How to Co-Design an Inclusive Laboratory

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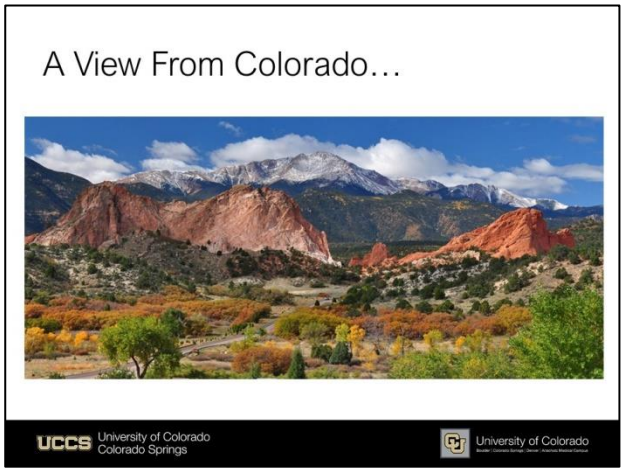
1. Introduction

It is my pleasure to be here. It is my second time in Japan and it is my favorite place I have been so far.

My topic, "How to Co-Design an Inclusive Laboratory," is an interesting topic that does not always get asked (Slide 1). I will share a bit more about my work, but I was here last year and shared more in depth specific projects that I have worked on. I see today as the beginning of more conversation long-term, where I can share more material.

First, I will share my background. I am from Colorado (Slide 1). In the future, I hope that I can welcome you all to Colorado.



Slide 1

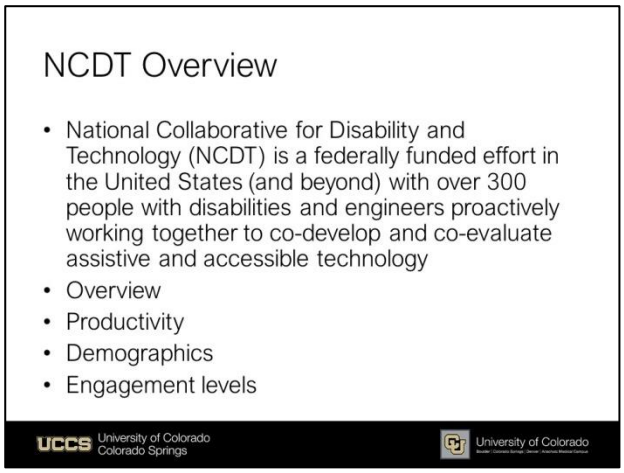
I have a few different roles that I currently serve in (Slide 2). First is the Director of the National Collaborative for Disability and Technology (NCDT). I will spend more time here talking about NCDT, but I have other roles within my current job as well. I am also a professor and a coordinator of a special education program at the University of Colorado Colorado Springs. I have also worked as a rehabilitation engineer and an assistive technology specialist, with a focus on access and inclusion for people with disabilities within schools, homes, and work places. I have also worked as a special education teacher.

Slide 2

2. National Collaborative for Disability and Technology (NCDT)

My focus now is on our NCDT project and how we have tried to co-design an inclusive environment (Slides 3-4). We are coming up on our 10th year of NCDT. We were founded back in 2011. NCDT is federally funded by the U.S. government. It is a collaborative that looks at the co-design of new technology and co-evaluation of existing technology.

Slide 3



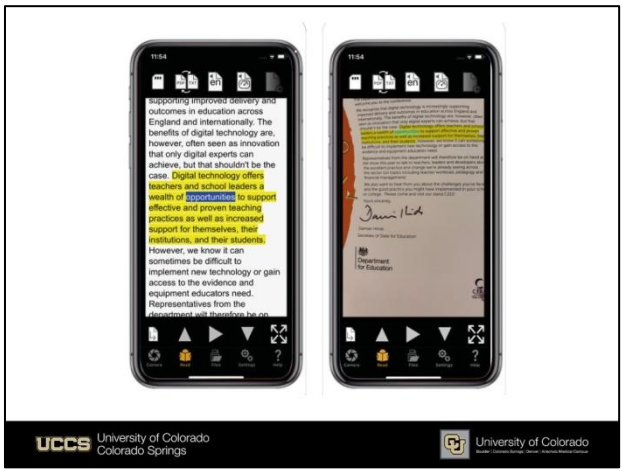
Slide 4

We started within the U.S., but we have now expanded into different countries. I have just returned from Russia, where we started a new project. My hope is that we can start efforts and collaboration here within Japan as well.

