February 16, 2012

ENGR110/210
Perspectives in Assistive Technology

David L. Jaffe, MS

Professor Drew Nelson

John Thiemer

Items

1. Presentation evaluation forms
2. Mid-term reports - due in class Tuesday
3. Carpool drivers needed for tour of Gait & Motion Analysis Lab in Menlo Park – Thursday, February 23rd
4. Passenger signup list in class next Tuesday

Tuesday

Ray Grott, MA, ATP, RET
San Francisco State University

Practical and Appropriate Technology Solutions

Presentation Schedule

1.	4:15 - 4:25	RotaBrake
2.	4:25 - 4:35	Spin a Story
3.	4:35 - 4:45	Piano Pedal
4.	4:45 - 4:55	Accessible Eateries
5.	4:55 - 5:05	KinExpressions!
6.	5:05 - 5:15	Transfer-mations
7.	5:15 - 5:25	Friendly Cane
8.	5:25 - 5:35	Customize the Wheelchair

Wheelchair Brake



ROTAbrake:

Tyler Haydell, **Jai Sajnani**, and **Mark Murphy**

Project: Explore designs for a low cost brake design for a manual wheelchair.

ROTAbrake

ENGR 110: Perspectives on Assistive Technology, Winter 2011-2012

Team: Universal Braking Solutions (U.B.S)

Jai Sajnani, Mark “Leko” Murphy, Tyler Haydell

Abstract

- Our team is working to develop a universally adaptable wheelchair wheel package that addresses the following:
  - Creating an anti-rollback mechanism that can easily disengage
  - A new parking brake that can be easily activated and sustains consistent performance
  - Implement a retarding brake into wheelchairs

Statement of Problem

- Wheelchair brakes currently on the market are difficult to activate and sensitive to tire size and wear. Anti-rollback mechanisms can not be easily disengaged, and they are separate from the actual brake. Wheelchair users must use the friction between their hands and the handrim as a retarding brake – which beyond being extremely strenuous and tolling, doesn't provide sufficient braking ability in normal or compromised situations.

Magnitude of Problem We are Addressing

- We are working primarily to create a parking brake that is independent of tire pressure and can be easily activated.. Secondarily, we are attempting to develop an anti-rollback mechanism that can be easily activated. We are also working to lessen the force on the user's hands required to brake the wheelchair.

Interviews

- **Marv Tuttle** – paraplegic; very active; tabs in handrim and lever brake damage hands; as tire wears brakes become less effective; always need hands on both rims; go through bike gloves in a week; wheels = costly; retarding brakes must be convenient
- **Ken** – quadriplegic; less hand function; exposed need for brake to not require much dexterity; again hand hits lever brake; wetness and dustiness make handrim slippery; had anti-rollback device that he didn't really use – wasn't convenient; chair must fit through doorways

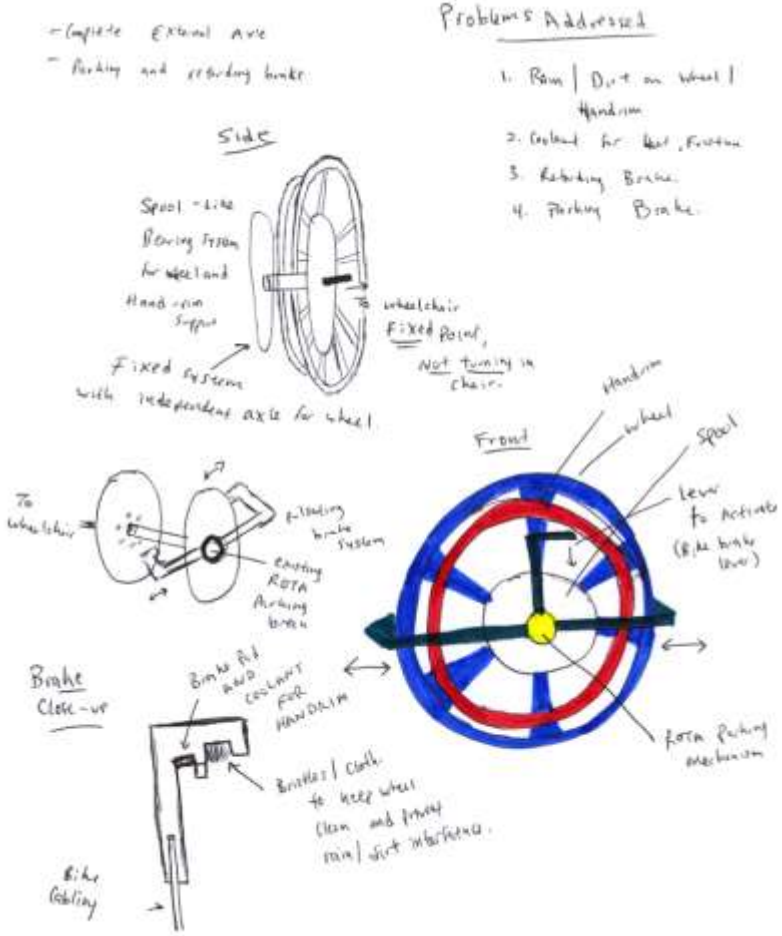
Statement of Specific Need

- Brake that is easily activated and doesn’t depend upon status of tire.
- Anti-rollback mechanism that can be easily engaged/disengaged.
- Retarding brake that can be easily activated and doesn’t require releasing handrim

Existing solutions

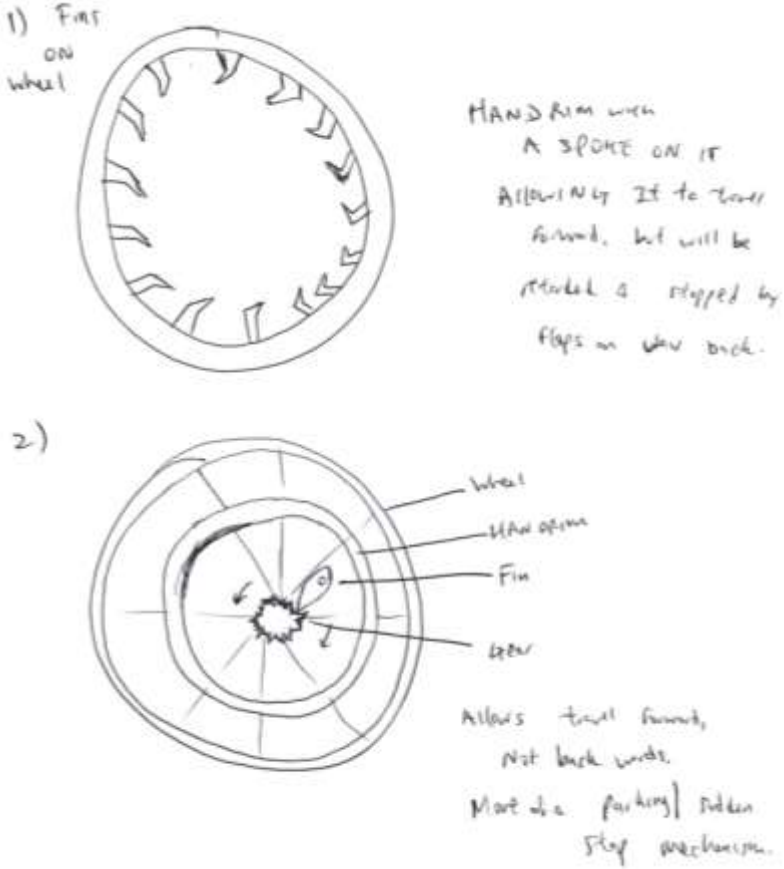
- Commercially Available Designs
1. Traditional Lever Brakes
2. Disc Breaks
3. “Magic Wheels” Gear Breaks
4. Coaster Breaks
- Limitations of These Solutions

Brainstormed Ideas



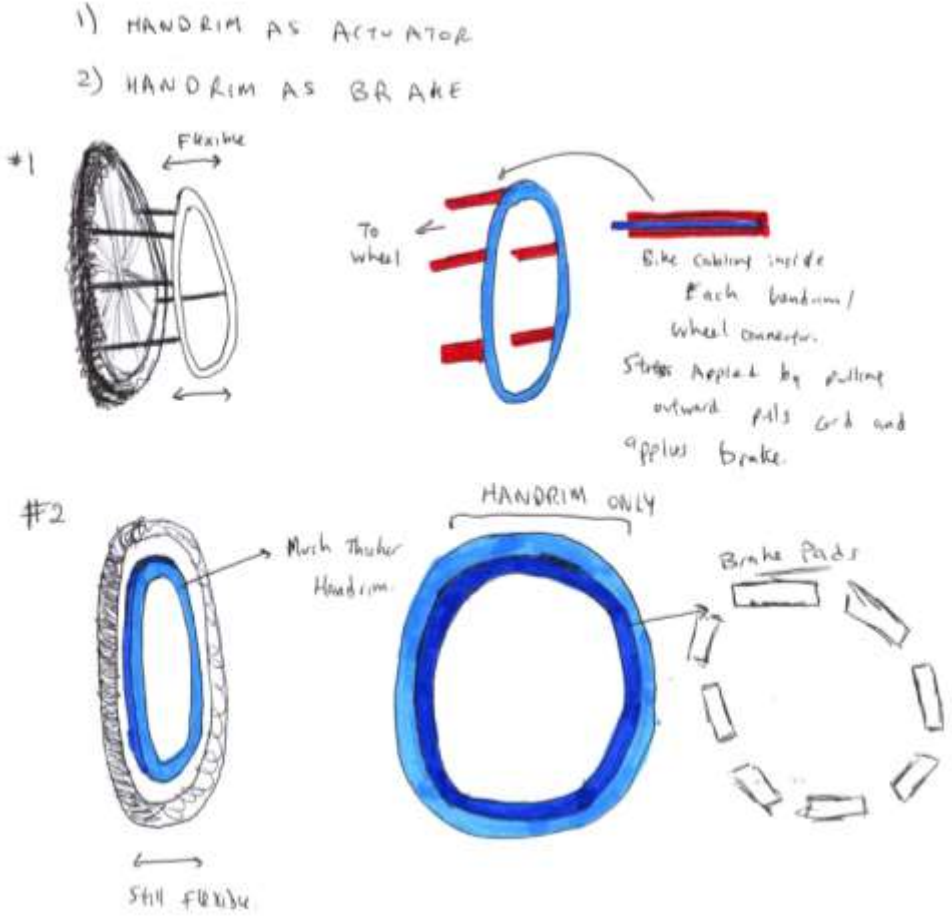
- **Handrim Device**
  - Description: Rod-like device that comes out of fixed axle and would clamp onto handrim
  - Function: retarding brake; potentially a parking brake; could clean handrim
  - Logistics: Activated by bicycle brake type mechanism
  - Cons: Difficult to prototype, would require very sturdy metal that may add weight, activation with cables would be difficult

Brainstormed Ideas



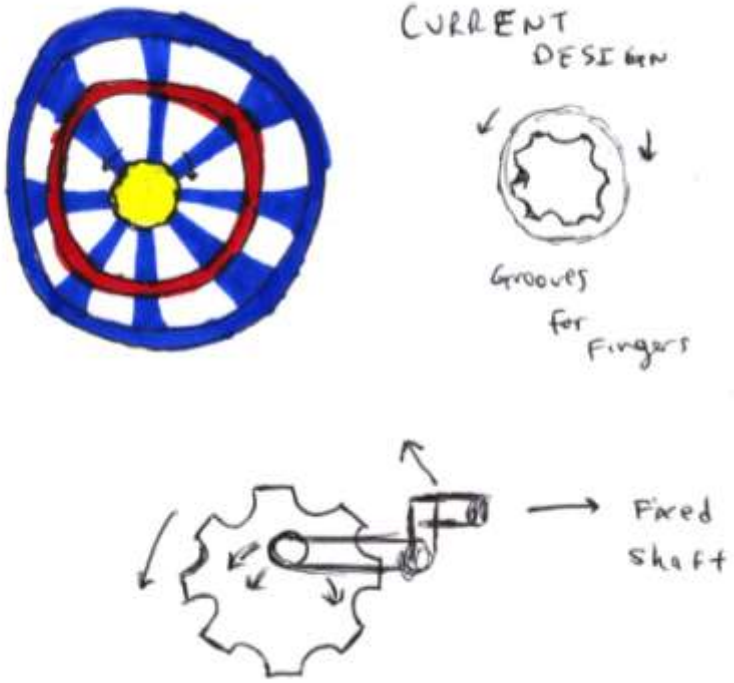
- **Wheel of fortune idea**
  - Description: if pushed forward, wheel would move forward, but if wheel is stationary, tabs would slow down wheel
  - Function: retarding brake; eliminate friction from hand when braking
  - Logistics: handrim and wheel would exist on different axles; gear-like mechanism would allow generate forward motion if pushed forward, but oppose it if stopped
  - Cons: would not allow for reverse; not a parking brake

Brainstormed Ideas



- **Push in Handrim**
  - Description: pushing inwards on handrims would activate brakes
  - Function: retarding brake, potentially parking brake
  - Logistics: would have to again make handrim semi-independent of wheel (forward motion would correspond to wheel, but not stationary or backwards); handrim would have to have various degrees of freedom
  - Cons: difficult mechanically to create; type of brakes activated by handrim would probably be cable which introduces problems

Brainstormed Ideas



- **Rotawheel crankshaft**
  - Description: utilize existing Rota parking brake but make it more accessible
  - Function: parking brake
  - Logistics: install crankshaft so that parking brake can be activated more easily
  - Cons: does not address retarding brake or anti-rollback mechanism; difficult to design crankshaft that remains upright

