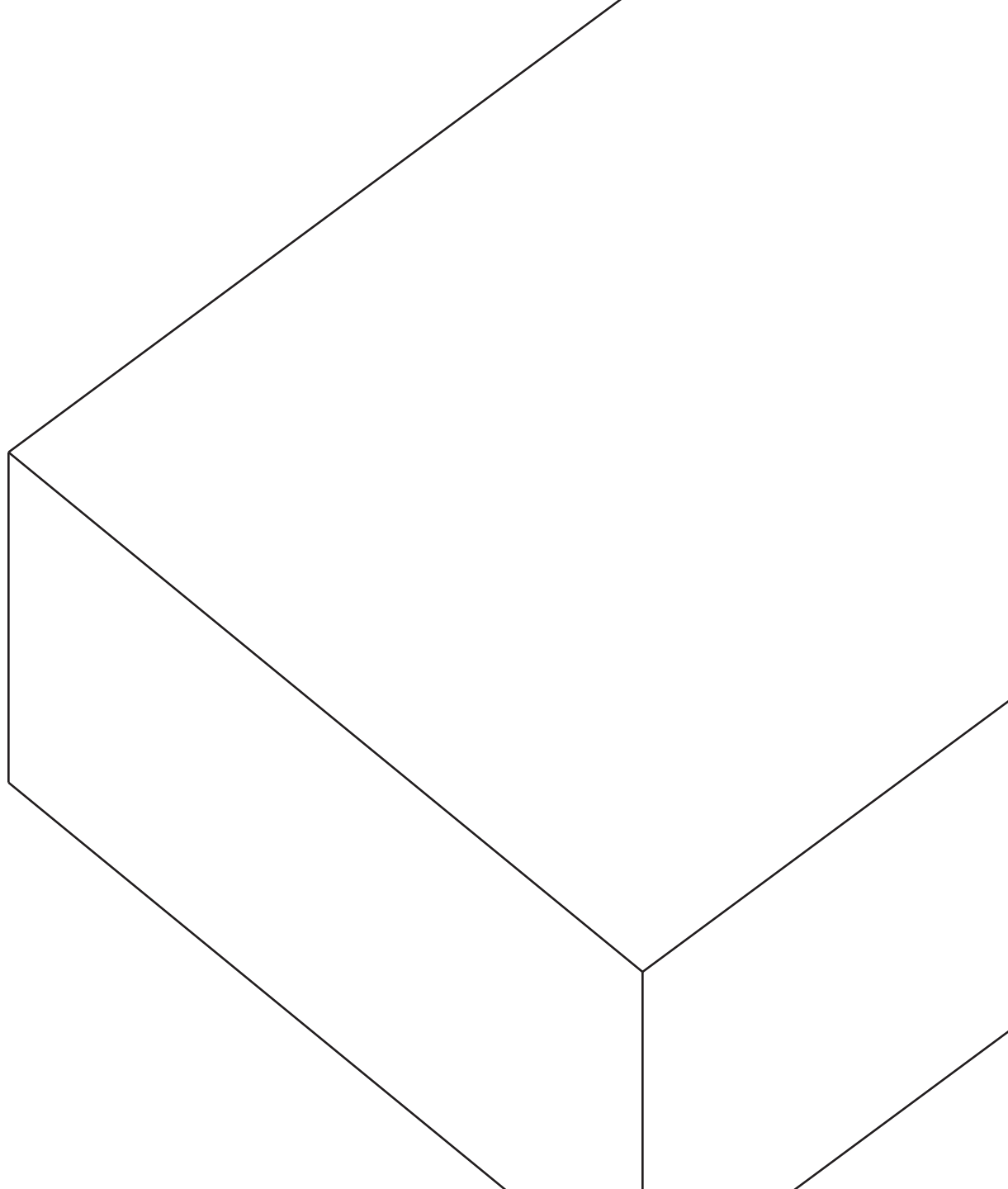
"If our bodies know something our minds do not, can the knowledge in our bodies help out our minds?"

not just a knock-off

In December 2003 I presented my memory game at the final review. One opinion was that the memory game was simply a knock-off of Dance, Dance Revolution, and I had not broken any new theoretical ground. While hearing this was discouraging, I accepted the critique. I knew that the memory game did not demonstrate the full potential for movement based interactive experiences. From the beginning, though, my intention was not to make the most cutting-edge application. The process served to advance my programming and electronics skills which allowed me to build more interesting projects in the future.

"Could their movement be helping them to recall what they saw on the screen?"

Nevertheless, the memory game was different from Dance, Dance Revolution. In playing DDR, devotees reported improved rhythm, coordination and reaction time. While my game had similar physical benefits, it was more cerebral than DDR. Players used their bodies to recreate the audio/visual compositions made by the computer.



body over mind

Books and articles about athletics and dance often refer to the practitioner's "physical" or "muscle memory." When we perform a physical movement several times, our body remembers the feeling. Eventually we do not need to even think about what we are doing and our bodies perform automatically. In a recent article in *Running and Fit News*, the author encourages runners to do leg exercises with resistance bands. His contention is that the runner's muscles will remember the motion and push harder when running. (Yessis, 2003)

I have first-hand experience with utilizing my physical memory. Many times, just moments before a dance performance, I could not recall how the piece began. This was a frightening feeling and nearly caused me to panic. Yet, once I got on stage, my body took over and I was able to dance the entire piece.

how movement helps learning

If our bodies know something our minds do not, can the knowledge in our bodies help out our minds? Helen Gummerseimer thought so. Mrs. Gummerseimer was my second grade teacher who taught us the "pronoun-a-la-go-go" to help us learn our pronouns. It was a simple little dance — a couple of hand gestures and some steps forward and back — that went along with a rhythmic chanting of "I, You, He, She, It, We, You, They." Thanks to Mrs. Gummerseimer, I will never forget my pronouns.

