A PORTABLE DEVICE FOR IMPROVING SOCIAL INTERACTIONS OF THE VISUALLY IMPAIRED

Gemstone Team Facial Analysis for Communicating Expressions

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Librarian: Mr. Jim Miller

Thesis Proposal
March 12, 2010

Video goes here? Rosie narrates as it happens. (No closing eyes, please)

Hi everyone, welcome to Team FACE's thesis proposal. Team FACE stands for facial analysis for communication expressions. My name is Rosie Zhang, my fellow presentors will be _____ and we will be presenting on behalf of our team.
Before we begin, I want you to imagine that it is your birthday and your friends have planned a surprise party for you. You open the door and walk into the room. "Surprise!" they yell, as they jump out from their hiding spots. You look at all the faces and you recognize everyone there, you see your best friend...you see your sister. You can see your friends' excited expressions.
But, what if you were visually-impaired? We take our eyesight for granted, but what if that eyesight all of a sudden disappears? Imagine opening that door without being able to see, you walk into the room and just hear a lot of commotion. You cannot see who is in the room. You cannot see anyone's expressions. How would you interact with people then? How would you feel?

Although we cannot restore the visually impaired's eyesight, maybe we can help them see some other way.

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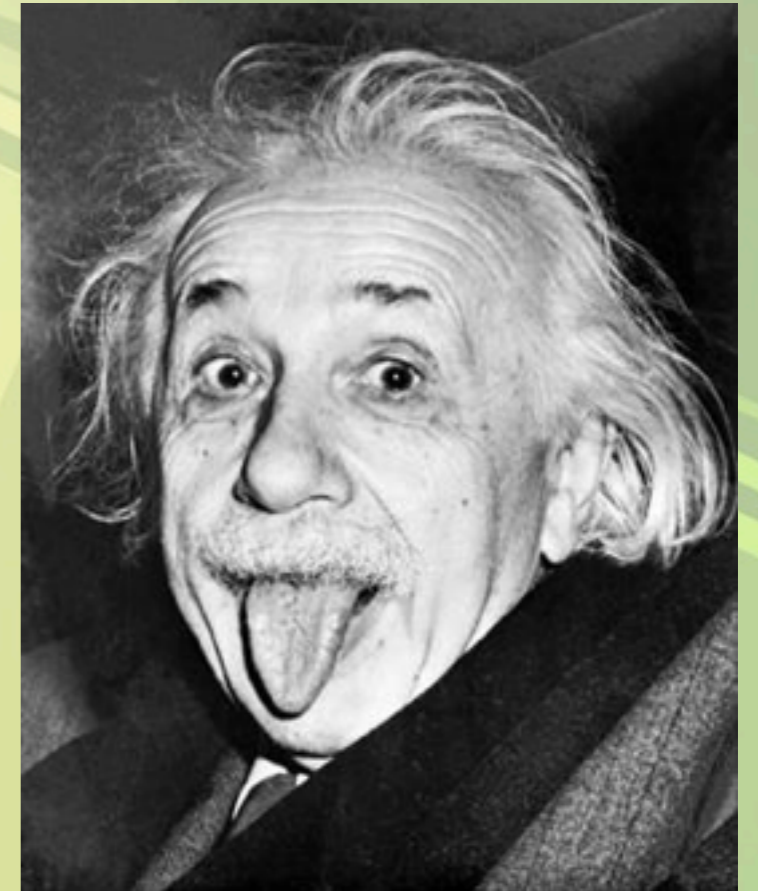
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OUTLINE

‣Background

‣Research Methodology

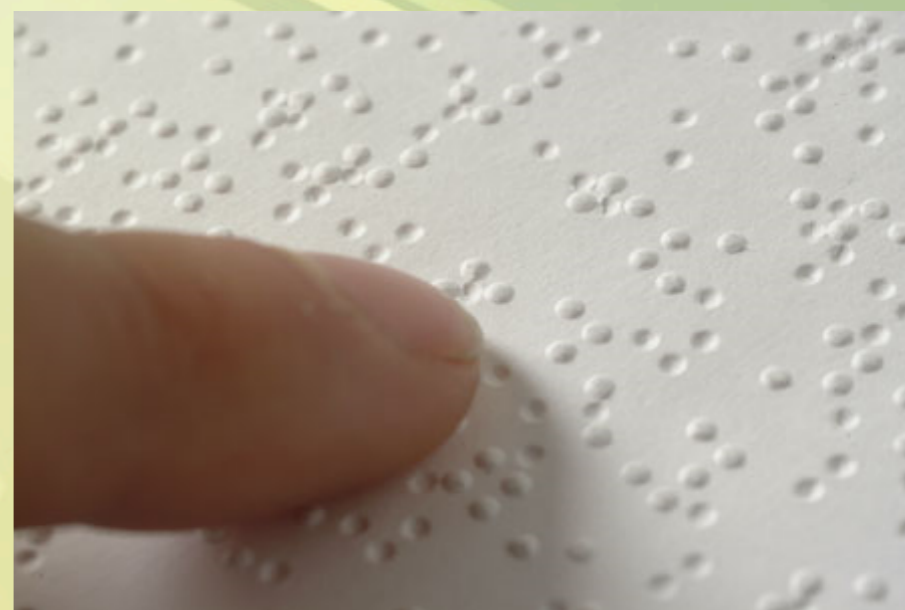‣Preliminary Research

‣Future Outlook

Thursday, March 11, 2010

Give you a little bit of a background and make the case for our research.
present you with our research question
tell you a bit about how we have developed it