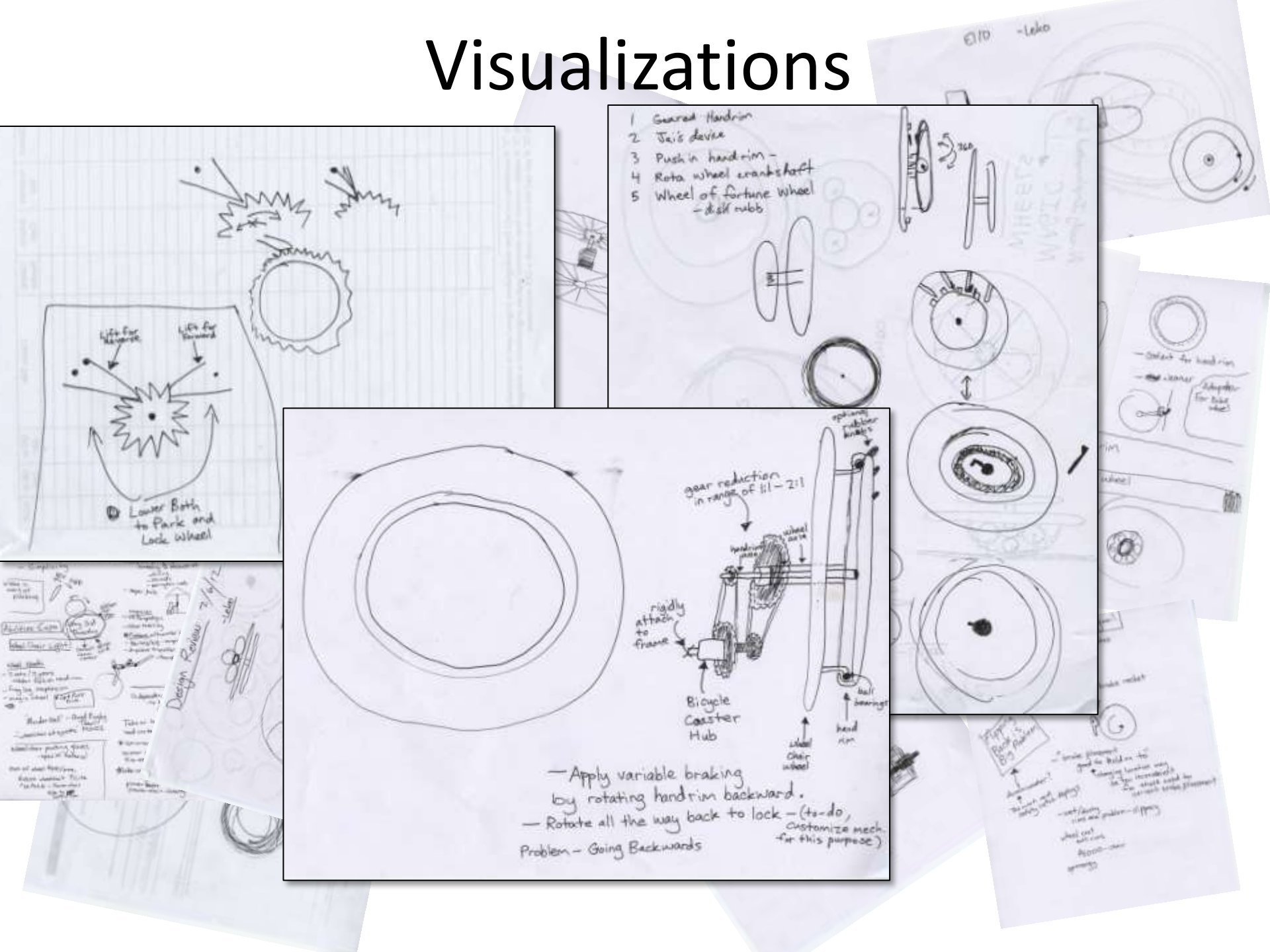
Brainstormed Ideas

- **Independent handrim**
  - Description: pushing forward on handrim would push wheel forward, but back ward would activate a brake instead of using friction to stop wheel
  - Function: retarding brake; potentially parking brake
  - Logistics = cons

Selected Idea

- **Coaster Hub Anti Rollback Brake System**
  - Description: Incorporates many of our ideas, including an independent hand rim, variable braking and anti rollback
  - Function: Uses the mechanism found in many 1-speed bikes, called a coaster brake hub. Instead of bike pedals, we attach a handrim
  - Logistics: These coaster brake hubs are commercially available and easy to obtain.
  - Pros: Simple installation, lessens need for custom manufacturing, no friction on hands when applying a braking force
  - Cons: The standard coaster brake hub does not include a parking brake solution

Visualizations



Selected Idea

- **Technical Feasibility:** not a totally new concept, simply taking it from a bike and putting it on a wheelchair
- **Engineering Difficulty:** creating an adaptor from the wheel to the chair can be easily done on the lathe.
- **Estimated Cost:** $249, commercially-available package
- **User Acceptance:** after our interviews, this solution seems to solve many of the problems faced by wheelchair users. Implementation looks like a normal wheelchair
- **Safety Considerations:** Our solution is safer than existing wheels because it lessens wear and risk of injury to the hands.

Selected Solution

Axle is rigidly attached to chair

Handrim connects directly to sprocket

Future of Rota brake

- Modify coaster hub to include a parking brake
- Allow coaster hub to easily switch between forward and reverse
- Design and manufacture an adaptor for the coaster hub axle to fit the wheelchair
- User testing and feedback on design

Spin a Story

SuperK:

Krystal Le

Project: Investigate and develop new educational activities appropriate for children with disabilities. This may include mechanical and/or computer software solutions that will provide interactive access for these learners.

Spin a Story

Krystal Le

Resource Area for Teaching (RAFT) Project

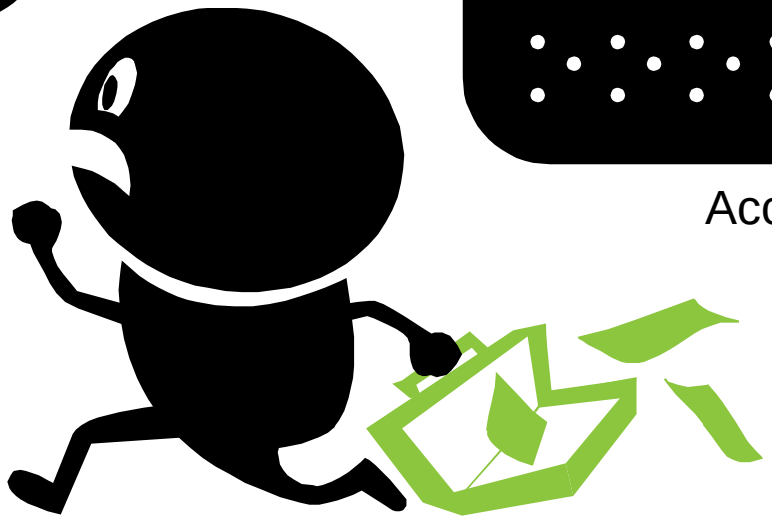
Brief Abstract

- **Background:** Resource Area for Teaching (RAFT) creates hands-on activity kits for students nationally.
- **Problem:** Special education teachers report that they often wish there were more activities focused on children with disabilities.
- **Aim:** Investigate and develop new educational activities appropriate for children with disabilities.

Design Criteria

Intellectually Stimulating

Accessible



Affordable

Overview

- Problem & Unmet Needs
  - Needfinding
  - Existing Solutions

- Brainstormed Design Concepts
- Description of 3 Selected Designs
  - Future Steps

The Problem + Needfinding

Challenges Students with Autism Face

Difficulty Communicating!

Hope Technology School

- Erlinda Cruz Quintero

Vocational Education Program Teacher

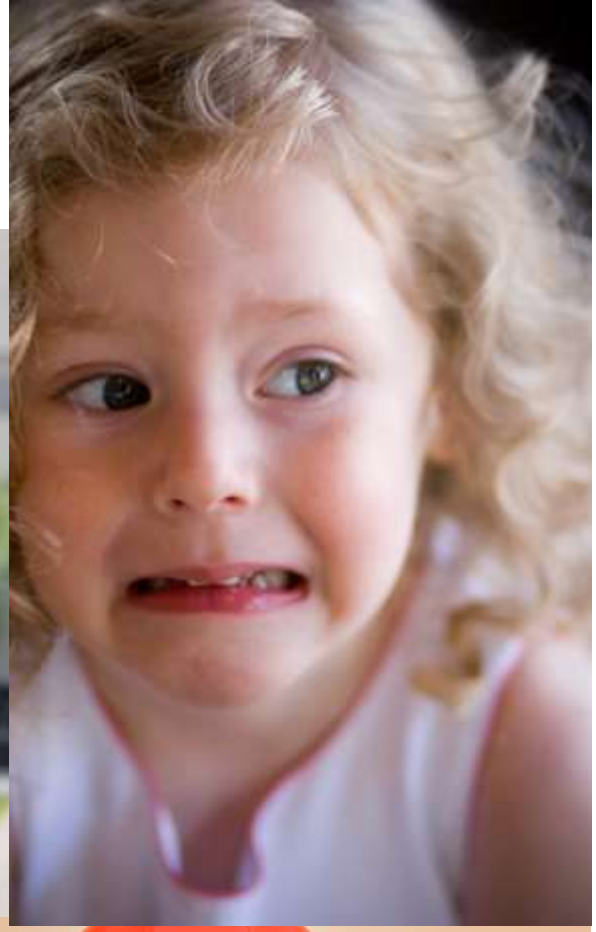
- Sandra Burke

Speech Language Pathologist

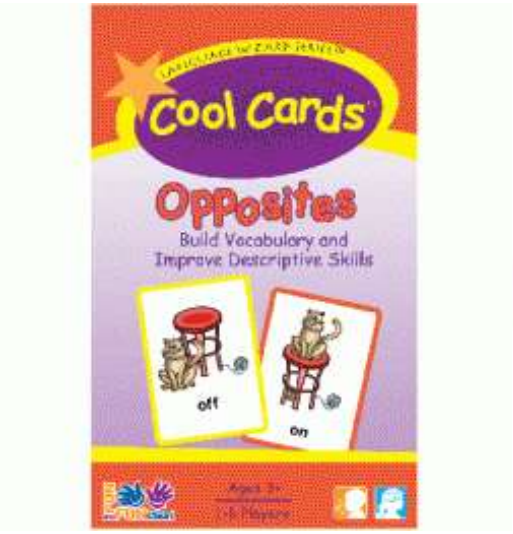
- Jen and Maisa

Special Education Teachers

Common Challenges



Existing Solutions



Flashcards!

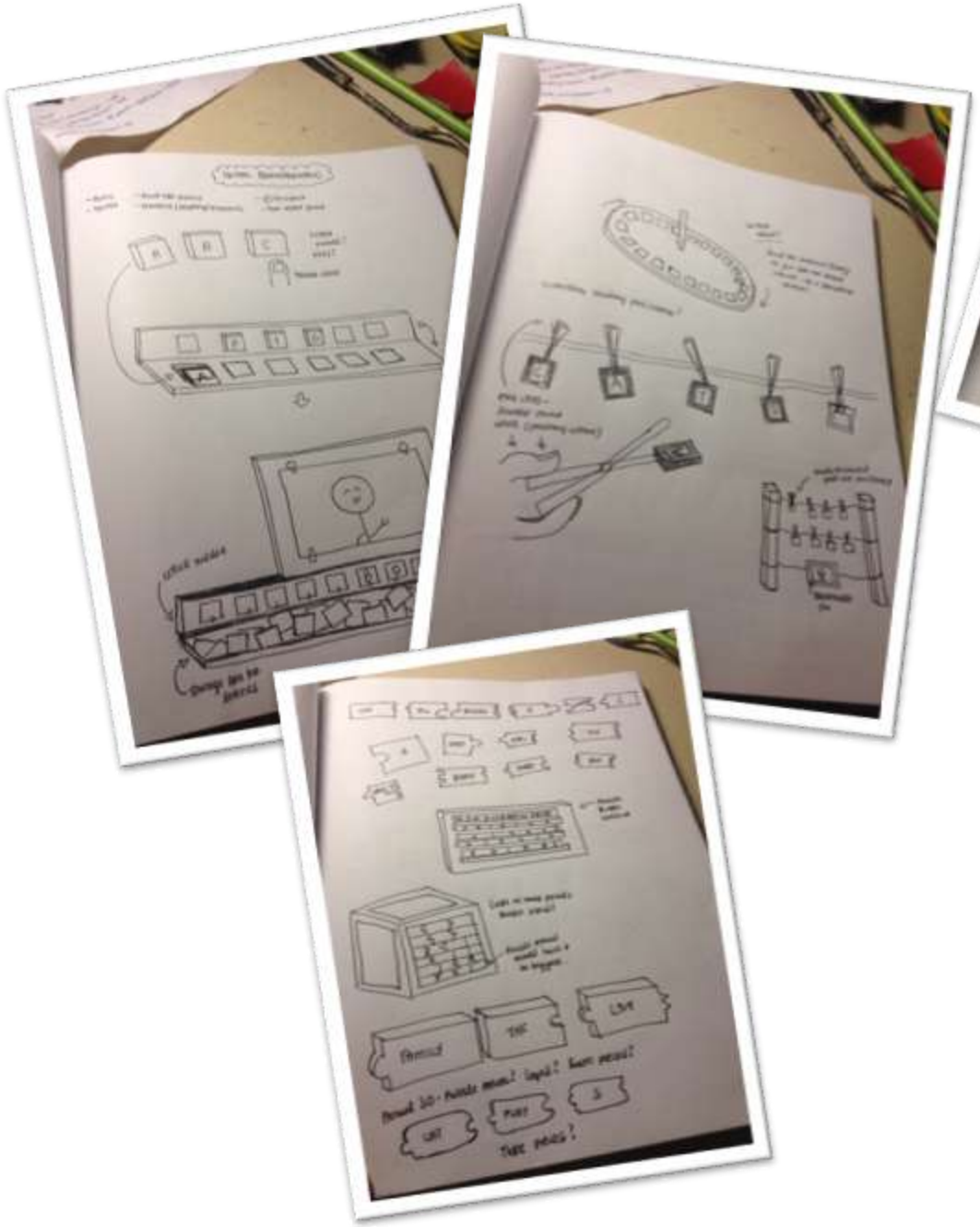
Chartlets

Board Games

iPad Apps

Sensory OVERLOAD!