Other educators besides Helen Gummerseimer subscribe to the philosophy of using physical motion to help kids learn. The Washington Center for Learning is a non-profit agency with the mission of helping primary and high school teachers with educating students in reading, writing, math and language. They developed KTM (Kinematics Teaching Methodology), a system that "uses a whole body's motion in space as a medium for translating abstract concepts to the concrete." Mathematical dances are one example of how the KTM philosophy is applied. These dances use timing, direction changes, and distance to reinforce mathematical concepts. (www.washingtoncenterforlearning.org)

On a purely physiological level, when we move, we are better learners. This is because when we exercise more oxygen gets directed to our brain. The brain accounts for less than 3% of the body's weight but takes over 20% of its oxygen when at rest. It has been called an 'oxygen guzzler.' Standing up and moving around can increase the flow of blood to the brain by up to 15% - 20%. (http://www.utexas.edu/student/utlc/makinggrade/physical.html) Shunting additional oxygen to our brains makes us more alert and allows us to think more clearly. (Peterson & Bryant, 1999). The fact of the matter is that our brains do not work best when we are sitting for long periods.

Moving helps us commit new concepts to memory. And, the ability to recall information and add new material to our memory bank is an essential part of learning. Neurologists have discovered that the two neurotransmitters, epinephrine and norepinephrine are responsible for making memories "stick". In his book, *The Owner's Manual for the Brain*, Dr. Pierce Howard recommends exercising shortly after learning new material in order to help remember it. "After a learning episode of an hour or so, take a break and do something to pump up your epinephrine levels; walk about, do isometrics, climb some stairs, do laundry, move some boxes – anything that will generate epinephrine and norepinephrine to help fix the memory." (Howard, 1994)

Perhaps the most prominent theorist to link movement and learning is Harvard education expert, Howard Gardner. In his book *Multiple Intelligences: The Theory in Practice*, Gardner disagrees with the use of the IQ test as a means of assessing a person's intelligence. He believes that people can have strengths in seven different types of intelligences: linguistic, logical-mathematical, spatial, musical, body-kinesthetic, interpersonal and intrapersonal. Once a person's intelligence strength is identified, it can be used as a learning avenue for content that is typically associated with a different type of intelligence.

Gardner relays a compelling example of a student who became engaged in a subject only when it was finally taught through an avenue of his interest. This was a child who had little interest in art or music but had a high aptitude and strong interest in science and mathematics. As prescribed by Gardner, the instructor engaged the student in an art project by adding a scientific component to the project, in this case building a sculpture with bones. Because the scientific-minded student was very interested in how the bones fit together, he was able to become occupied with the art project. (Gardner, 1993)

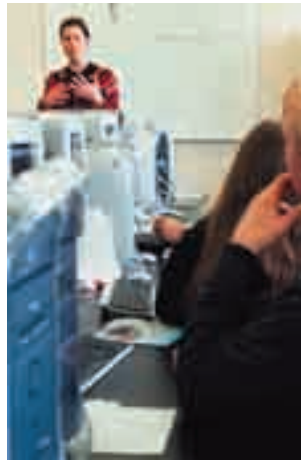
I found this phenomenon fascinating and set out to build interactive experiences especially suited to users with high aptitudes in body-kinesthetic intelligence, (people that have good control of body movements and are able to perform specific movements when required to do so and are able to solve problems using their body). While movement would be a key part of the experiences I built, the content of the experiences would not at all be movement related. The memory game added a new dimension to what an interactive movement based experience could be. Users were getting benefits that weren't necessarily related to movement, and the movement was integral to their learning. Could an interactive, movement based system assist the learning of a non-movement related subject?

The eight intelligences according to Howard Gardner.

why make it educational?

Making a learning tool naturally appealed to me because I am a teacher. For the past eight years I have taught design at the college level. I enjoy this role very much. Just as I am wired to move, I believe I am wired to teach.

Making a learning tool also interested me because I am a practical person. The designer's role is to solve a problem, and by making a learning tool, I was giving myself a problem to solve. I believe this is what separates art from design.



Me, teaching.

how the theory could be implemented

At a visit to the Boston Museum of Science, I saw an exhibit about gravity. It was comprised of a large disk, about 3 feet in diameter, with a hole in the bottom. You could drop a ball into the disk, watch it spin around and eventually see it go down the hole. From this experience you were supposed to understand the concept of gravity. I felt that this experience shed no new light on the subject. How would someone who didn't understand gravity "get it" after participating in this experience?