THE VISUALLY IMPAIRED

▸Verbal vs. nonverbal communication

–65% nonverbal

▸Social complications

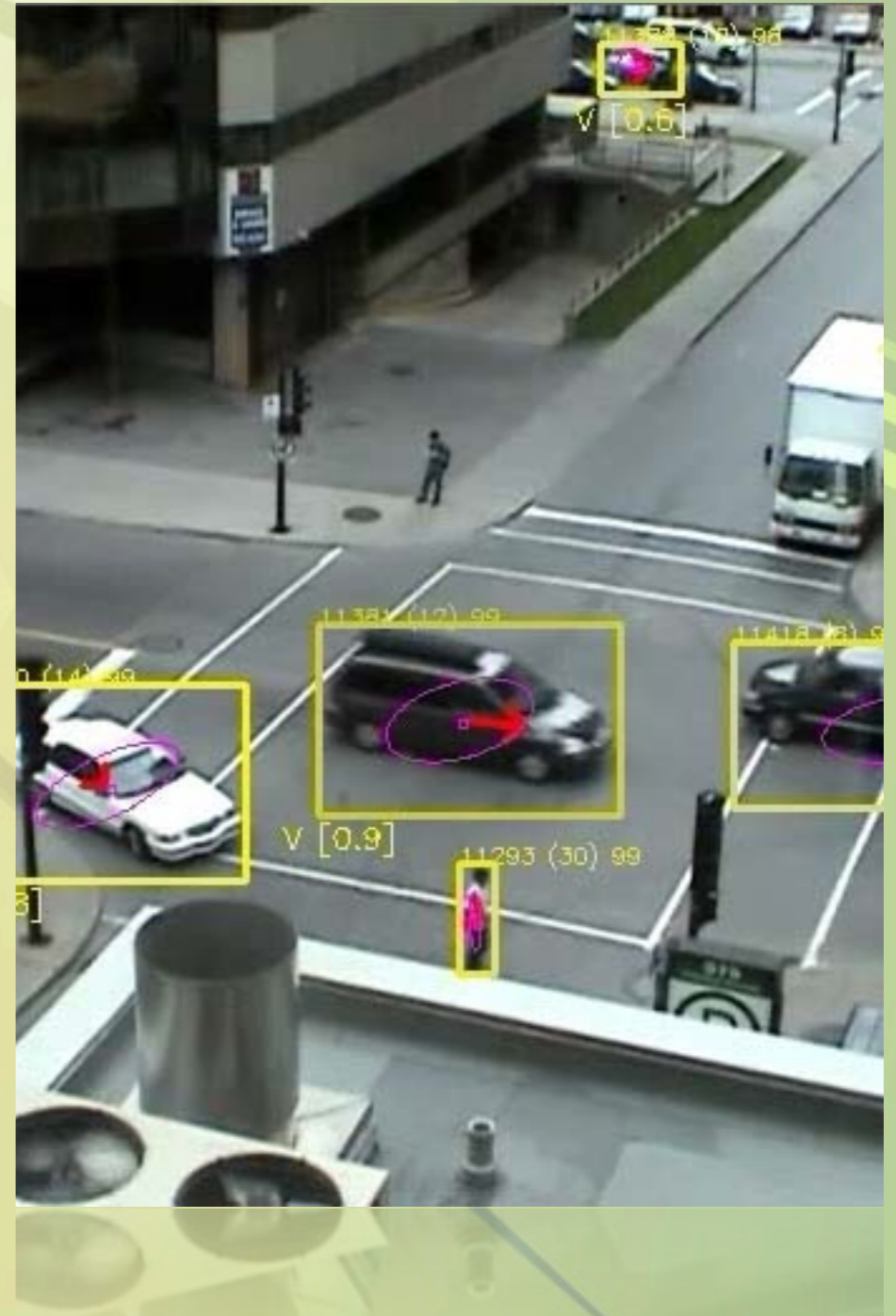over 11 million visually impaired
face challenges: trouble finding their way, trouble identifying people
communication is often overlooked (blind people can hear, right?)
nonverbal vs. nonverbal

Now consider that there are over 11 million people in the united states who are visually impaired. They face all sorts of challenges every day. Sometimes the blind have trouble finding their way around places, sometimes they have trouble identifying people. One often overlooked consideration is in communication. You may think communication is just words – blind people can hear well enough, right? In reality, communication is made up of two parts: verbal and nonverbal. True, verbal communication is important. It is afterall the message that is to be communicated. But how that message comes across depends on the underlying nonverbal units of communication. These include facial expressions, gestures, and body language. Blind individuals cannot see, and therefore cannot understand this nonverbal communication. This handicap can be seen as a barrier to independence and social prominence in the blind.

COMPUTER VISION

▶Typical applications

▶Face recognition

▶Expression recognition

▶Stereo vision

Now let us introduce the concept of computer vision. Computer vision uses a combination of computers and optical devices to mimic human eyesight. It has been important in image analysis, robotics, and security systems.

Some interesting developments have included the capacity to recognize faces and facial expressions. Another interesting use is the capability to calculate distances of objects in images. This can be done using two or more cameras placed side by side.

http://www.crim.ca/fr/r-d/vision_imagerie/images/PTZ_1.jpg

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RESEARCH QUESTION

How can computer vision be used to improve interactions between the visually impaired and sighted individuals?