Brainstorming



- Spelling Games
- Word and Picture Puzzles
- Personalized Workbooks

Quick Prototypes

Prototyping + 3 Designs

Tell Me What You Want!

***Physical Description**: A rectangular box with a clear pocket at the top and a series of flashcard holders at the bottom. In this picture, there is a piece of paper in the pocket with the question, "What do you want to do today?" written on it. The three flashcards at the bottom show pictures of a computer, a family running outside, and a mother and daughter sleeping. Each flashcard is accompanied with a word or phrase ("Computer," "Go outside," "Sleep").*

Physical Description: A similar picture but with the question, “How are you feeling today instead with different flashcards.

Give Me Some Sentences!

***Physical Description**: A series of flashcards with different pictures of subjects ("mommy", "house"), verbs ("run", "eat"), and articles/prepositions ("to", "the") pinned with thumbtacks to a cork board. The flashcards are arranged to form sentences.*

Tell Me a Story!

***Physical Description**: Different pieces of fabric (with stickers on top of them) are lying on a corkboard/storyboard. Some of these stickers are pictures of bears, dancing hippos, penguins, etc.*

Future Steps

User Testing + Reiteration

Thank You!

Questions after class!

Piano Pedal

Team name:

Ntokozo Bhembe

Project: Explore designs that would enable a Menlo Atherton high school student with paralysis to operate the sustain foot pedal on his electronic music keyboard.

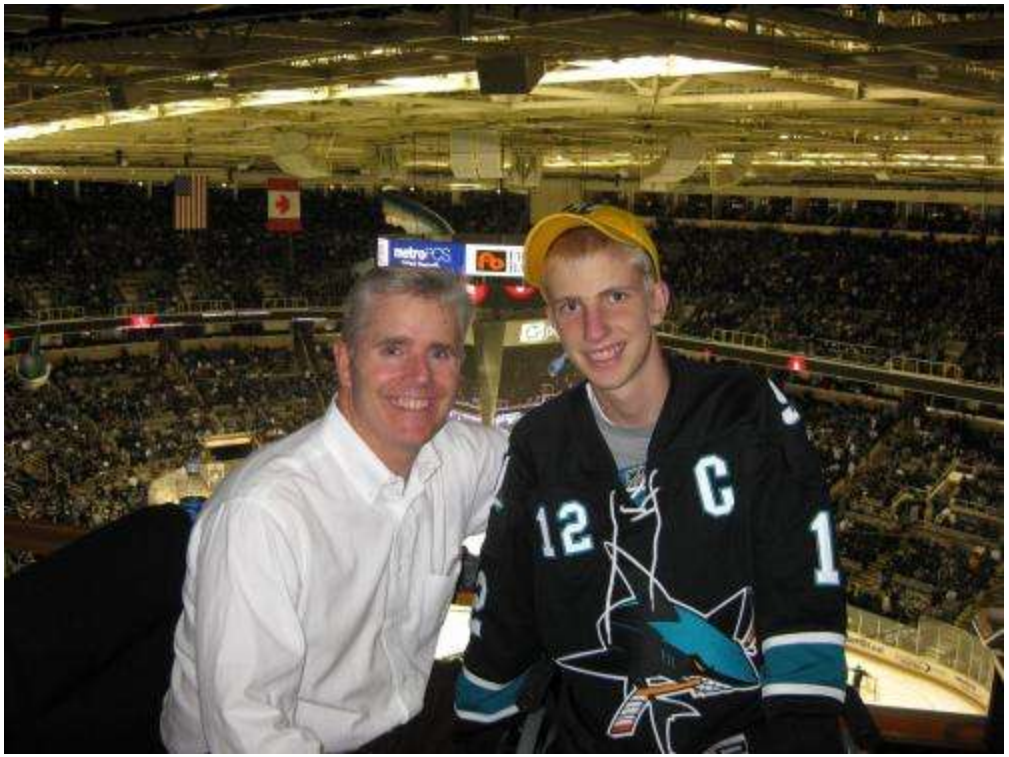
Piano Pedal Project

Project Suggestor: Zack & Darci Wentz

Ntokozo Bhembe

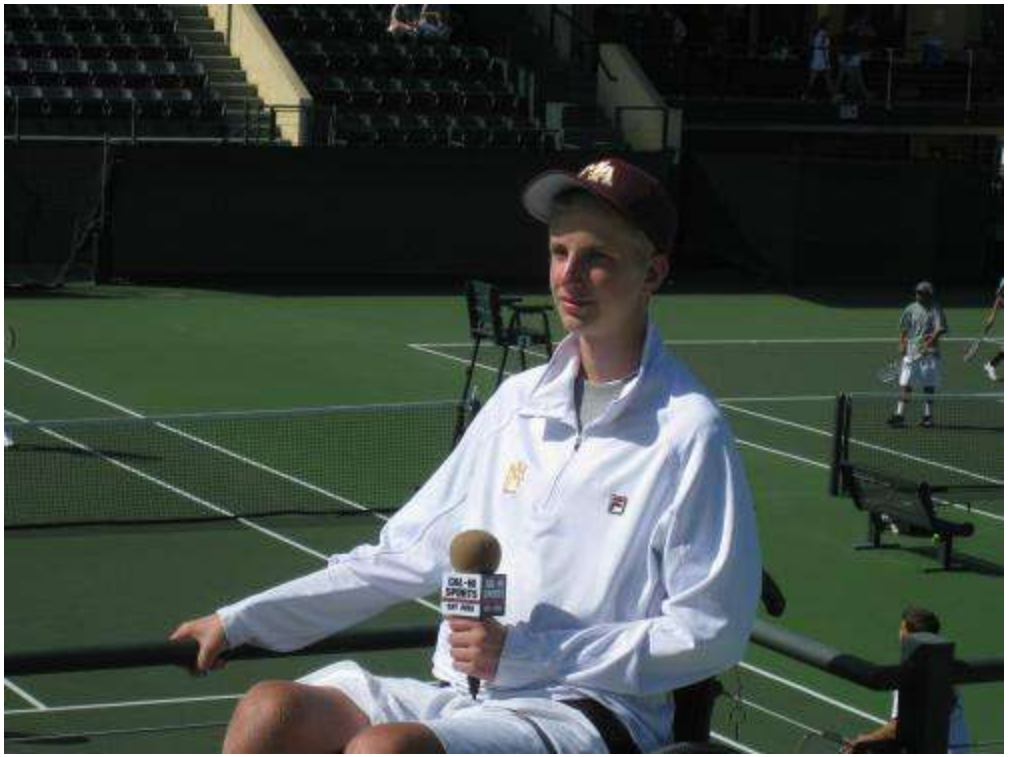
Zack “Music and Sports are my two passions”

- Has signed basketball from Lebron James
- Also plays the guitar and enjoys rapping



Project background

- Zack Wentz
- Amazing young man born with acute epidural hematoma (blood clot) along his spinal cord from vertebrae C6 to T4
- Zack has lost use of his body starting



Investigating the Problem

- Zack plays electronic keyboard but has no use of his legs
- He also has no control of his upper body posture due to lack of core muscles

Existing solutions: None

- Zack's solutions:
- Tried using his mouth but that didn't work because he couldn't fit the entire pedal in his mouth and wanted to sing/rap
- Has tried to use forehead (very uncomfortable and not practical)
- Often gets help from his mom/family members to operate the pedal for him

Existing potential solutions:

- Zack has done extensive research
- Switch sip/puff switch

Existing potential solutions:

- AM/FM Radio with tilt switch headset (Model 340) with set of head position headphones

HeadMouse® Extreme
Wireless Head Controlled Mouse

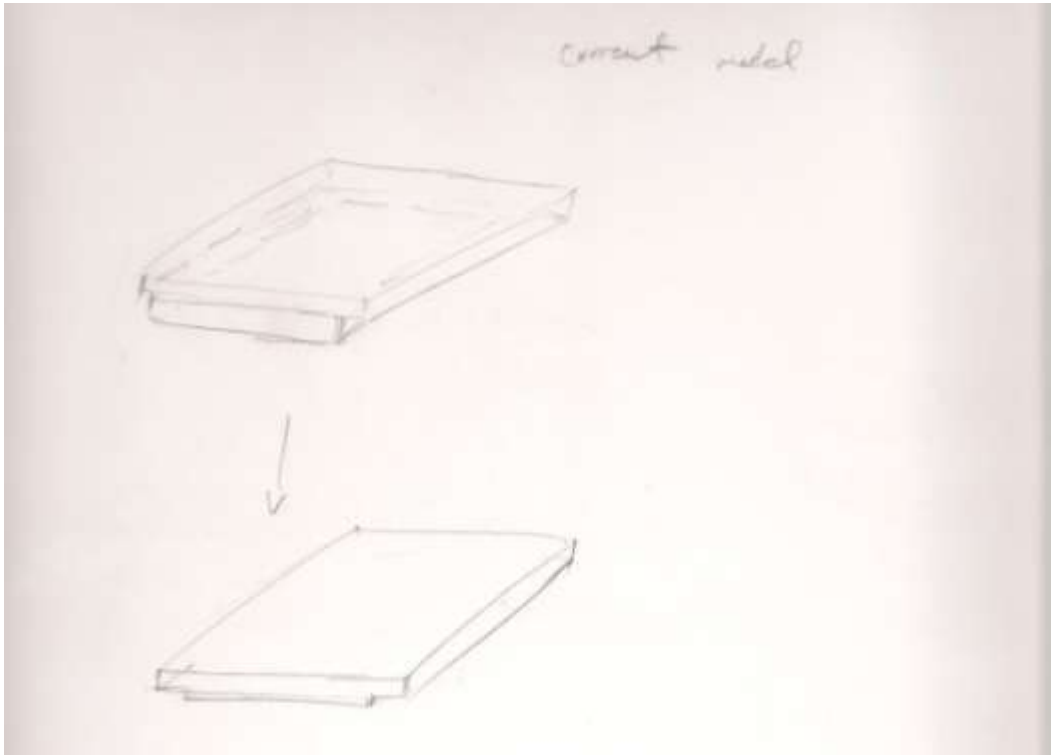
- Uses head movement to move cursor on screen
- Could be adapted as a switch

The problem with these:

- Too expensive to be practical
- Involve “unnatural movement” from use
- Restrict the use of the mouth
- Too complicated

Explored ideas: The pedal

- Understanding the Sustain Pedal
- Just a switch



Explored ideas: Back operated pedal

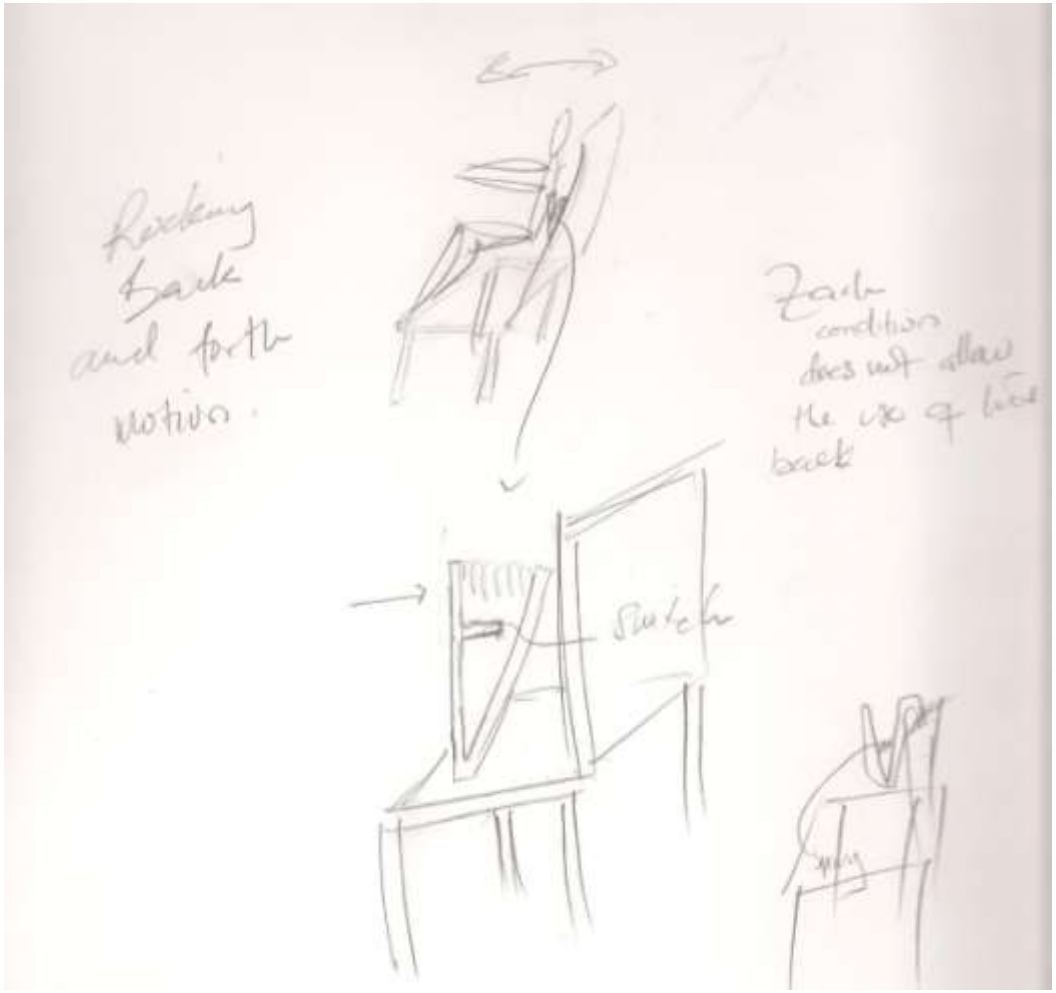
By rocking back and forth the pedal is operated