What if, instead of watching the ball go down the hole, the user had to exert some type of physical effort in order to prevent the ball from descending? Perhaps there were a number of different objects that the user had to suspend in air. Different amounts of effort would be required to keep the various objects afloat. Consider, for example, a feather versus a stone. The user might only have to use a bit of energy to keep the feather up in the air but work very hard to suspend the stone. Engagement in this type of physical activity would most certainly help the participant better understand the nature of gravity.

emergent literacy project

target audience and subject

With the goal of creating an interactive movement-based system that could help a user learn non-movement related content, I began my next project. The target audience was children, as they would be a receptive age group to this type of experience. The children needed to be old enough to follow directions, but young enough to be learning content that was simple and easy to interpret. Somewhere between 4 to 12 would be the desired age range of my users.

The content grew out of the research I did relating to movement and learning. The investigation involved meeting with experts in the field of education. One of these was Judy Corley, Doctor of Education at Fontbonne Univeristy in St. Louis, Missouri, (my aunt). Her specific area of expertise is in teaching children how to read. This was an ideal subject to incorporate into an interactive movement based experience.

The objective became to help children in the "emergent literacy" phase of reading develop their reading skills. Children in this stage tend to be between the ages of 4-6. Their skill set involves recognizing that language is made out of words, words are made out of sounds, sounds can be matched with letters and a limited set of these letters exist. Kids would use their bodies in order to make sounds. Different movement patterns would generate different words. In Gardner's terms, children would be using their body-kinesthetic skills to enhance their linguistic intelligence.

how it works

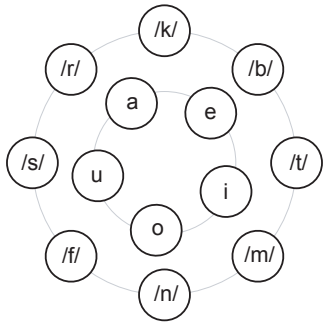
Like the memory game, the input device for the Emergent Literacy Project is a mat embedded with "hot spots" in various locations. However, in this case, each hot spot is associated with a phoneme (a sound that contributes to making a word). The outer "ring" of hot spots corresponds with sounds made by consonants and the inner ring is associated with vowels. When the user activates a hot spot, he hears the corresponding sound.

The sounds produced by each vowel hot spot vary randomly. For example, sometimes activating the "a" hot spot yields a long a sound, as in the word, "bait". Other times it produces the short vowel sound, as in the word "bat." Consonant sounds remain consistent.

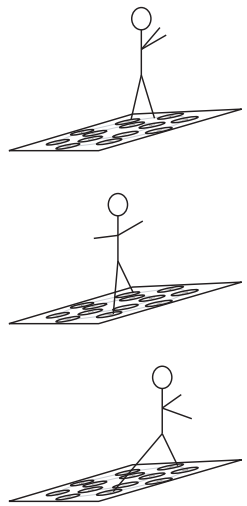
The visuals correspond to the letter and the sound that is made. For example, the visual associated with the "u" is a mixture of animated "u"s, and the one associated with the letter "t" is an animated mixture of the letter "t".

Only when the user activates the hot spots in an order that creates a word will the user see an animated visual representing the word and hear the word, itself.

The intention is to get the 4-6 year-old-user to move around on the mat, discovering the many possible words that can be made from the component sounds, enjoying the experience of seeing these words come to life.



Emergent Literacy Project - configuration of mat.



Emergent Literacy Project - user scenario.

why it is an effective learning tool

The Emergent Literacy Project is a useful tool for helping children learn to read. A key discovery for kids in the early stages of learning to read is the idea that letters are associated with sounds. This is reinforced by the activation of hot spots (that are labeled with the letter they represent), and hearing their corresponding sounds. The act of creating words by assembling these sounds helps the user understand that words are composed of sounds, another key skill for beginning readers.

An additional byproduct of using this system is that users are exposed to rhyming words. Words that require the user to move to similar locations have sounds in common, and will therefore, in some cases, rhyme. Recognition of rhyming words is an important idea for beginning readers to grasp.

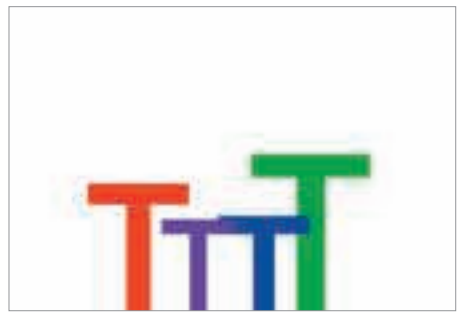
This project, while especially appropriate for children with high body-kinesthetic intelligences, should appeal to most kids in the 4-6 year-old age group, as children of this age tend to enjoy moving.

assessment

At the May 2004 review, comments about this project were uniformly favorable. Even though the programming and five animations that resulted from the successful formation of words were completed, I was not able to fully test the application. There is no way to measure the success or failure of a project without doing actual user testing. This became a priority for my final case study.

Two additional issues were raised in the Emergent Literacy project: the incorporation of animation and setting. The Emergent Literacy Project marked my first attempt to incorporate animated content in a movement based, educational, interactive experience. This added an interesting new dimension. When incorporating animation with computer-driven interactivity and physical motion, a relationship is established where the user animates the character and the character animates the user. This scenario tends to motivate and engage the user. There was now a link between the work I had done in animation and the movement based interactive experiences I was building. My work was all coming together; I made the decision to incorporate animation to a greater degree in a final case study.