Steve Jobs style – THRILLED

All of that raises a question fit for scientific research. How can we address the one with the other – handicap assistance and computer vision – together to address some of the issues that blind individuals face daily. How can we help them surmount these obstacles? And How can we use computer vision to do this? Additionally, we hope that this project will shed new insight on the importance of nonverbal cues in communication.

emphasize that this is new. we are doing expression analysis. stereo vision. novel feedback systems. and examining the social side through real testing and evaluation by the blind.

PREVIOUS RESEARCH

Needs –
Expression Theory–
Algorithms –
Databases –
Existing Systems–
Feedback systems –

PREVIOUS RESEARCH

| Need	The Question	The Mean Score
8.	I would like to know if any of my personal mannerisms might interfere with my social interactions with others.	4.5
6.	I would like to know what facial expressions others are displaying while I am interacting with them.	4.4
3.	When I am standing in a group of people, I would like to know the names of the people around me.	4.3
7.	I would like to know what gestures or other body motions people are using while I am interacting with them.	4.2
1.	When I am standing in a group of people, I would like to know how many people there are, and where each person is.	4.1
2.	When I am standing in a group of people, I would like to know which way each person is facing, and which way they are looking.	4.0
5.	I would like to know if the appearance of others has changed (such as the addition of glasses or a new hair-do) since I last saw them.	3.5
4.	When I am communicating with other people, I would like to know what others look like.	3.4

Krishna, et al. (2008)

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Needs –
Expression Theory–
Algorithms –
Databases –
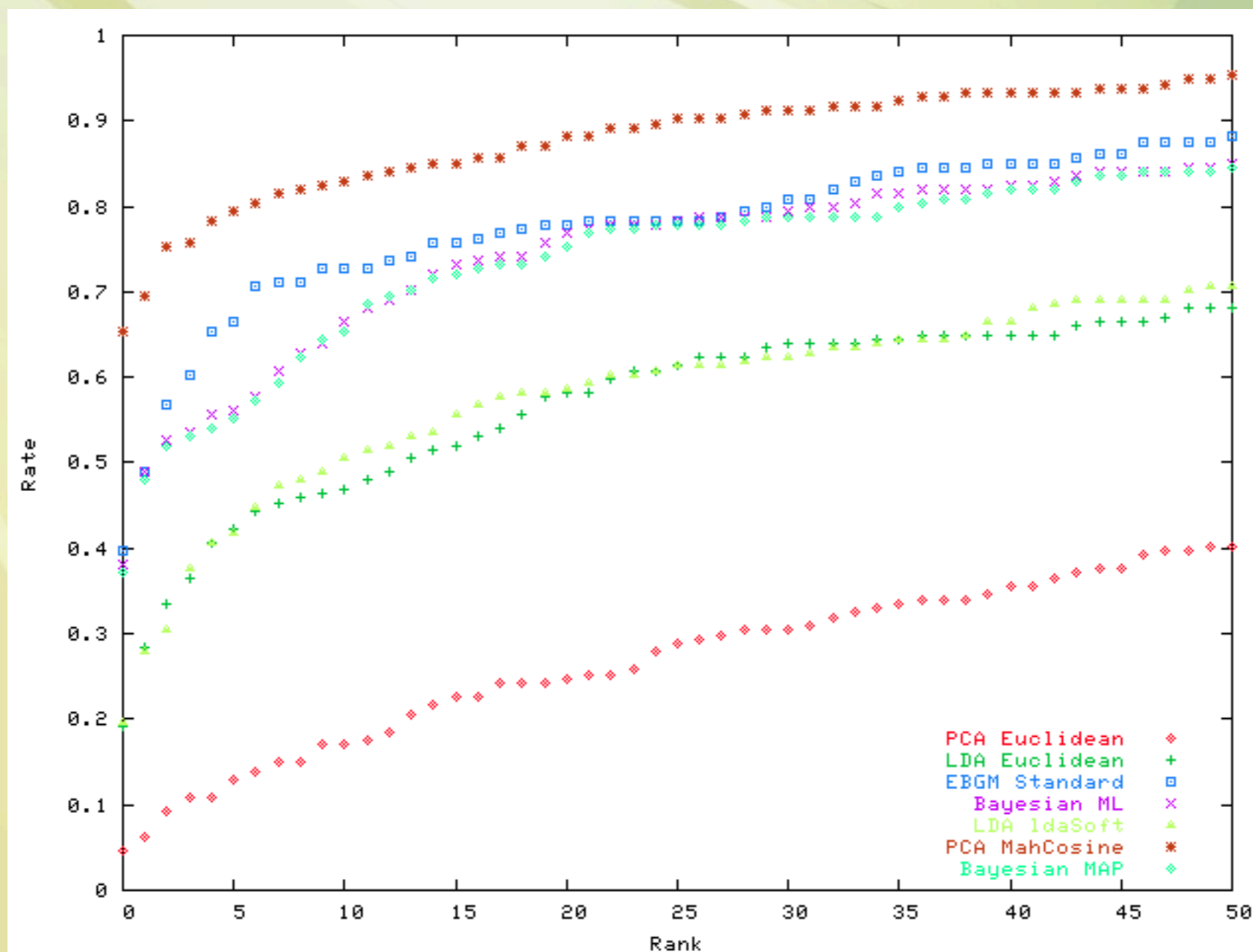Existing Systems–
Feedback systems –
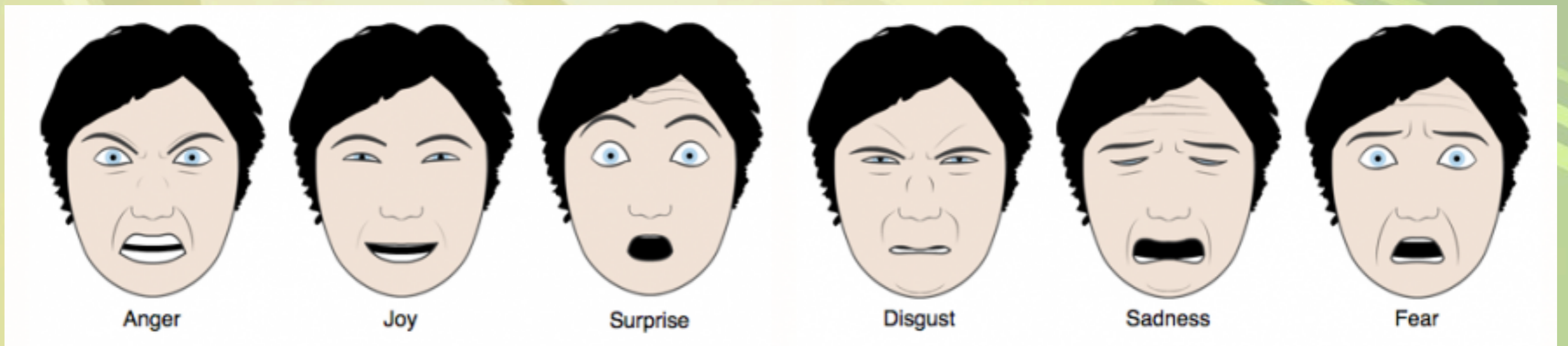
PREVIOUS RESEARCH