We try to cap our membership at 300 of both people with disabilities and engineers who co-develop technology.

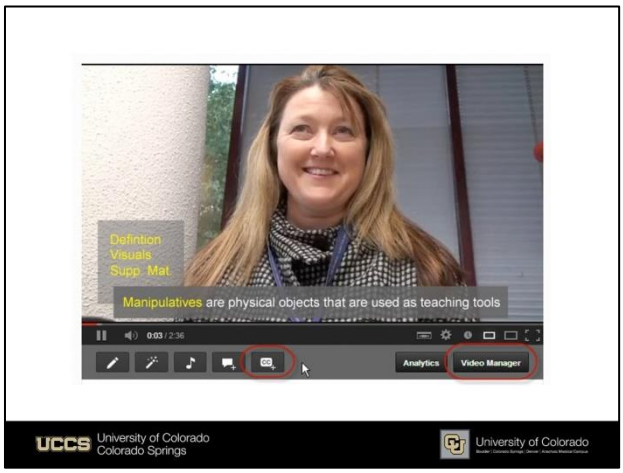
Over the past 10 years, we have developed around 50 different products, several patents and other technology. Some projects are small and more focused on development of programming code, but we also develop hardware as well. I will quickly show a few of my favorite projects that we have been involved with, and then I will get to the primary point of our presentation.

This is a text-to-speech software program (Slide 5). If you take a picture of text, it speaks real-time back out loud. I just took a picture of the RCAST brochure and real-time it spoke back out loud to me. This was originally intended for individuals who are blind or have low vision to be able to take a picture of a document and real-time listen to the text on the document. Our next extension of this is to provide different learning support tools for all students, not just students with disabilities, by incorporating this within the learning process, where all students within a classroom would have a device with this software on it and be able to take a picture of text, get definitions, and other learning supports.



Slide 5

This was a dynamic video caption project (Slide 6). With YouTube, it automatically has text based off of what is said. People can click on words and definitions of the words show up, or supplemental information, graphics, other learning supports, so you can interact with the video captions.



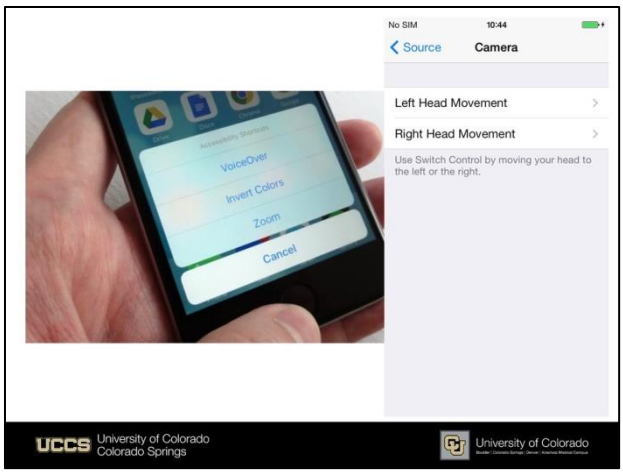
Slide 6

This is an augmentative communication device (Slide 7). It shows pictures, and if I select a picture, it speaks what that picture represents. If it is cold outside, you would see pictures of jackets or sweaters. If a student goes from science class to lunch, the symbols change from science symbols to lunch-related symbols. Other environmental factors lead to the automatic selection of pictures to enrich communication for individuals with speech or language disabilities.

Slide 7

My last example is with Apple (Slide 8). A lot of our NCDT members have been close partners with Apple and looking at their different usability and accessibility features. If you have an iPhone, as you look into your setting, you will see a wide range of different accessibility features; for example, being able to control your phone by moving your head to the left or right using your internal camera. I have a project right now that involves the internal camera on the iPhone, with eye movement and eye blinks as a control method.

These are just a few examples and at my last visit I shared a lot more. If you want to learn more about NCDT, I can share more.