The other issue that the Emergent Literacy Project raised was that of setting. Even though the coding was complete and the hardware built, I had not considered where my project would be used. Was this a classroom tool, a game you would play at home, or an exhibit for a children's museum? This issue of setting would greatly affect the design of any project. I had to determine the scenario for which I was designing before commencing my final case study.



Screen shots from the Emergent Literacy Project.

setting for an interactive movement based learning tool

in the classroom?

After completing the Emergent Literacy Project, I sought feedback from teachers of the targeted age group. The two teachers I consulted were Cordellia (Diddie) Ossi, an elementary school teacher in Norfolk, Virginia and Maggie Leonard, a pre-kindergarten educator at the Shady Hill School in Cambridge, Massachusetts. Their responses assured me that my concept had merit, and helped me to decide when and where my interactive, animated, movement-based learning tool might be used.

"The higher ups don't like for us to use worksheets to drill them, so a game that gets them up, out of their seats…is a huge thing…

Diddie immediately saw potential in integrating my system into an elementary school classroom.

> *The main thing that I have noticed in both third and fourth grade is that the kids are no longer learning (very well) the basic addition, subtraction, (in K, 1, and 2) and multiplication/ division facts (3-5th grades) but the higher ups don't like for us to use worksheets to drill them, so a game that gets them up, out of their seats, or at least using more tactile modalities is a huge thing...*

Maggie and her colleagues were less enthused. This could be attributed to the school's anti-technology stance. Maggie asked, why let the computer teach a kid something — wouldn't a live teacher be better? She thought that an activity such as the Emergent Literacy Project would be a godsend for parents in the winter when they want their kids to do something educational and physical. But, she had a hard time envisioning such a system in the classroom.

I did see possibilities for classroom integration. During a visit to Maggie's school, I noticed that many of the projects done with these children were creative and collaborative. For example, the students all drew a picture, made a collage or contributed writing that became part of a larger book. Could my system facilitate a digital equivalent of this type of activity? What if the interactive movement system was a station that students could use during "choice time" that allowed for creative expression, and the compositions created could be saved and shared among the entire class.

From my teacher consultations, school visit and research, I learned what children of different age groups are mastering and I saw opportunities to build interactive, movement based systems around these learning objectives. However, if an interactive movement based system were to be installed in a classroom, it must be tied to the existing curricula. It must also evolve; students will lose interest if the application is not re-engineered with new content periodically. Because of these constraints, I decided against designing my final case study for the classroom. Nevertheless, I still believe that an interactive movement based application could have a role in a classroom environment.

why an exhibit?

My experience in the classroom prompted me to visit exhibit spaces and consider whether an educational, interactive movement-driven, computer based experience might fit into this environment.

Designing an interactive application for an exhibit space offers distinct advantages over designing for a classroom setting. While the curriculum in a classroom is broad and constantly changing, the educational goal of an exhibit is specific. It is a one-time learning experience, and it is obviously easier for a designer to address one learning objective rather than a variety.

Projects placed in an exhibit space receive larger exposure than those placed in a classroom. The implication is that a greater variety of people will be using the system. If the system were placed in a third grade classroom, the designer could be assured that the target audience was primarily third graders. In an exhibit environment, no assumptions about target audience can be made.

Museum visitors have new expectations, especially when visiting ones geared towards children. Exhibit designer, Maeryta Medrano, explains the shifting paradigm. "In the past, people tended to view museums as equivalent to schools, more and more they have become places where people have a kind of shared social experience." (Winn, 2003) I knew from my observations of Dance, Dance Revolution that motion-driven interactive experiences foster a social experience. Therefore, it seemed like an animated, movement-driven, interactive learning experience would fit well in this environment.

Once I decided to design my final case study for an exhibit space. All I needed was a host...

computer based physical interactive exhibits

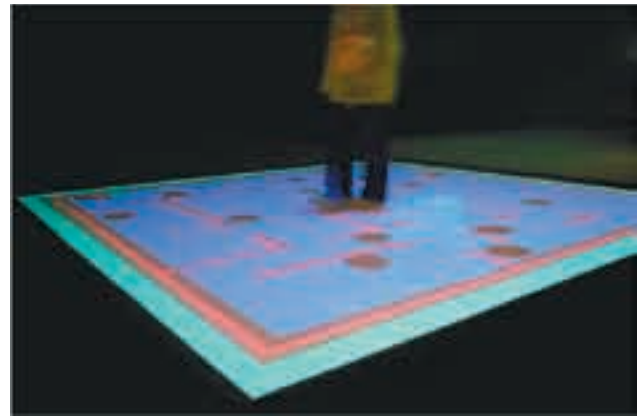
I visited local museums to see if physical, animated, educational, interactive experiences existed. The MIT museum featured two projects that were computer based, interactive and physical: the Stomping Ground and the Metafield Maze.

The Stomping Ground is a platform on which participants move. The computer tracks not only the movement and pressure of users' feet, but their upper body movements as well. Abstract graphics (on a large screen in front of the carpet) and music are produced based on the users' interaction with the carpet and the space. Several users can occupy the carpet simultaneously which allows for collaborative play.