Ekman, et al. (1971); Lien, et al. (1998)

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Needs –
Expression Theory–
Algorithms –
Databases –
Existing Systems–
Feedback systems –

PREVIOUS RESEARCH

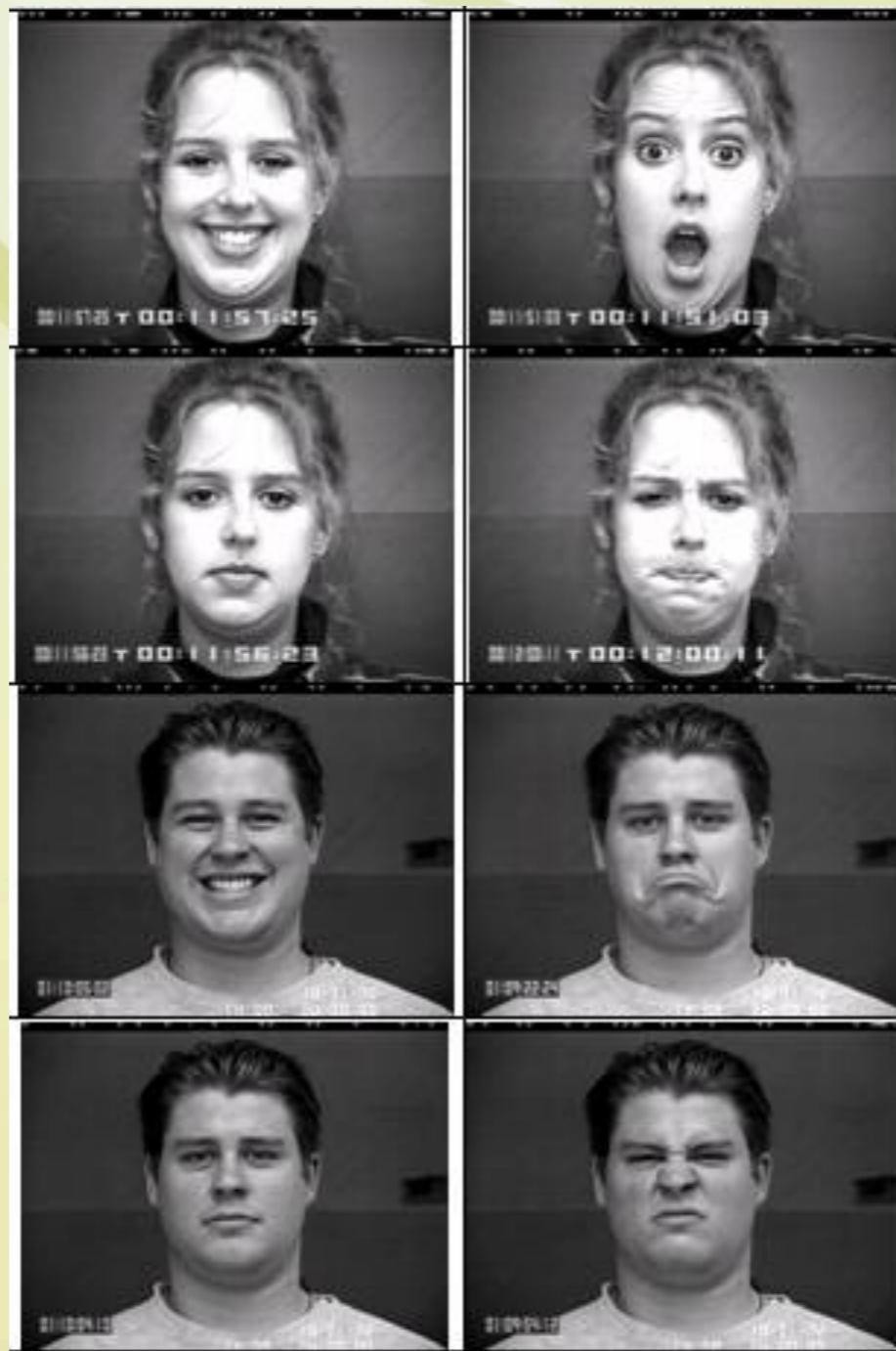Tian, et al. (2000); Beveridge (2007)