Pros

Relatively simple

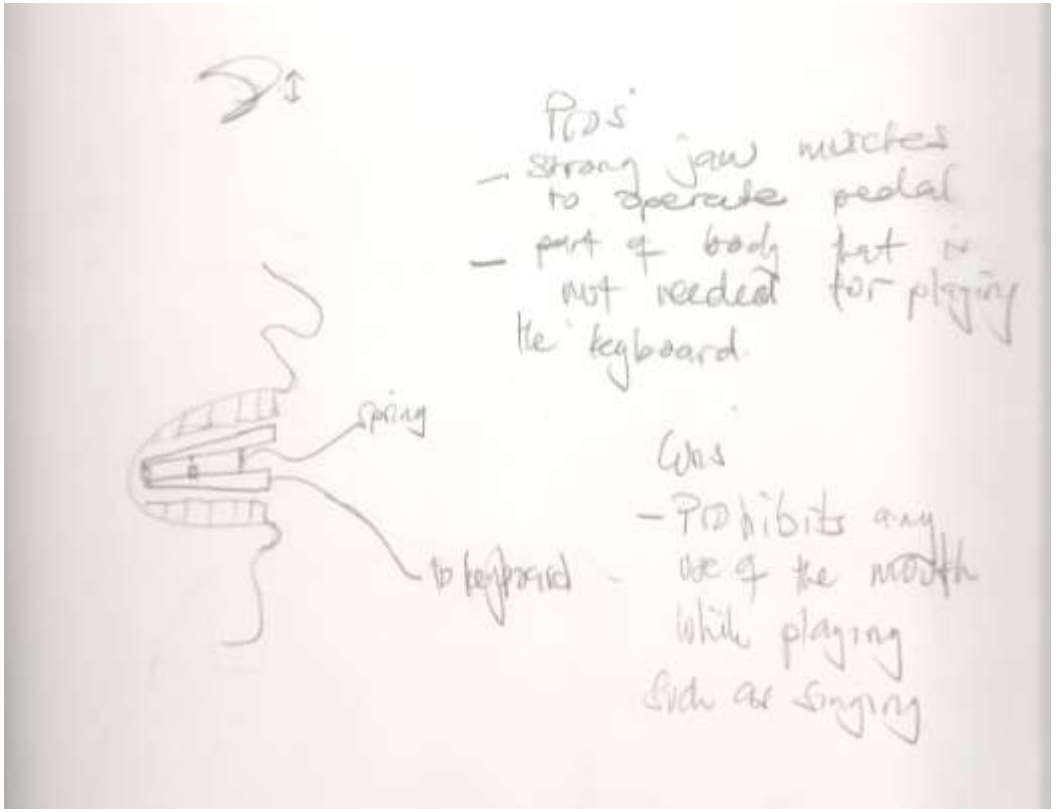
Cons

Zack has virtually no core muscles



Explored ideas: Mouth operated switch

Operated by pressing switch with teeth by biting



Pros

Simple and small

Cons

Prohibits singing

Explored ideas: Armpit switch

Operated by pressing pedal in between the armpit

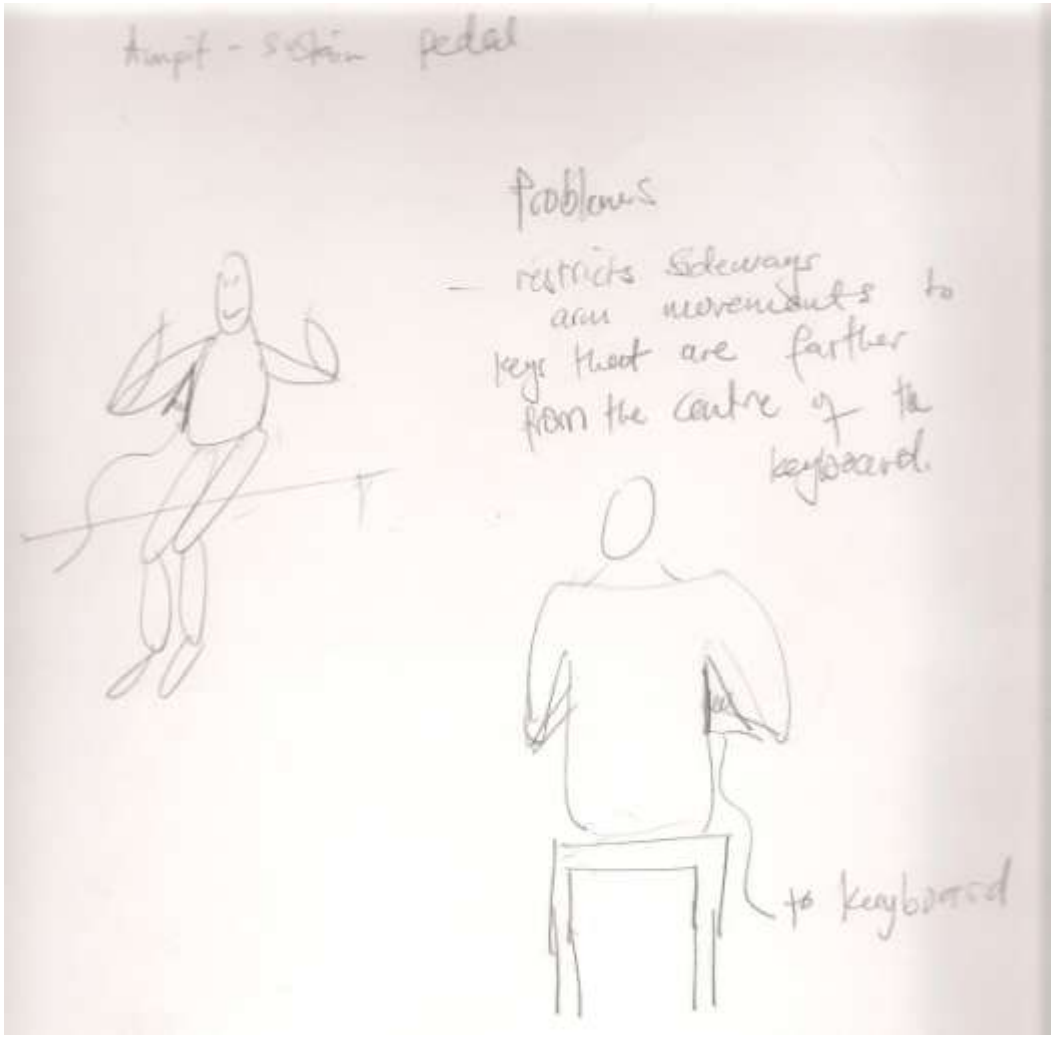
Pros

Not as weird and easy to make.

Would be cheap

Cons

Restricts arm range of motion

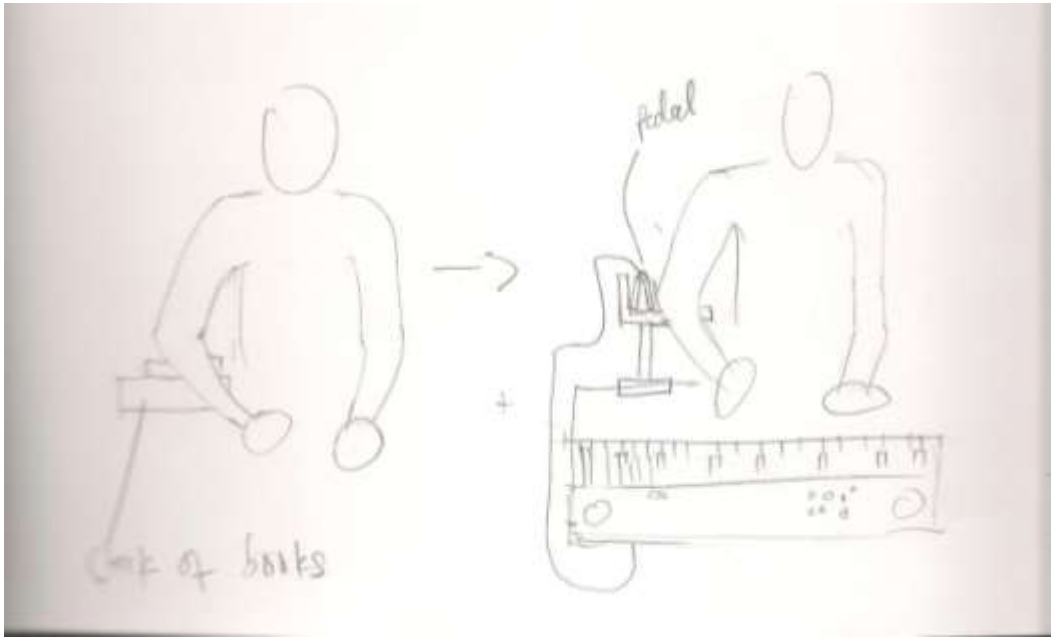


Explored ideas: Winner

Came out of observations made during visit with Zack for a meeting

Zack has to lean with his left arm to support his torso

Integrate pedal into arm-rest solution



Problems encountered

- Acquiring a piano pedal to take apart and perform a product forensics
- Means to travel and see Zack more often
- Lack of teammates to bounce ideas with

Accessible Eateries

Team name:

Nicole Torcolini

Project: Create an accessible database of restaurant menus that can be accessed via a website or a mobile application.

Accessible Eateries

Nicole Torcolini
(and Lexia)

A Table Using a Screen Reader

table with 3 columns and 3 rows
A La Carte
Combo
The Axe
6.25
7.25
Five ounces of Angus Beef
The Billy Erb
6.00
7.00
Free Range Turkey Burger
table end

The Real Table

	A La Carte	Combo
The Axe	6.25	7.25
Five ounces of Angus Beef		
The Billy Erb	6.00	7.00
Free Range Turkey Burger		

An Alternative

The Axe

Five ounces of Angus Beef

- A La Carte $6.25
- Combo $7.25

The Billy Erb

Free Range Turkey Burger

- A La Carte $6
- Combo $7

The Website

- http://www.accessibleeateries.com

Social skills for elementary students with Autism Spectrum Disorders

KinExpressions!:

Anna Ly and **Hain-Lee Hsueh**

Project: Explore mechanisms of enhancing social skills for students with Autism.

kinExpressions!

Learning and Applying Emotions with Kinect

Assistive Technology
ENGR 110 | 210
Anna Ly | Hain-Lee Hsueh

Team LDT

Hain-Lee Hsueh

Background in ECE and Software Engineering from Cornell. Formally worked for Oracle Enterprise Applications.

Anna Ly

Background in HCI, Business & Communication Design from Carnegie Mellon. Formally worked for IBM Strategy.

Background

Autism Today

- 1 in 110 American children are on the autism spectrum
- More children this year will be diagnosed with autism than with cancer, diabetes or pediatric AIDs COMBINED
- ASD affects 3 million individuals in US / 10 million worldwide

Diagnosis Criteria (DSM-IV)

Qualitative impairment in social interaction as manifested by two of the following:

- Use of nonverbal behaviors
- Failure to develop peer relationships
- Lack of social or emotional reciprocity
- Lack of empathy

Empathy

Pamela Wolfberg

SFSU, Associate Professor of Special Education

- "We stress integrated play **initiated by the children** themselves."
- " We don't want them to see this as instruction time. We want the situation as **natural and random as possible**"

Michelle Fong

Associated Learning & Language Specialists, CCC & SLT

- "A lot of kids **can't imitate facial expressions**...or sometimes they over-exaggerate so it looks unnatural."
- "The facial teaching tools they have today where you put together faces (eyes, noses and mouths) have parts that don't even look human. The smiles **are angular and look robotic**."
- "**Play needs to be complex** and they need to be able to **transfer it** to a natural context. If they do not reach that level, they will continuously be **behind as they grow older**"

Empathy

Sandra, Erlinda, Jen, Maisa

OT / SLT @ Hope Technology School

- "What's frustrating about applications is that sometimes, kids just want **to click on it to get the feedback instead of actually learning**"
- *Sandra*: "One kid once came up really close to me (*stands up against another staff member to illustrate) and said, "It's nice to meet you!" and I had to back away to let him know that **he was standing too close**."

Evelina Liu

Mother of 5 year old boy with autism

- "**Communication is a major problem**...when I ask him a question, he often doesn't answer it and just says whatever happens to be on his mind at the moment."