The Metafield Maze is a more goal oriented computer based physical, interactive experience at the MIT museum. In this exhibit, a maze is projected on the floor at a size of approximately 12 x 12 feet. A ball is projected onto the floor as well. The user walks on top of the projection and the maze "tilts" in reaction to the user's position. The objective for the user is to move the ball through the maze. While both of these exhibts at the MIT Museum are fun to play, they are not necessarily educational.

At the Boston Museum of Science, there were many computer based interactive educational experiences. Most were driven by a mouse, keyboard or touch screen. The one physical interactive experience was a game called "Virtual Volleyball." In this game users stood in front of a screen and volleyed a projected ball across a virtual net. The ball reacted to the movement of the users so the experience came close to simulating a real game of volleyball. On the day I visited the museum, this exhibit had more participants than any other in the museum.

Clearly, children enjoy physical, interactive computer based activities. But, even at a premiere museum like the Boston Museum of Science, there was a lack of these types of experiences. I have yet to see an interactive computer based physical experience that focused on teaching a non-movement related concept in an exhibit space.



Metafield Maze

Virtual Volleyball

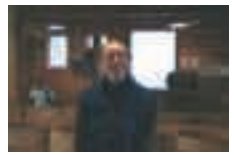
final case study: the barn owl project

background

The Barn Owl Project is truly the project that all of my other work led to. It is an animated, movement-driven, interactive exhibit designed for the Franklin Park Zoo. It teaches kids about barn owls via animation and interactive physical activities.

The idea for the project emerged after a meeting with people that worked at the zoo. They had an interest in teaching children about birds or owls. They also had a space at Franklin Farm in which they could host an exhibit.

Franklin Farm is an area at Franklin Park Zoo where children can interact with farm and barn animals. It includes a large barn and several outdoor pens for chickens, sheep, goats and other barn animals. Currently there are placards about the animals but no interactive exhibits in the space.



Anthea Lavalle
Director of Education,
Franklin Park Zoo

In the summer of 2004, my movie, "The Great Escape", about the escapee gorilla from the Franklin Park Zoo was featured in the New England Animation Bash. One of the curators of the show told me that his friend, who worked at the Franklin Park Zoo, would really love to see it. When I delivered her a copy of the movie, I explained that I was looking for an exhibit space for my interactive, animated movement-based educational project. She put me in touch with the director of education at Franklin Park, Anthea Lavalle, who became my primary zoo collaborator.

Barn Owl Project - preliminary character sketches.

why barn owls?

When brainstorming ideas for the project, one of the zoo staffers suggested making an exhibit that would allow users to experience flight. If the bird got injured or flew into a sub-optimal environment, the user would have to work harder in order to keep the bird suspended in the air.

I pursued the bird idea, building a simple Flash application that worked with one of my mat pads. If the user jumped on the pad, the bird stayed suspended in the air. If the user stopped jumping, the bird sunk. I took this a step further and created a similar application that required the user to do jumping jacks to keep the bird afloat. While these were interesting experiments, for an exhibit there needed to be more of a curriculum.

Inside the barn at Franklin Farm there are two barn owls. They reside in a cage in an elevated area inside the barn. Even with a sign informing visitors to "Look Up!" to see the barn owls, they are easily missed by the casual visitor. Creating an exhibit dedicated to these creatures would finally bring them the attention they deserved.

Barn owls make an interesting subject for an interactive, animated movement-based exhibit. They are distinct looking animals from which a unique character could be created. Their behavior is also fascinating. They are nocturnal and rely on their super-sensitive hearing to do all their hunting at night. Barn owls also mate for life — spending several years with the same partner.

For inspiration, I visited the children's section at the Brookline Public Library and pulled out several books on birds to peruse. One of these was a book on barn owls, and upon seeing it I had an "A ha!" moment.

Barn owls at Franklin Park Zoo.

"Anything that gets the kids engaged - that's not a passive learning experience where maybe they are just reading or being lectured to - anything that involves them learning in a more dynamic way has a better chance to leave more of an impression."

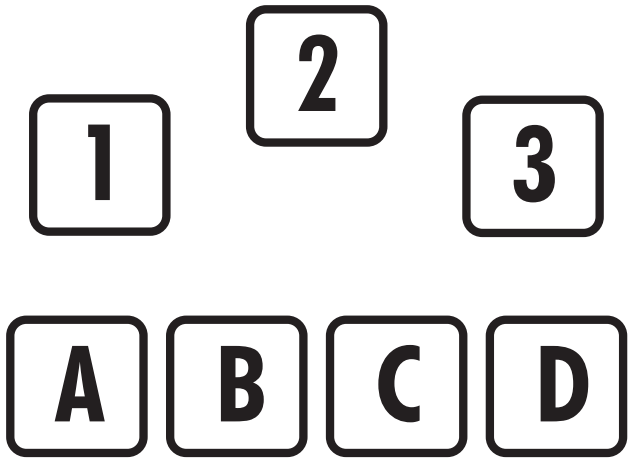
— Anthea Lavalle,
Director of Education at the Franklin Park Zoo