Needs –
Expression Theory–
Algorithms –
Databases –
Existing Systems–
Feedback systems –

PREVIOUS RESEARCH

Kanade, et al. (2000)

Needs –
Expression Theory–
Algorithms –
Databases –
Existing Systems–
Feedback systems –

PREVIOUS RESEARCH

Krishna, et al. (2005)

Needs –
Expression Theory–
Algorithms –
Databases –
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Feedback systems –

PREVIOUS RESEARCH

Figure 2. Haptic belt harness and tactor modules.

McDaniels, et al. (2008)

Needs –
Expression Theory–
Algorithms –
Databases –
Existing Systems–
Feedback systems –

PRODUCT DEVELOPMENT

Idea generation
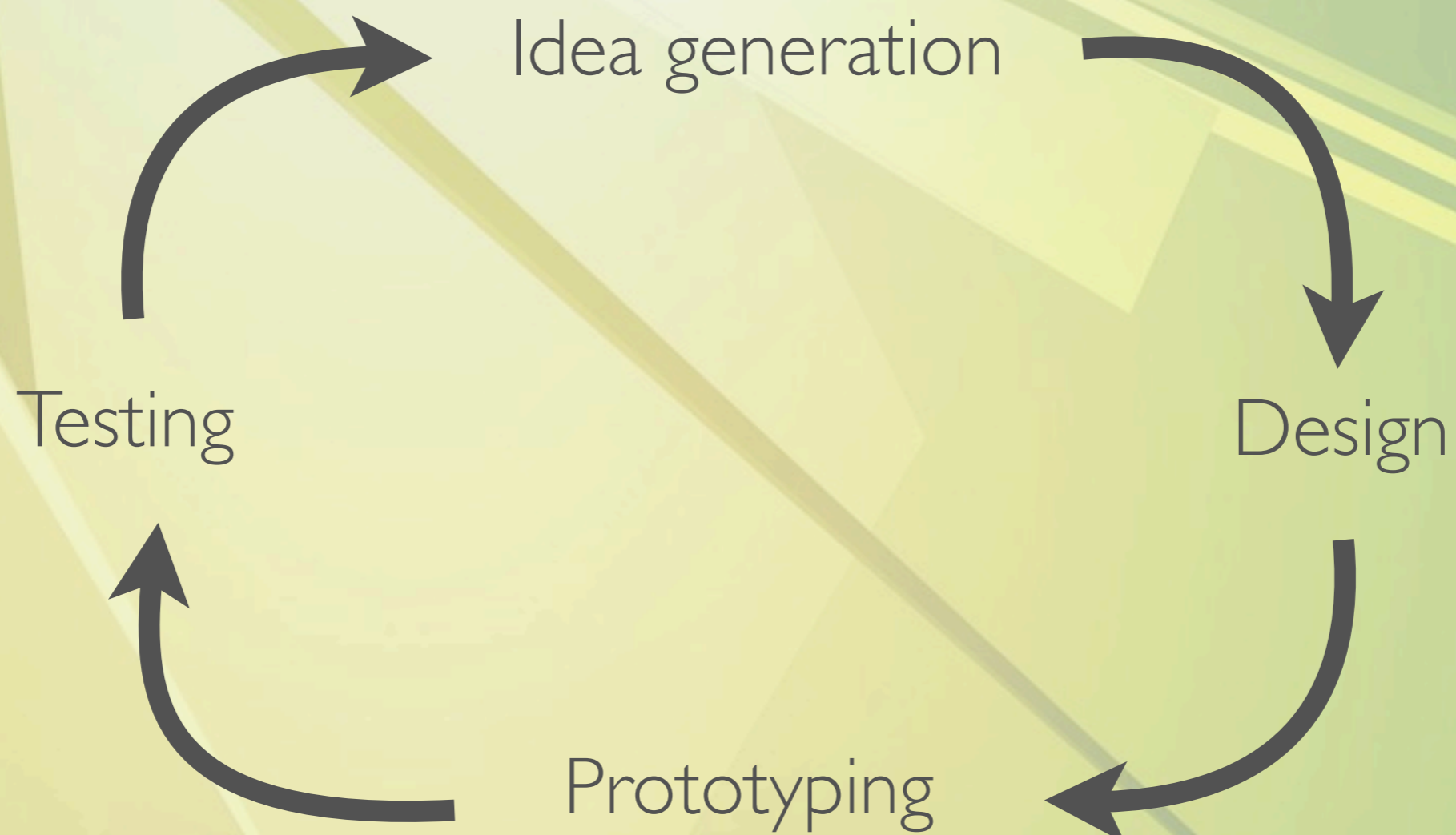
Design

Prototyping

Testing

mention cycling of process. as testing takes place, revisions need to be made, and we go back to idea generation or design/prototyping phases

IDEA GENERATION

▸Brainstorming

▸Meeting

▸Evaluation

  –Internal, feasibility analysis

  –External, interviews and focus groups

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Brainstorming: thinking of initial ideas, anything that could potentially help or work

Meeting: NFB, got some real feedback from the technology assessment team for design, plausibility, what they prefer