Define

5-10 year old children with mild to moderate autism need a way to recognize and express both emotions and social nuances because failing to do so may lead to ***social isolation*** as well as ***delayed psychological*** and ***educational development.***

Existing Solutions

mindreading

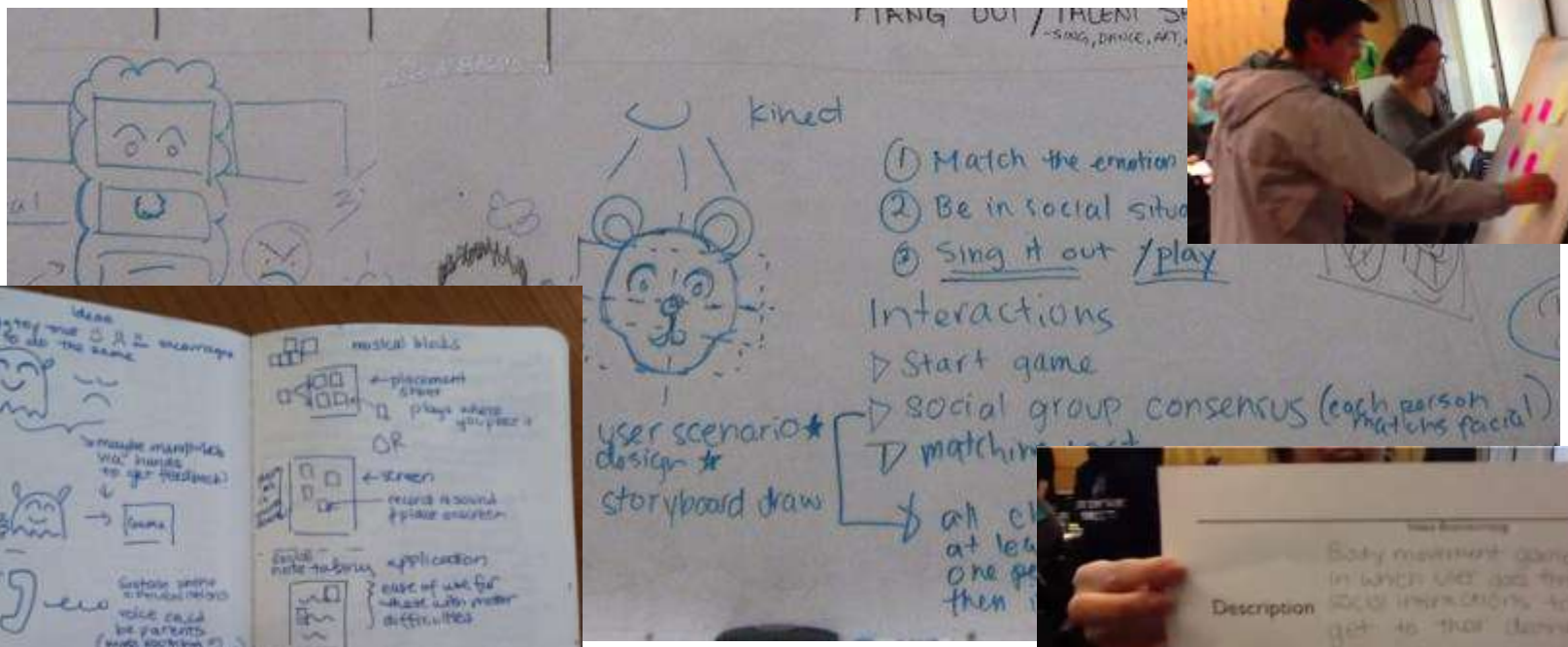
Feel Electric

The Transporters

Limitations

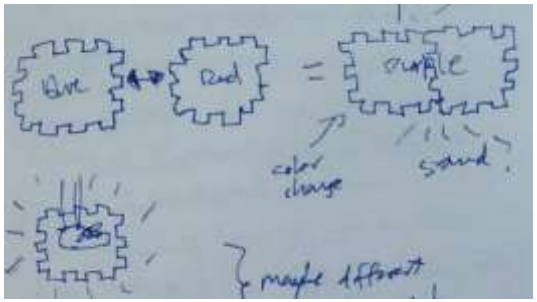
- “Glorified Flashcards“
- Unrealistic
- Effective emotion recognition, but no solution for evaluating emotion expression
- Individual learning vs. interpersonal experience
- Not multisensory or kinesthetic
- Gender constraints

Ideation: Initial Brainstorming



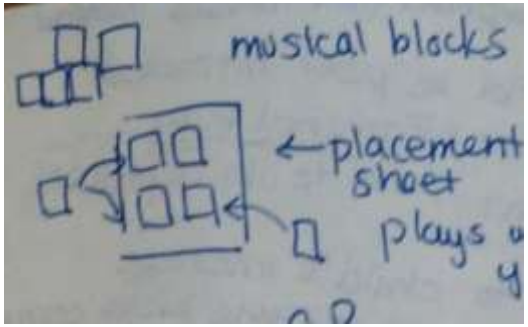
Ideation: Design Concepts

Facilitated Group Story Creation
(video)



Color-changing Tiles

Interactive Social Story Quest



Music Generation with Blocks
(video)

Selected Design: kinExpressions!

Core Concept

- Teaching and practicing emotions with others through facial & gestural recognition and expression using the Microsoft Kinect.

Core Mechanic

- Facial & gestural expressions are modeled
- Players must imitate and match the face
- Players' faces are displayed real-time
- **Video Prototype** ("MotionEmotion")

kinExpressions!

Technical Feasibility

- Kinect resolution can distinguish facial features
- Numerous SDK's available for development

Engineering Difficulty and Performance

- Processing, filtering, and analyzing data from the Kinect sensor
- Algorithms for matching two facial expressions
- Fidelity of graphics, animation, and texturing (for displaying characters and players' face)

kinExpressions!

Estimated Cost

- Kinect sensor: $150
- Learning resources for Kinect development: $0 - $30?
- License for existing facial recognition algorithms and data: ??

User Acceptance

- Therapists forecast Kinect as the "next big thing"
- Off-the-shelf Kinect games already being used (video)
- Therapists constantly seeking for multisensory tools

Design Considerations

- **HMW** get kids with autism to empathize? (i.e. imagine things from others' perspective?)
  - *Ex: Cars in the cookie bag*
- **HMW** get kids to transfer what they see on the screen
  - *Ex: Child getting a haircut*
- **HMW** convince kids with autism that social rules are important (e.g. picking your nose is bad)
- **HMW** leverage multi-sensory input without inducing sensory overload

Current Activities / Status

- **Underway**
  - Meeting with Director of Developmental Pathways for Kids
  - Participatory design for our current prototype
  - Fleshing out more interaction points
  - Evaluating idea of prototyping a mobile app to demonstrate proof of concept
- **Pending**
  - Obtaining algorithms for facial/emotion recognition
  - Contact with researchers at Microsoft
  - Potential meetings with other researchers in emotion recognition and autism

Challenges

- Difficulty in observing children play groups
- Working with non-typical children
- Strategies for "off-loading" engineering challenges to existing solutions
- Coordinating shared access to a Kinect sensor

Going Forward

Week 7 – Feb 20	Week 8 – Feb 27	Week 9– Mar 1	Week 10 – Mar 8
• Phone conference with researchers from MIT • Decide which SDK to use • Get up and running with kinect and sdk (sample code) • Get IRB	• Program to display a picture on one side, and a skeletal/face-tracking picture of the player next to it • Decide on 1-2 key emotions and 2 scenarios for each	• User test to see what ideas come out of this kind of set up and interaction • More partic. design • Refine prototype to flesh out 2-4 scenarios and game play	• Continue refining • Explore ideas for multi-player interaction

Low Cost Transfer Device



Transfer-mations:

Sofia Rojasova, **Nick Akiona**, and **Rahul Sastry**

Project: Explore designs for a low cost transfer device for a wheelchair user.

Transfer-Mations

Nick Akiona, Sofia Rojasova, and Rahul Sastry

Mission Statement

Under guidance from Rotamobility, we aim to create a low cost transfer device that reduces the physical strain of transfers, is portable yet applicable to most situations, and provides a feeling of safety.

Scope of the Problem

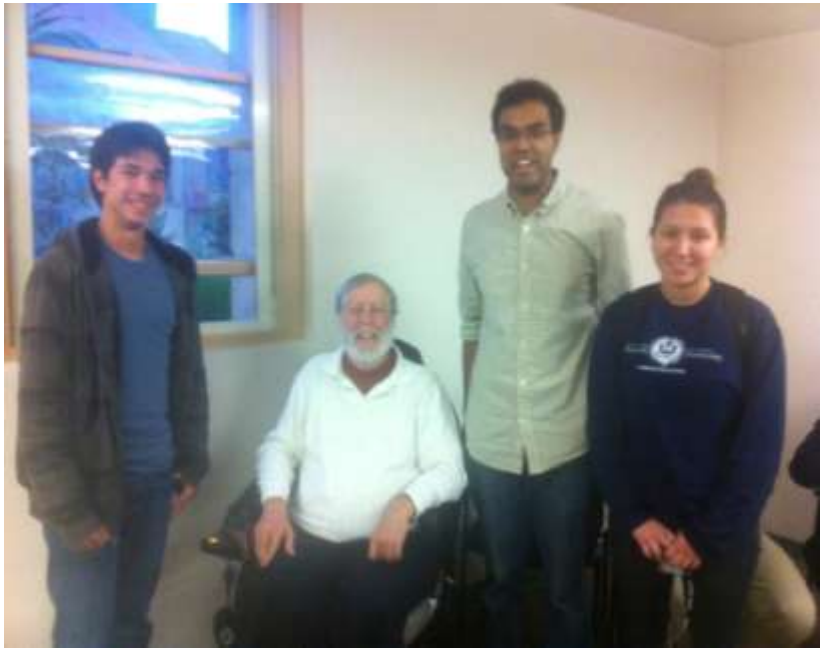
- Understand the point-to-point transfer challenges
- http://www.youtube.com/watch?v=JJWo8FFfjuE#t=0m18s
- Understand clinical recommendations for how-to transfer
  - PT/OT endorsement

- ~2.8 million U.S. wheelchair users
- ~10,000 people every year are spinal cord injured
- ~80% of wheelchair users are over 44 years old

Interviews and Needfinding

We interviewed 3 wheelchair users and are in the process of consulting with a PT.

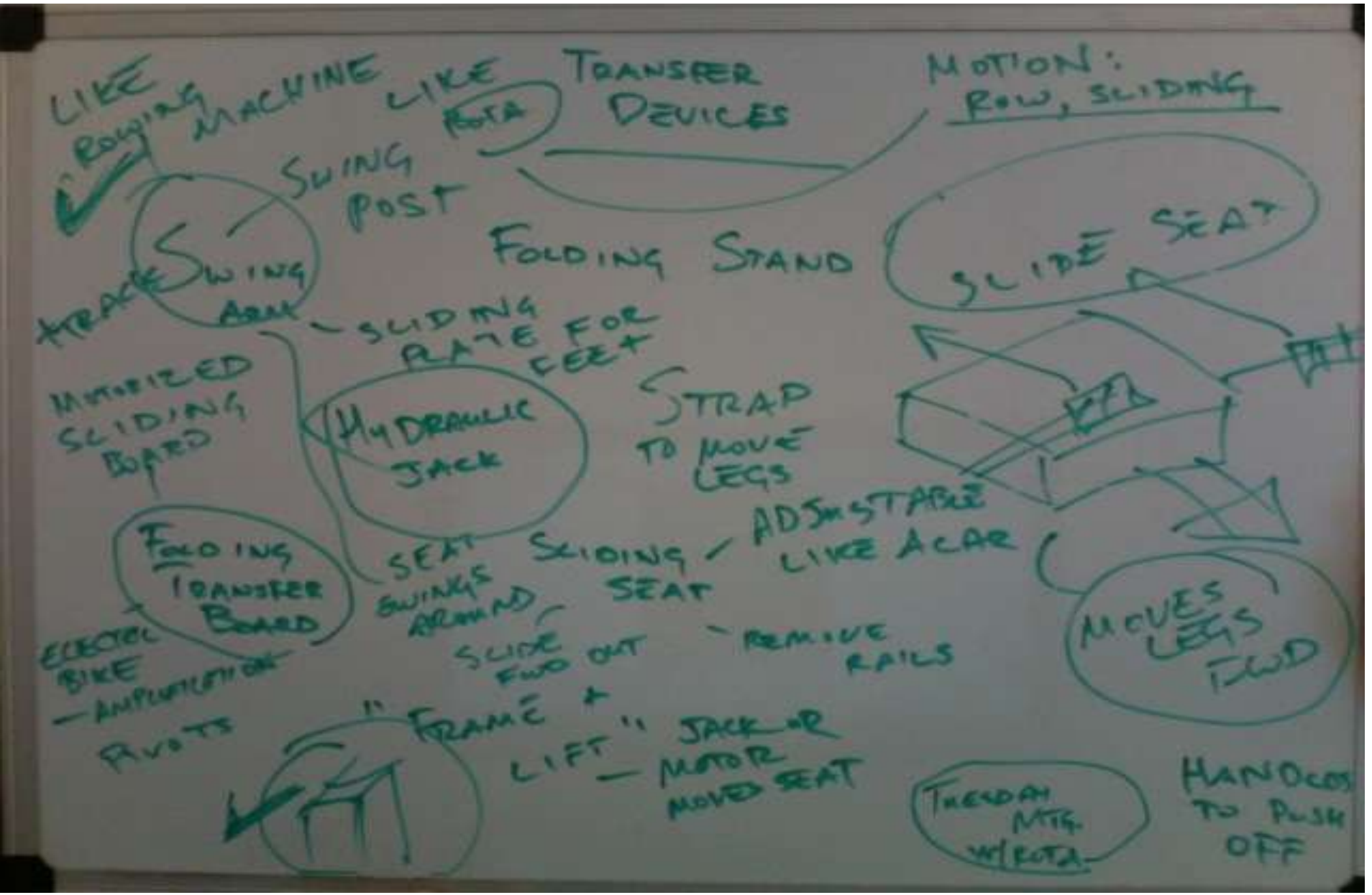
- Issues to consider:
  - Cost
  - Material strength
  - Portability
  - Strain injuries
    - Peak strain force
    - Repetitive strain
  - Elevation changes
  - Feeling of security
  - Feeling of independence
  - Family
  - Low profile



Existing Solutions

- Transfer Boards
  - Sliding Transfer Boards
- Transfer Handle
- "Magic Pole"
- Motorized Lift