how it works

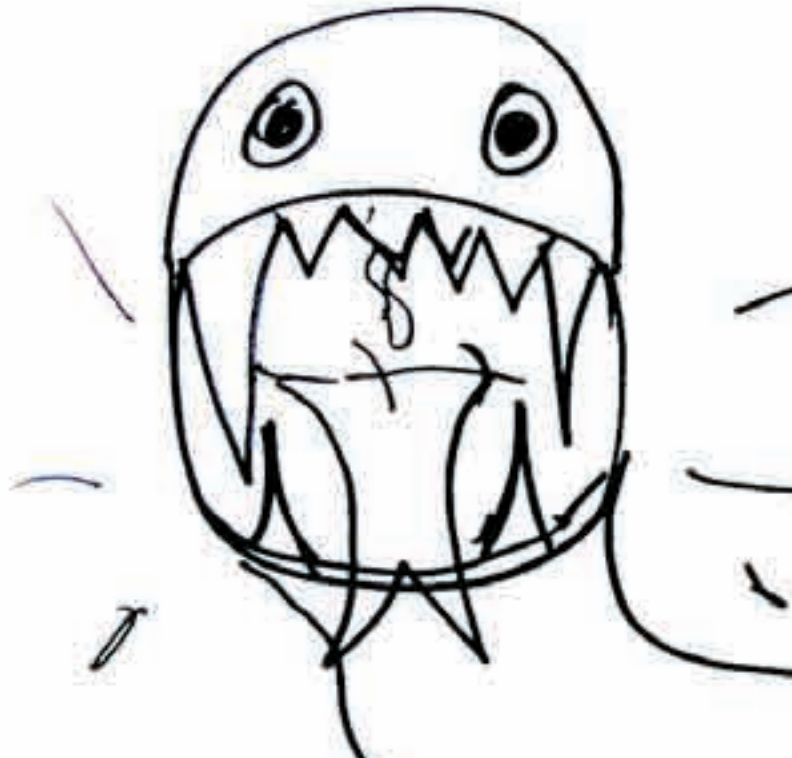
The exhibit is based on the life of an adult barn owl named Larry. In the program, Larry talks about his life and then gives the user an opportunity to participate in games that mimic his life experiences. There are five interactive, movement-driven activities interspersed with six pieces of linear animation. The interactive experiences are: hatching, feeding, flying, warming the nest and hunting.

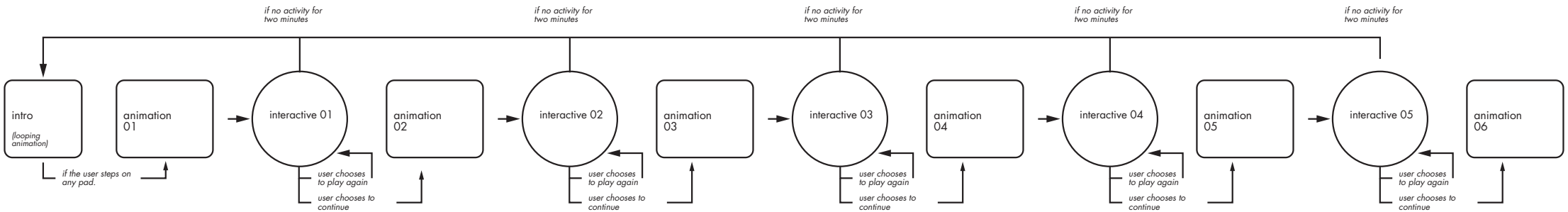
I used the mat that I constructed for the Emergent Literacy Project for this project as well. But the configuration for this project is less complicated. It comprises of only seven pads (labeled A-D and 1-3), and the arrangement of the pads facilitates the playing of all of the five games.

The games are fairly simple. Most are timed experiences where the user has to accomplish a goal within a certain period of time.



Barn Owl Project - mat configuration.





Barn Owl Project - architecture of system.

"Welcome to Franklin Farm! I'm Larry, and I'm here to teach you what it's like to be a barn owl. Just keep watching, and I'll let you know when to move!"

Barn Owl Project - storyboards.

hatching interactive

In the hatching interactive, the user takes on the role of Larry as an unborn chick and has only thirty seconds to get him out of his shell. To do this, the user must first crack the shell with his egg tooth. Once he makes a significant crack in the shell, the user must make Larry move his wings and legs to break open the shell the rest of the way. Three pads (1, 2, 3) control the different parts of Larry's body: wings, egg tooth and legs. The user needs to press the pads at the right time and also move quickly.

feeding interactive

In the feeding interactive, the user takes on the role of Larry as a young chick. Larry has 4 other siblings and must compete with them to get fed. To do this, Larry must first get in the position closest to the mother barn owl. To move Larry in front of one of his siblings, the user needs to select the pad associated with the sibling immediately in front of him, (A, B, C or D). The user must be quick because sometimes Larry is pushed back by another chick. If and when he makes it to the front position, he must squawk to get fed before another one of his siblings pushes him out of the way. Larry needs to eat four rodents in one minute in order to be successful at this task.

flying interactive

The flying interactive begins with the mother barn owl perched on the barn window with a young Larry. When she nudges him off of the window sill, the user must make Larry fly by doing quick jumps on pads A-C. If he is not successful within 3 tries he loses the game.

defending the nest interactive

In this interactive experience the user takes on the role of Lulu, the female owl. She has two jobs: 1) keep the eggs warm and 2) fend off predators during the egg incubation period (one minute).