Evaluation: Internal feasibility, evaluating our ideas for their plausibility according to resources and knowledge. External from focus groups and interviews with the Columbia Lighthouse and NFB

DESIGN AND PROTOTYPING
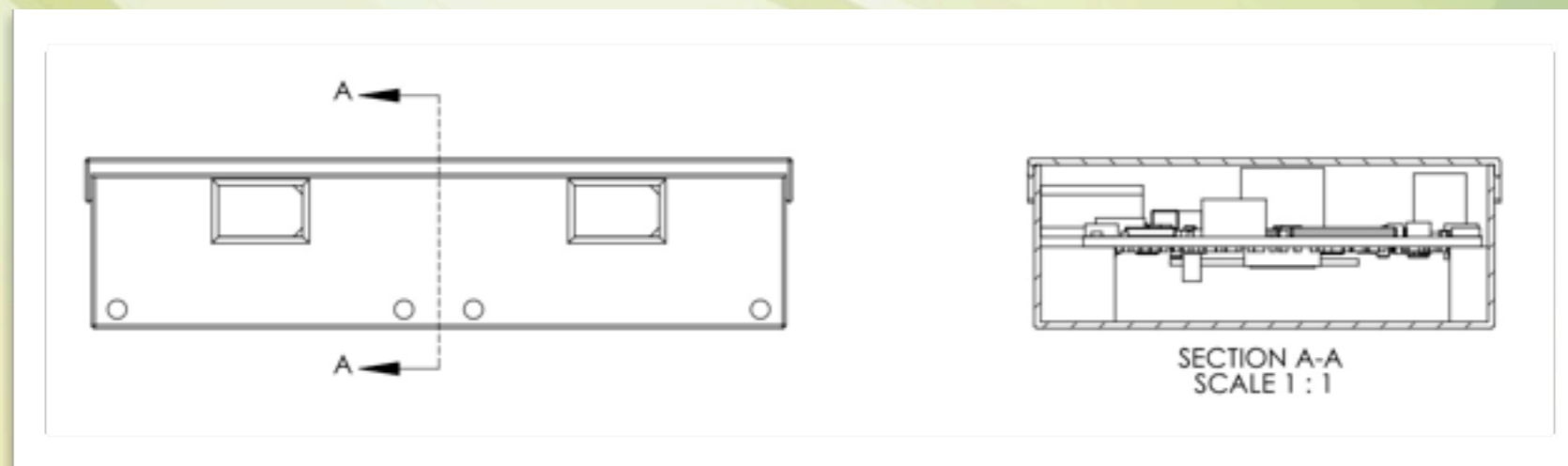

```
cvNamedWindow("input",0);
CvCapture * camera = cvCreateCameraCapture(CV_CAP_ANY);
cvWaitKey(0);
IplImage * imgA = cvCloneImage(cvQueryFrame( camera ));

IplImage *  gray_image     = cvCreateImage(cvSize (imgA->width,

cvCvtColor (imgA, gray_image, CV_BGR2GRAY);
imgA=gray_image;

cvWaitKey(0);cvWaitKey(0);
cvQueryFrame( camera );
cvQueryFrame( camera );

//for(int i=0; i<100000000;i++);;
IplImage *frame = cvQueryFrame(camera);
IplImage * imgB = cvCloneImage(frame);
IplImage * imgC = cvCloneImage(frame);
IplImage *  gray_image2     = cvCreateImage(cvSize (imgB->width,
cvCvtColor (imgB, gray_image2, CV_BGR2GRAY);
imgB=gray_image2;

cvShowImage("input", imgA);
cvWaitKey(0);
cvShowImage("input", imgB);
cvWaitKey(0);
```

Also talk about code! It's critical in designing

Hardware: Deciding how to mount the cameras and circuit boards, getting the necessary materials such as canes, firewire cables, etc. Deciding between wireless and wired

Feedback: What materials, how to proceed, haptics, sounds, etc.

Actually building the prototype according to our designs: making a basic prototype first with our resources available, then getting a machinist for a more professional look

TESTING

▸Algorithms

▸Hardware

▸Troubleshooting

▸User evaluation

Feedback systems must be especially well tested for effectiveness and other factors

Algorithms: Viola Jones to recognize face, Facial recognition (I don't know these specifically, PCA, LDA…) AND expression algorithms (Yacoob and Black, Eckman's action units, any others?) for speed and accuracy.

Hardware: Cameras for frame rate, resolution, whole real-time feedback system assessment

Troubleshooting: Any problems with mounting, design, algorithms, or hardware/software in general

User evaluation: What they think of our system, how much they will use it, how comfortable they are using it and being seen with it, any suggestions on improvements
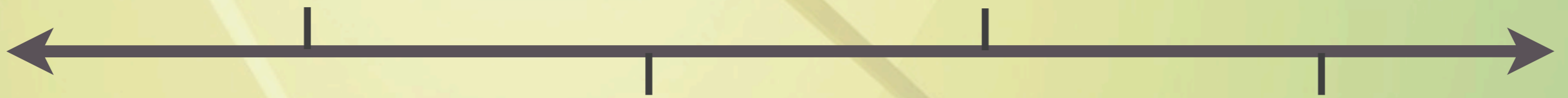
TIMELINE