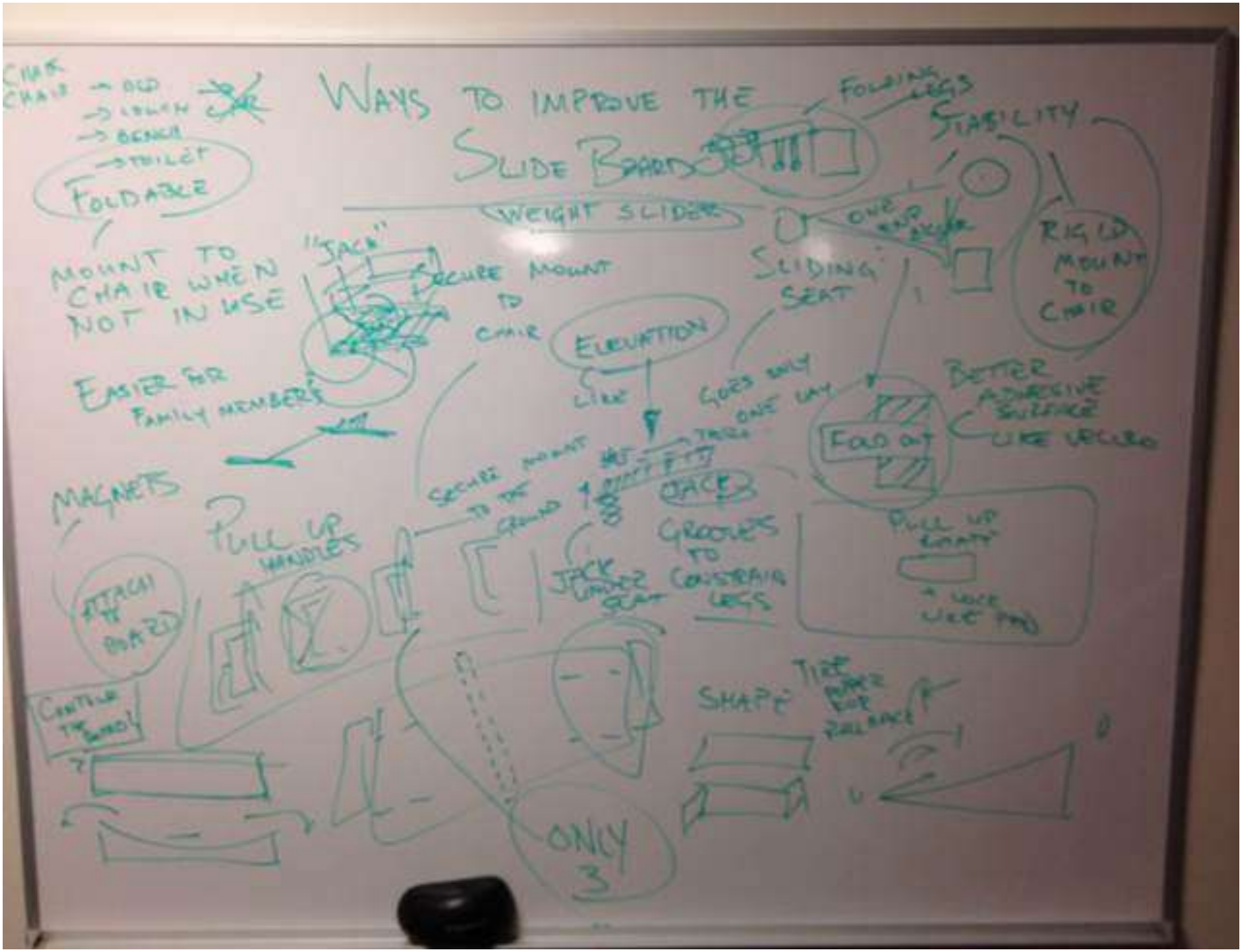
Brainstorms

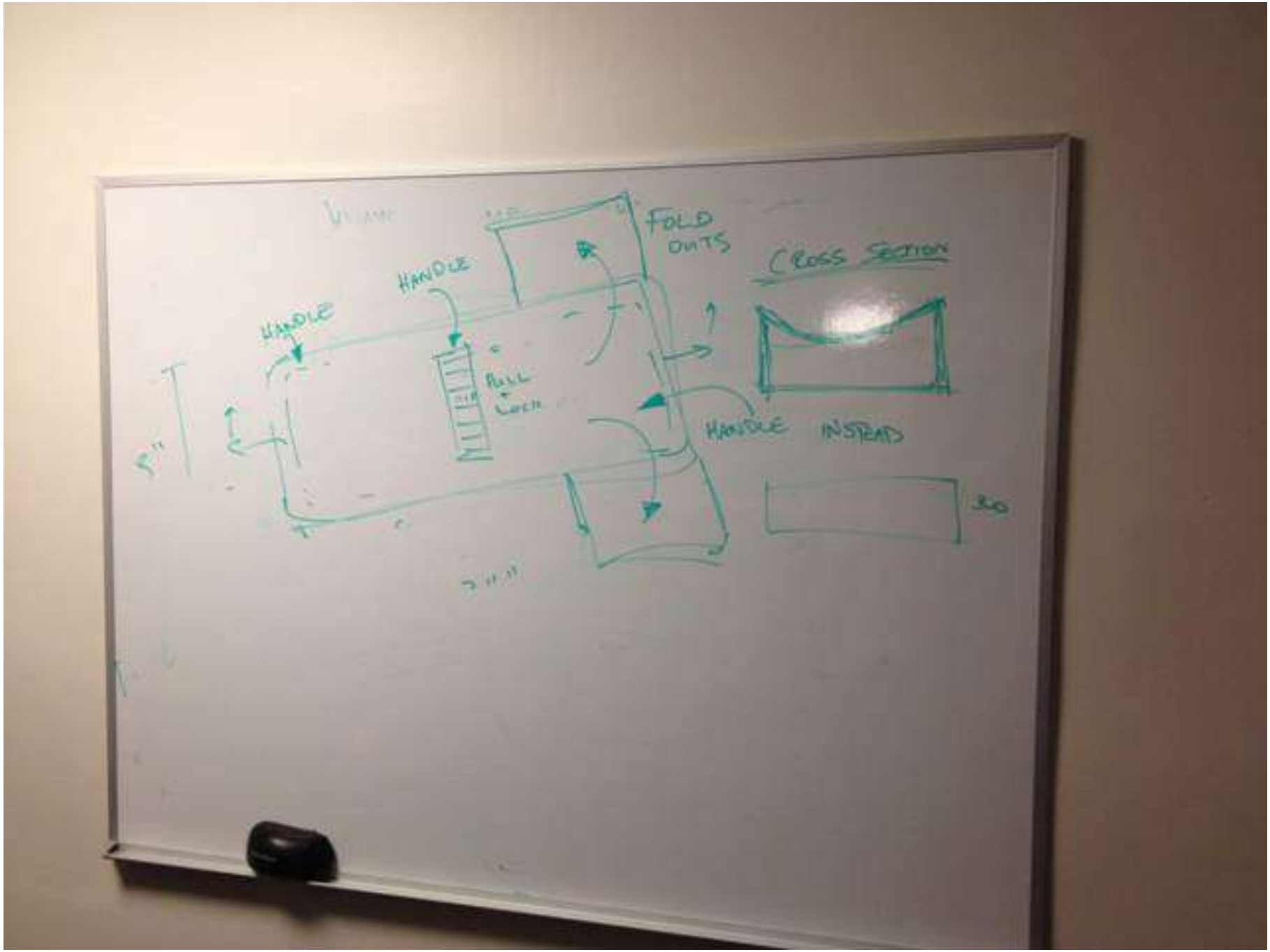


Final 3 Candidates

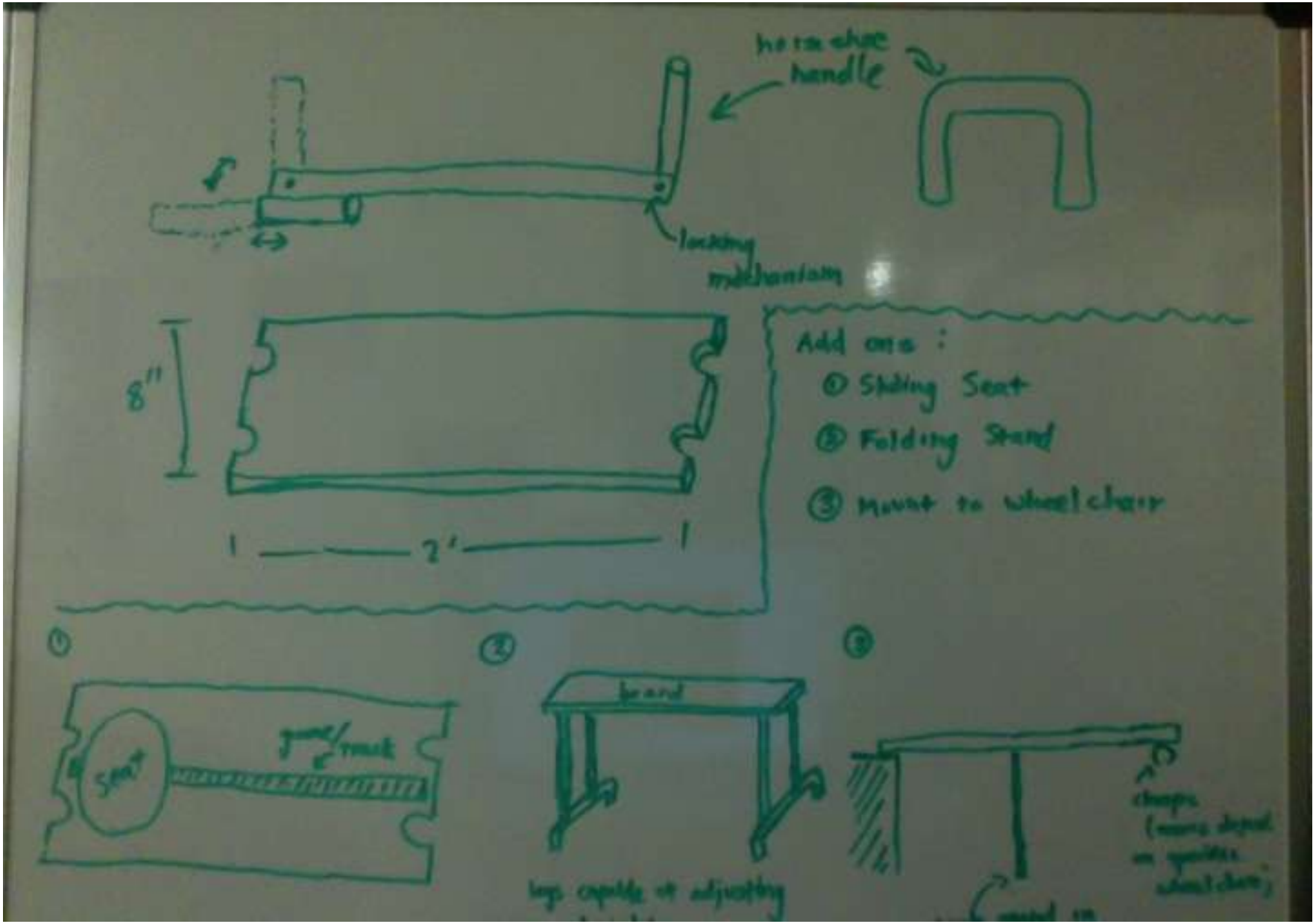
- Swing arm
- Seat Jack
- Transfer Board 2.0

The Swing Arm


WAYS TO IMPROVE THE SLIDE BOARD
FOLDABLE
MOUNT TO CHAIR WHEN NOT IN USE
FOLDING LEGS
STABILITY
RIGID MOUNT TO CHAIR
WEIGHT SLIDER
ONE WAY SLIDER
SLIDING SEAT
"JACK"
SECURE MOUNT TO CHAIR
ELEVATION
EASIER FOR FAMILY MEMBERS
GOES ONLY ONE WAY
FOLD UP
BETTER ADHESIVE SURFACE
MAGNETS
PULL UP HANDLES
SECURE MOUNT TO THE GROUND
GROOVES TO CONSTRAIN LEGS
JACK UNDER SEAT
PULL UP KNOB
SHAPE
ONLY 3


FOLD OUTS
CROSS SECTION
HANDLE
HANDLE
ROLL CATCH
HANDLE INSTEAD

Best Solution



Next Steps

- Interview with OTs & PTs
- Prototyping
- Concept Evaluation with Actual Users
- More Iterations

The End

Works Cited

- http://www.newdisability.com/wheelchairstatistics.htm
- http://codi.buffalo.edu/graph_based/.demographics/.statistics.htm

Friendly Cane

Team Wombat:

Nate Wynn and **Cindy Au**

Project: Explore designs for a light weight cane that can accommodate the weight of its user and easily retract and extend with one hand.

TEAM WOMBAT

PROJECT *i*CANE

•ENGR 110: Perspectives in Assistive Technology

Midterm presentation

16 Feb 2012

OUR TEAM

CINDY AU
Class of 2013

Major:
Biomechanical Engineering
Hometown:
Bentre, Vietnam

NATE WYNN
Class of 2012

Major:
Mechanical Engineering
Hometown:
Spokane, Washington

PRESENTATION OUTLINE

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PROJECT DESCRIPTION

problem

Current canes are heavy and awkward to stow when they are not being used, and clumsy to use when both hands are needed - such as when carrying something.