To keep the eggs warm, the user must touch the pad corresponding to each egg, (A, B, C and D), frequently and lightly.

To prevent the predators (a cat, snake and raccoon) from attacking the eggs, the player must use her attack button. Predators that return more than once need to be fought off more aggressively than the first time they are encountered which means that the user has to press the pad more than once. This forces Lulu to be away from her nest longer which makes the game harder as time goes on.

If one of the eggs is attacked by a predator or gets too cold, the user loses the game.

hunting interactive

In the hunting interactive, the user takes on the role of Larry trying to capture his prey (a rodent). Each location corresponds to a pad. When the user hears the sound corresponding to a location, she must quickly choose the correct pad. If she does this quickly enough, the owl catches the rodent. The owl must capture four rodents within one minute.

process

For the linear animation between the interactive experiences, the script needed to be factual but light and conversational in tone. Reliable references as well as feedback from my zoo collaborators assured a truthful script. Establishing the appropriate tone was more challenging. I read the script out loud and revised it several times before recording.

A colleague with acting and voice-over experience played the role of the narrator, Larry the barn owl. He truly gave life to the character. His skillful reading made the script sound natural, light and jovial.

A paper prototyping session helped determine how the interactive experiences would work. I made a paper version of the mat and played the role of the computer while Brian Lucid (my thesis advisory) was the user. My classmates took notes and watched a timer. Our goal was to simulate the real experience as much as possible. As the computer, I read the linear parts of the experience. I also reacted to Brian's interaction with the mat in accordance with how I anticipated the interactive experiences working.

From the paper prototyping session we discovered that many of my games could be simplified. For example, in the defending the nest game, my original plan was to force the user to press different pads to fend off different predators. After paper prototyping, I decided Ithat was too confusing and I would have just one button that would fight off all the predators.

In creating the animated content, lessons learned in previous projects drove the direction of the piece. To teach users how to play the game, I took advantage of the flexibility of the animated medium. For example, in some cases, I show what is happening on the screen at the same time as I illustrate what should be happening on the mat. I also utilized fluid and unexpected transitions to a greater extent in an effort to hold the viewer's interest between games.

Programming the interactive experiences required extensive testing. Some of the games worked well when playing them with a keyboard, but not initially with the mat. For example, in the flying game, it was easy to make the owl fly if you were pressing keys on the keyboard. Making the owl fly by jumping on the mat was much more difficult. I had to alter the variables controlling the level of difficulty several times after watching users attempt it on a mat.

Paper prototyping.

Recording the script.

assessment

This project is a true culmination of all I have learned at Mass Art. Obviously, it requires the user to move. It is also reliant on animated content and has an educational goal.

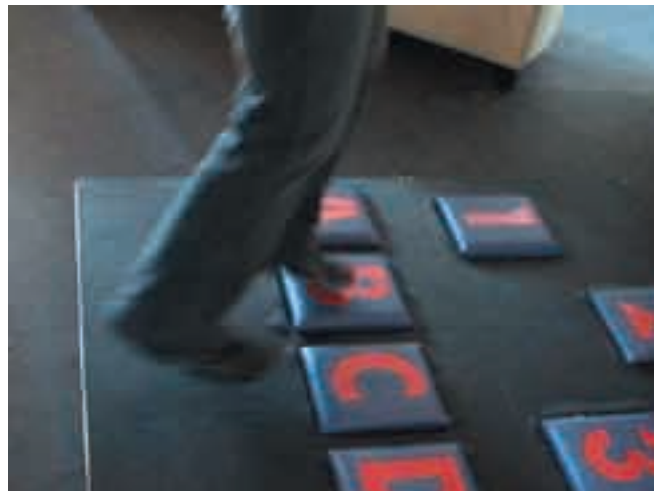
The Barn Owl Project was installed in the gallery at the New England Institute of Art as part of the Boston Cyberarts festival in April 2005. This allowed me to watch many different people experience the exhibit.

These observations validated my concept. Participants really had to move! Some got quite sweaty and attributed failures in the game to being out of shape. While some adults were initially shy about playing, many lost their inhibitions once they were absorbed in the game. Children, on the other hand, approached the physical challenge with enthusiasm and wanted to play again and again.

The exhibit was also successful at fostering a social atmosphere. Observers would help the player by yelling out what pad(s) he should hit. Sometimes children played the game collaboratively. For example, when testing the Defending the Nest game, on brother-sister team split duties, one monitoring the attack button while the other warmed the eggs.

In the midst of all the fun, by participating in these perceptual experiences, players gained an appreciation for what it is like to be a barn owl. One player reported that she never thought warming a nest would be difficult. Many were surprised to learn how barn owls hunted, and how many rodents the owl needed to capture. I do not believe that the participants would have this level of understanding if the format of the exhibit were more traditional.

Barn Owl Project set up for Boston CyberArts Festival.