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Spring and Fall 2010
Interviews and focus groups
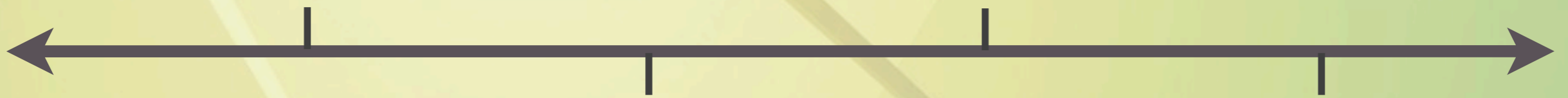Algorithm implementation
Initial prototyping
Junior colloquium

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Spring 2011
Prototype testing
Subject Testing
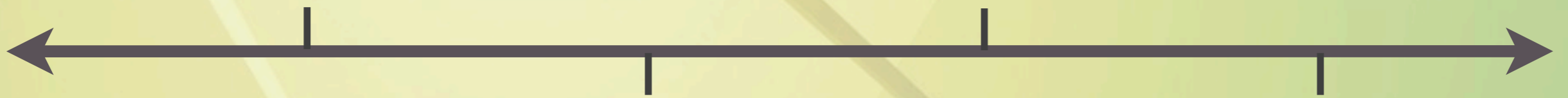Revise designs

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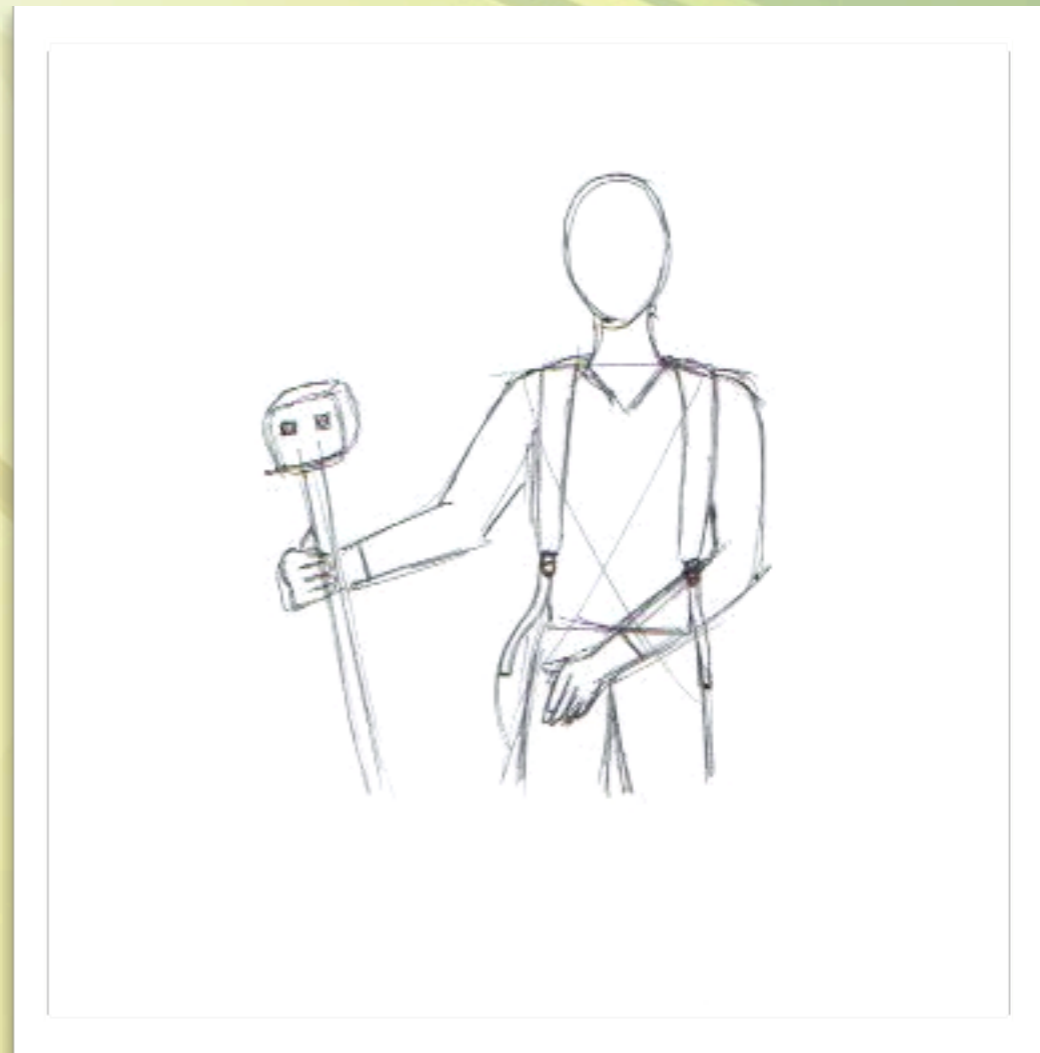Prototype testing
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Spring 2012
Present thesis
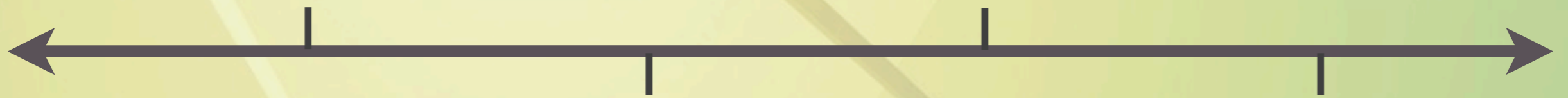
PRELIMINARY RESEARCH