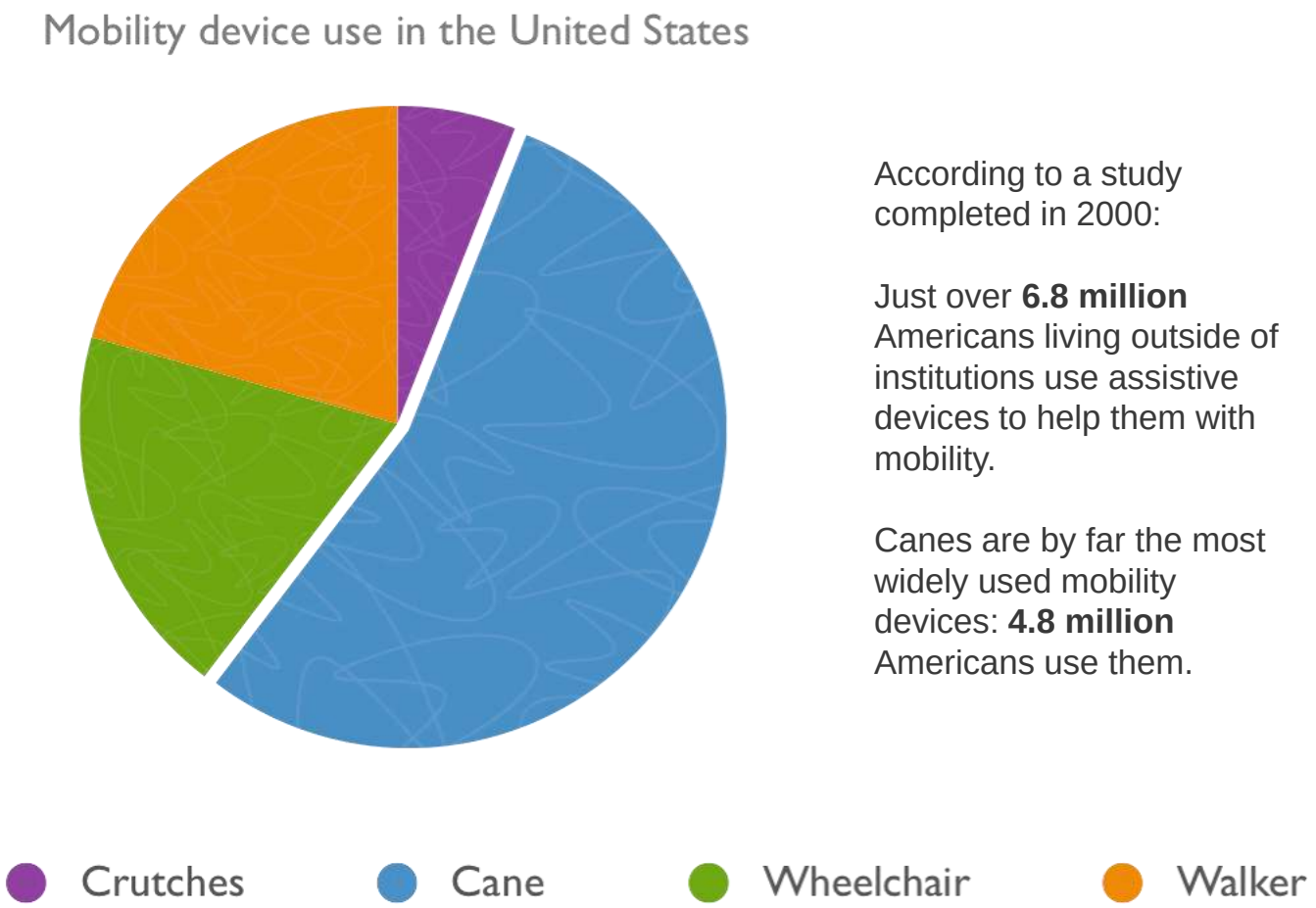
aim

Explore designs for a light weight cane that can accommodate the weight of its user and easily retract and extend with one hand

design criteria

1. Effective in addressing users' need
2. Attractive
3. Low cost

AID DEVICE DEMOGRAPHICS

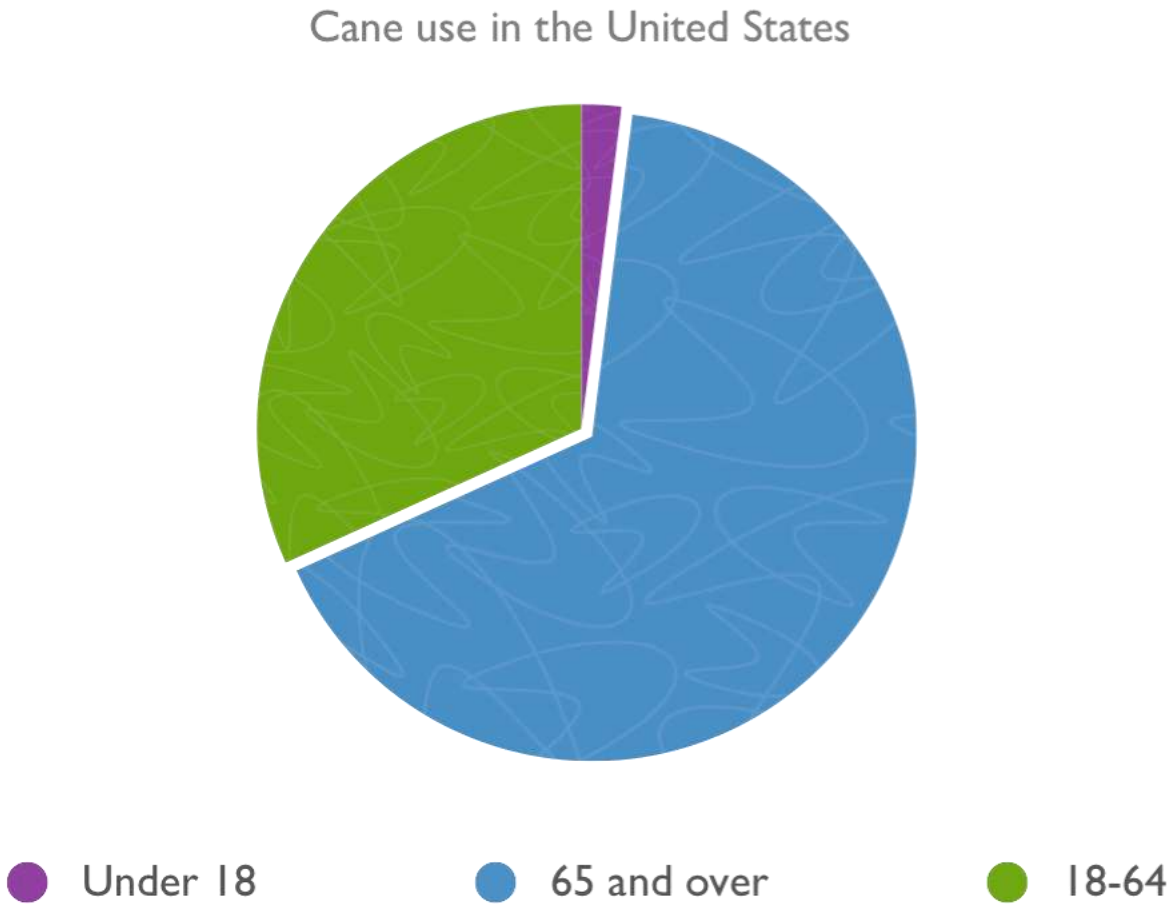


According to a study completed in 2000:

Just over **6.8 million** Americans living outside of institutions use assistive devices to help them with mobility.

Canes are by far the most widely used mobility devices: **4.8 million** Americans use them.

AGE DEMOGRAPHICS



According to a survey involved 1000 Canadian seniors aged 70 and older, 7 out of 10 seniors report having a mobility or health issue that reduces their quality of life due to a physical limitation. Yet, 46 percent of those surveyed refuse to use a cane, walker or scooter.

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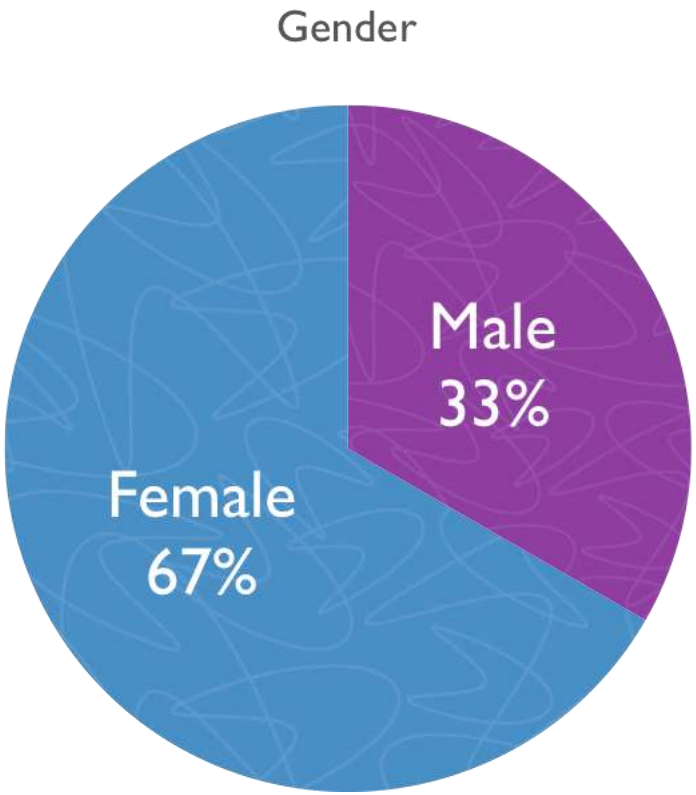
NEED-FINDING METHODS

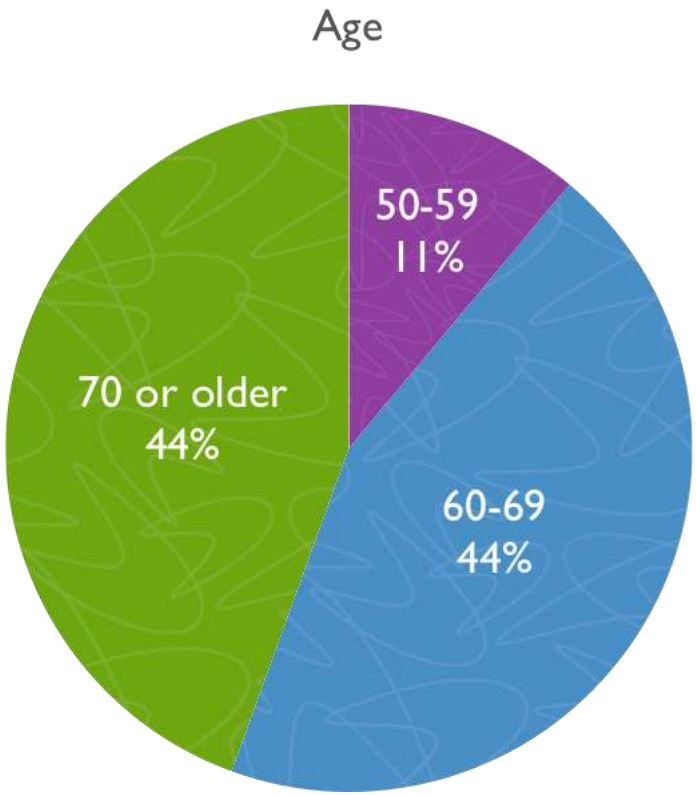
1
interviews

2
observation

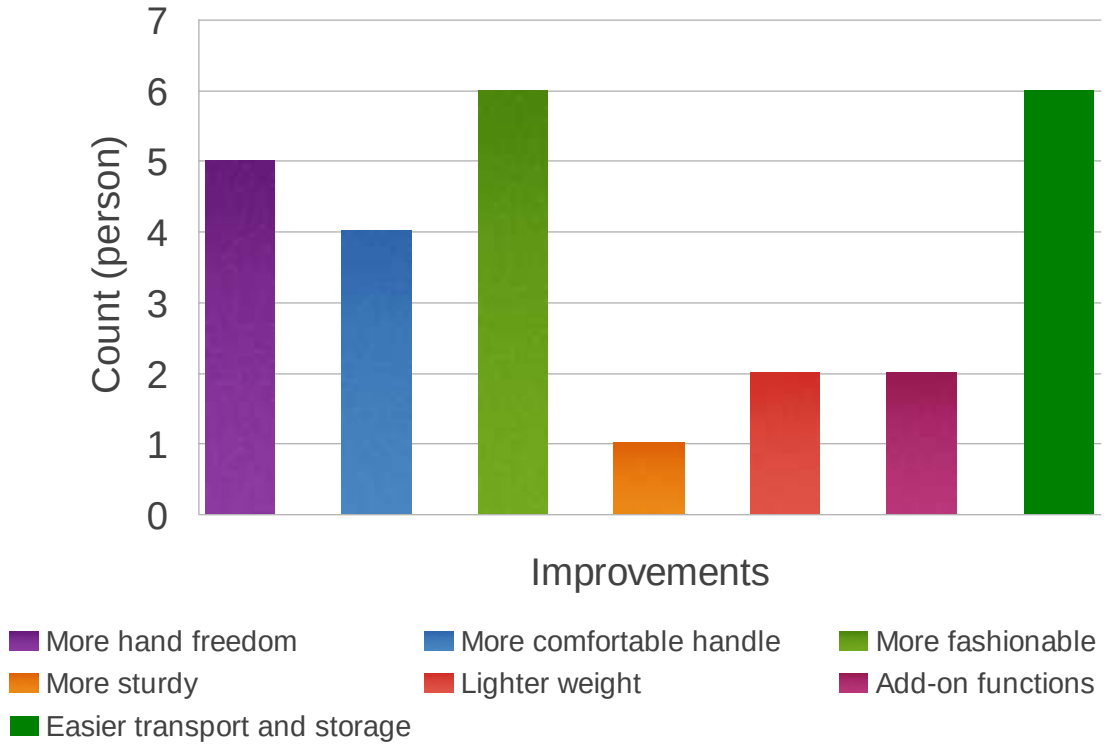
3
survey

SURVEY PARTICIPANTS





DESIRABLE IMPROVEMENTS



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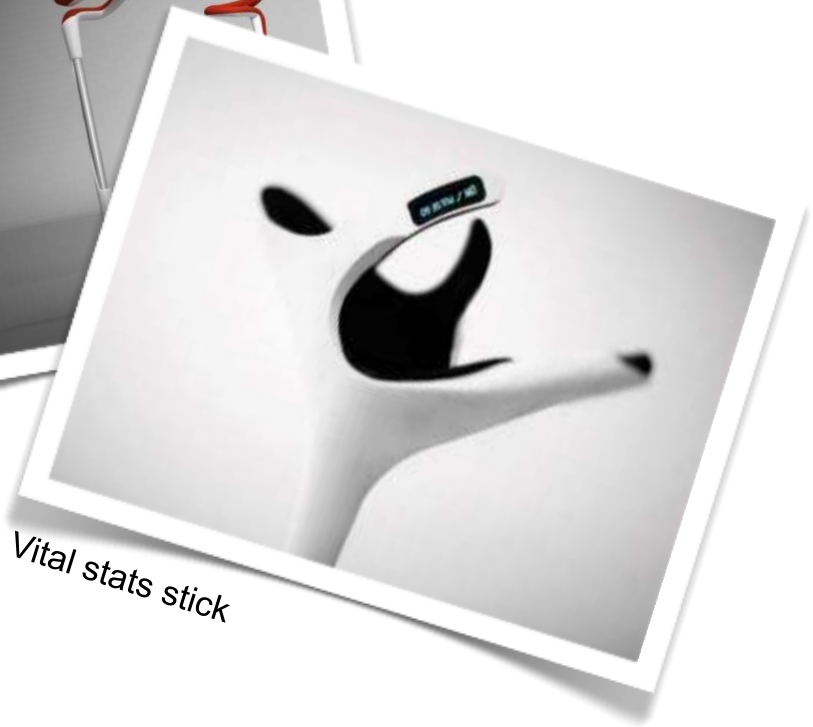
EXISTING SOLUTIONS