Barn Owl Project - user testing.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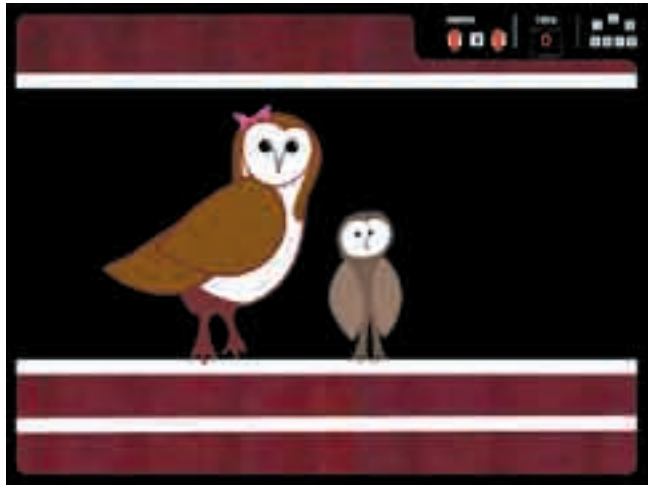

Screen shots from Barn Owl Project.

conclusions

My long and winding thesis process has led me in many different directions. I began by considering ways in which motion and new media relate. This led me to the discovery of movement-driven video games where I observed their tremendous physical and social benefits. When I began to make my own physical interactive experiences, I realized interactive movement-based experiences could facilitate learning. Animation became integral in these experiences, because it is a unique medium that is especially suited for instruction and fantastical, whimsical storytelling. Putting it all together I executed my final case study: an animated, movement-driven interactive learning tool for an exhibit space: the Barn Owl Project.

This final case study was successful at demonstrating the theories articulated in this document. It required people to move, which transformed the experience from a passive to an active one. It also fostered a social and collaborative atmosphere. The animation in the piece set a playful tone and facilitated in teaching. The result was that users seemed to retain the content and enjoyed themselves in the process.

The Barn Owl Project would not have existed had I not executed all of the projects leading up to it. From prior work I learned lessons that I recalled while working on my final project. For example, when animating I was able to render organic and creative movement with more seamless and inventive transitions. Audio and video mishaps in past projects made me especially diligent about execution in this project. The programming and electronics knowledge I obtained in prior work was also required. I was also careful to consider setting and target audience. Finally, being able to fully build the project and test it has been interesting and something I did not achieve with previous projects. The result of all of these hard lessons learned was that I was able to build a project that is usable and desirable.

The success of my final project is a testament to the thesis process itself. I did not know where this journey would take me, but I kept experimenting. This was an immense learning experience. Rarely do I execute a project without knowing where I am going. I have learned to do work that interests me, reflect, and trust that the journey will lead me to an interesting place.

references

books

Gardner, H. (1993). *Multiple Intelligences: The Theory in Practice*. New York: Basic Books.

Gillet, J. & Temple, C. with Crawford, A., Matthews, S. & Young, J. (2000). *Understanding Reading Problems: Assessment and Instruction*. 5th Edition. New York: Longman.

Hooks, E. (2003). *Acting for Animators*. Portsmouth: Heinemann.

Howard, P. (1994). *The Owner's Manual for the Brain: Everyday applications from mind-brain research*. Austin: Leonrian.

Laybourne, K. (1979). *The Animation Book: A Complete Guide to Animated Filmmaking – From Flip-books to Sound Cartoons.* New York: Crown Publishers, Inc.

McCloud, S. (1994). *Understanding Comics*. New York: Perennial Currents.

Muybridge, Eadweard. (1955). *The Human Figure in Motion*. New York: Dover Publications.

Shedroff, Nathan. (2001). *Experience Design*. Indianapolis: New Riders.

Tufte, Edward. (1997). *Visual Explanations: Images and Quantities, Evidence and Narrative*. Connecticut: Graphics Press.

web sites

http://acg.media.mit.edu/people/simong/stompingGround

http://affect.media.mit.edu

http://web.media.mit.edu/~joep/SpectrumWeb/captions/Carpet.html

http://web.mit.edu/museum

http://www.c-motion.com

http://www.charactermotion.com/danceforms

http://www.childrennow.org

http://www.dance.ohio-state.edu/labanwriter

http://www.ddrfreak.com

http://www.immersionmusic.com

http://www.kidsource.com

http://www.merce.org

http://www.mos.org

http://www.sportscad.com

http://www.utexas.edu/student/utlc/makinggrade/physical.html

http://www.troikaranch.org/isadora.html

http://www.washingtoncenterforlearning.org

articles

Computer game teenager gets DVT. *BBC News UK Edition*. (2004, January 29).

Laidman, J. Video games figure in school shootings. *Pittsburgh Post-Gazette*. (1999, April 27).

Peterson, J. & Bryant, C. (1999). Considering the mind/body connection reveals that there are many more benefits to exercise than meets the eye. *Fitness Management Magazine*. 15 (8). 46-47.

Yessis, M. Four Exercises to Increase Your Running Speed. *Running & Fit News*, 21(5), 2.

Winn, Steven. Once they were called museums. Now they're more like amusement parks. Don't bewilder today's museum-goer with facts and figures. Make it splash. Make it sizzle. Make it fun. (2003, July 19). *San Francisco Chronicle*.

films

Zimmer, Elizabeth. (1998). *Turner Classic Movies' Documentary: Busby Berkeley: Going Through the Roof.*