‣Institutional Review Board approval

‣Cane-mount concept

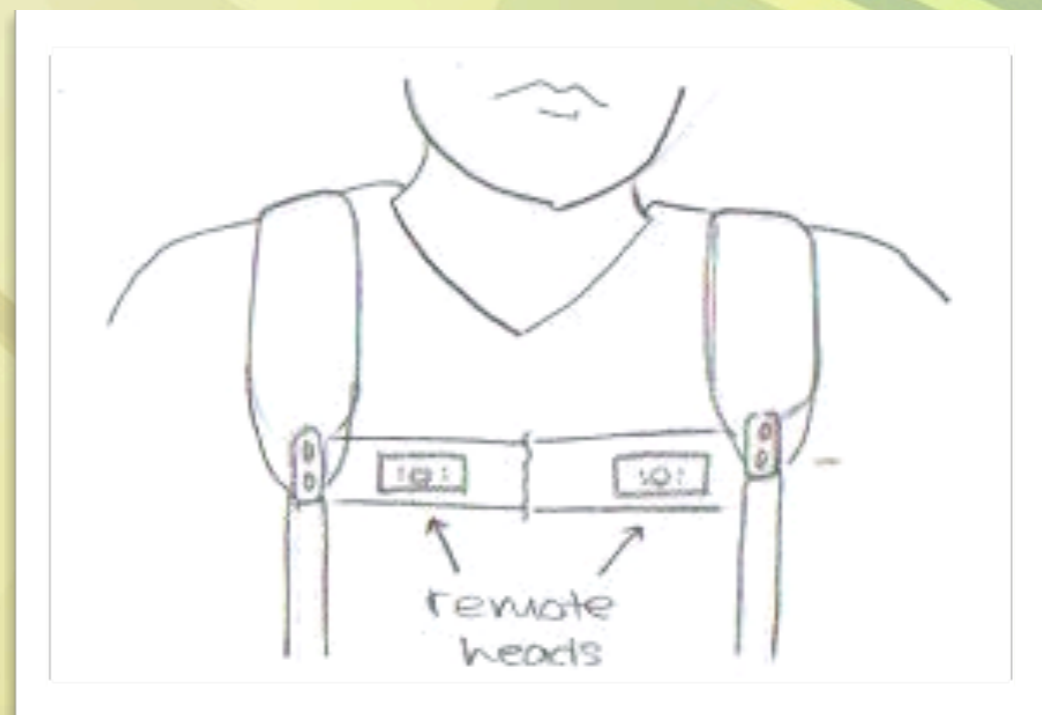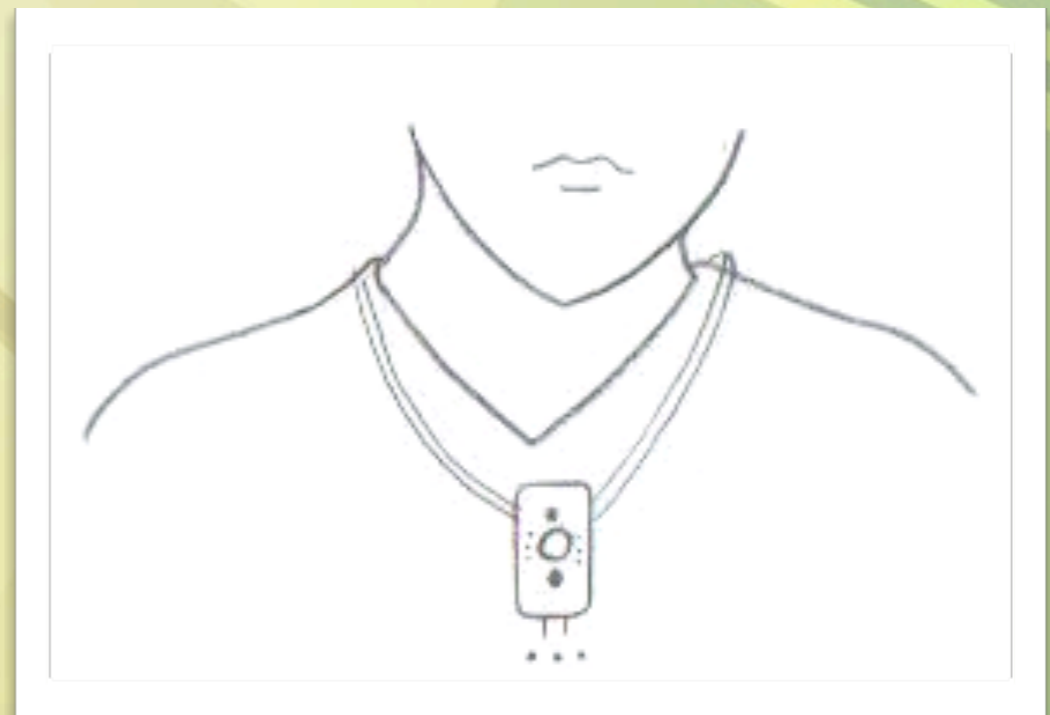‣OpenCV progress

‣Algorithm demos...

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NATIONAL FEDERATION OF THE BLIND
FACEBOOK
CANE MOUNTED
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SUMMARY

▸Research vs. product development

▸Unique approach

this constitutes research
- not product development

what we're doing differently:
- real time feedback
- expression recognition
- subject test

conclusion
- we can't give them back vision, but we can make a change
......addressing a fundamental issue..........address the impact of non-verbal communication?.....
the blind community is an ideal situation to study this question.......by providing them with the
non-verbal visual cues that they have lost (or never had).

in the conclusion also explicitly state something to the effect of:

Questions?