Adjustable folding cane

Fiesta Flamingo walking stick

Self-balance walking stick



Vital stats stick

EXISTING SOLUTIONS

PRODUCT

Adjustable folding cane

DETAILS

- Lightweight anodized aluminum body
- Height adjustments from 31" to 35"
- Can be folded up into four sections to be conveniently stored in a black canvas bag
- Supports up to 250 pounds
- By far the most well-received commercially available product

LIMITATIONS

- Difficult to assemble and to take apart using one hand
- Metal tube body doesn’t look attractive
- Ergonomics

EXISTING SOLUTIONS

PRODUCT

Self-balancing staff

DETAILS

- Consist of a simple hand grip and a weighted bottom
- Stand upright by itself on both even surfaces and slopes
- Hands can be used for other tasks when needed
- Small base to allow easy climbing of stairs
- Nice, clean design

LIMITATIONS

- Not yet commercially available
- Cost - might not be covered by insurance
- Weight - heavy weighted bottom can cause fatigue.
- Can’t be stored in bag
- Difficult to store in car

EXISTING SOLUTIONS

PRODUCT

Fiesta Flamingo Crutch

DETAILS

- Ergonomic
- Simple and aesthetic form
- Shock absorbing
- Height adjustable
- Looks really cool

LIMITATIONS

- Concept only
- Might be difficult to store and carry around
- Seniors who don’t want their cane to look too conspicuous might not find the “fiesta” look to their liking

EXISTING SOLUTIONS

PRODUCT

The Aid

DETAILS

- “The world’s first smart cane”
- Monitor seniors’ pulse, blood pressure and body temperature
- Offer a simple navigation system
- SOS button to alert home location when getting lost
- Won Grand Prize at the Fujitsu’s Design AWARD 2011

LIMITATIONS

- Ergonomics
- Cost
- Storage

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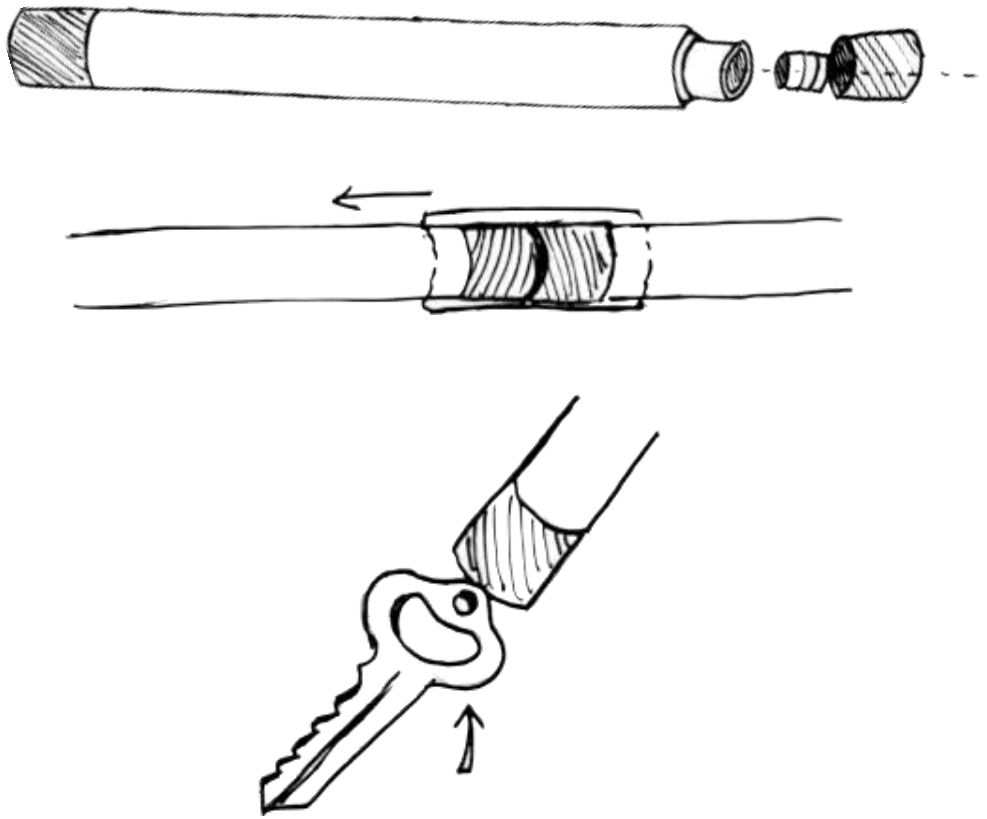
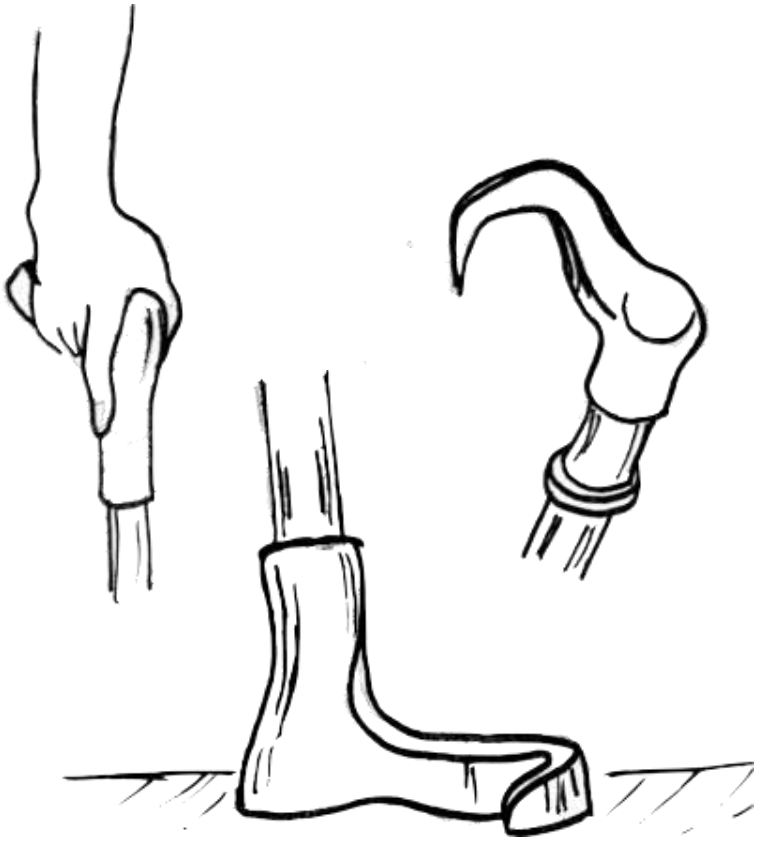
IDEA
#1

Detachable magnetic cane segments



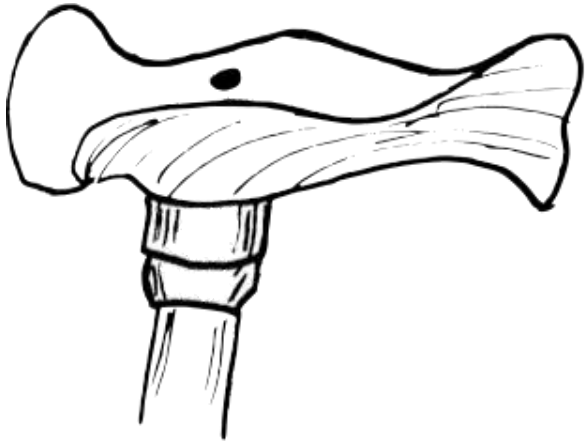
IDEA
#2

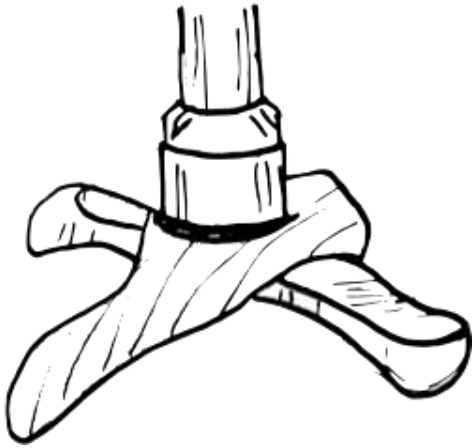
Ergonomic self-standing inverted handle



Expandable handle

IDEA
#3

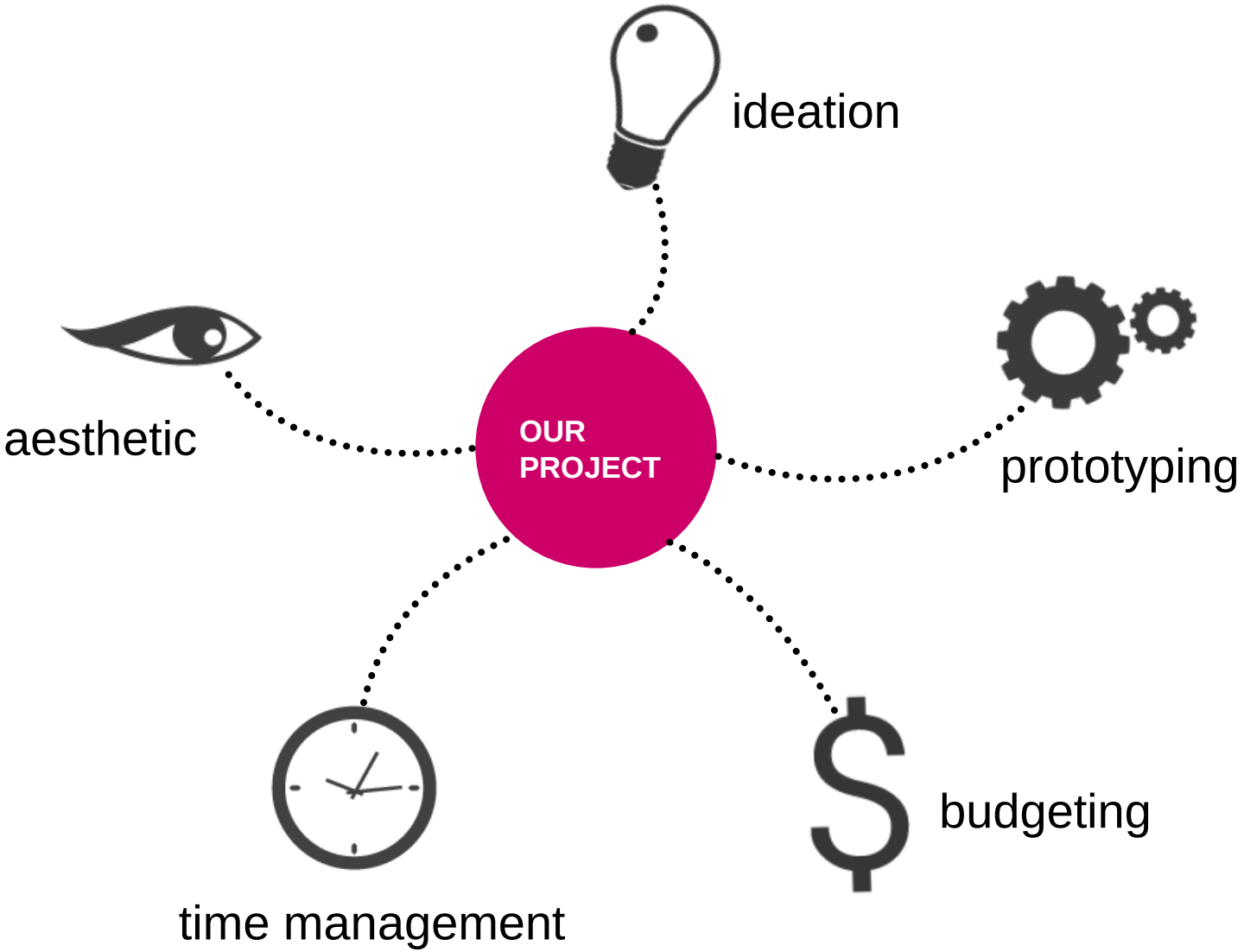




PROTOTYPE
#1

PROTOTYPE
#1

PROTOTYPE
#1


ideation
aesthetic
OUR
PROJECT
prototyping
budgeting
time management

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RE WORK

Winter quarter

MAKING THE DESIGN FUNCTIONAL

- Integrate the handle design and the collapsible shaft design
- Have a functional prototype of a collapsible, ergonomic, and free standing cane by the end of the quarter

Spring quarter

MAKING THE DESIGN ELEGANT

- Explore ways to improve the aesthetic of the prototype
- Manufacture the new design

Summer

QUALITY CHECK

- Usability test
- Refinement

THANK **YOU**

for your attention

?

Customize the Wheelchair

Team name:

Mia Davis

Project: Explore ways to add a personal aesthetic to wheelchairs.

Fini

Short Break