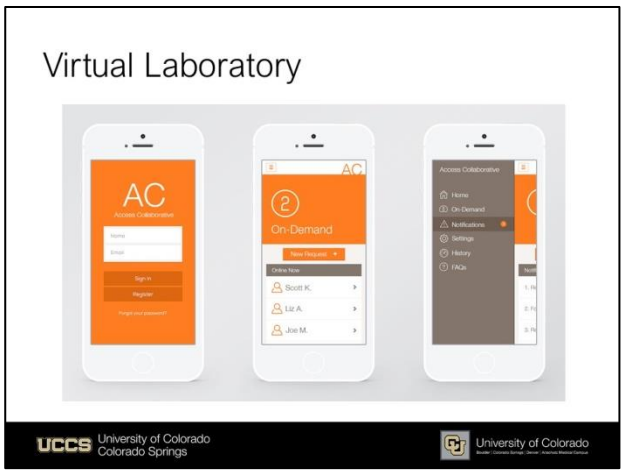


Slide 8

3. Accessibility

My focus for our conversation today is to talk about co-designing an inclusive lab. We have a physical lab at the University of Colorado that is very similar to other engineering and maker space layout (Slide 9). I will talk more about some accessibility features of this lab, but in general, we are actually moving toward a virtual lab. Our challenge is that we have collaborators who are not always physically within the same room. We have something called the Access Collaborative (AC), which is a virtual workspace or virtual lab for our collaborators (Slide 10). As I was thinking about this talk and how we have tried to make efforts to have co-design of space, I wanted to highlight a couple of key areas that have helped us.

Slide 9



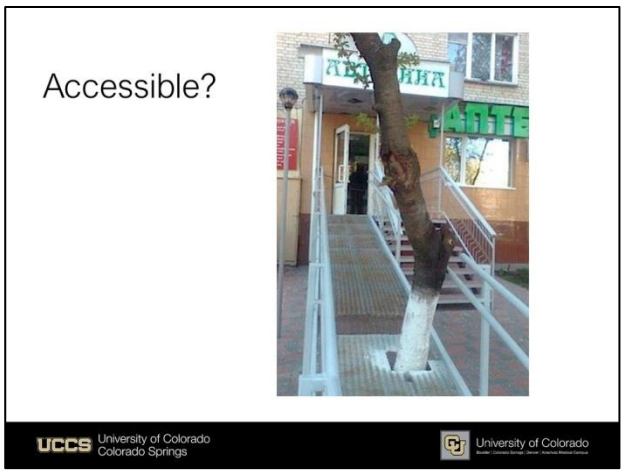
Slide 10

Slide 11

Before we can even get to an inclusive lab, we need to look at access (Slide 11). Inclusion is predicated on access. We need access. For those of you who came to my talk last year, you have seen these pictures (Slides 12-15). These are pictures of what not to do in terms of access. Typically when we talk about access, we think of a wheelchair ramp. This is a nice yellow-lined wheelchair ramp, but it only takes you up to the first stair (Slide 12). This picture shows a ramp at least going from the bottom to the top of the stairs, but the piece of wood does not look very safe (Slide 13). The next picture shows a ramp with a tree in the center (Slide 14). The tree is painted white, but it does not leave much room to move around. The last example of what not to do is a sign that says, "Caution. Hot glass (Slide 15)." It has Braille. Hopefully as you are reading the Braille, you do not get burned. People send me these pictures. If you come across other ones, feel free to send them to me.

Slide 12

Slide 13



Slide 14

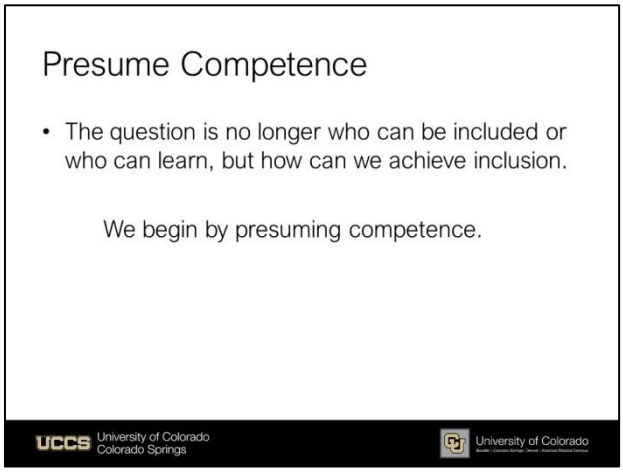
Slide 15

As we think about our physical space and virtual lab space, our goal is universal design (Slide 16). We typically talk about the idea of universal design within the physical environment like tables that can raise or lower and fire alarms that have both a strobe and auditory signal. But for our virtual lab, which is unique, where we are developing technology not in person, but virtually, there are some other examples I can share. For example, in our virtual workspace, every picture has a text description. Typically, you think of a text description that describes a picture as being an alternative text for people who are blind, but that text description can help other people as well. For our virtual lab, we use something called Panopto. It captures or records the activity that is going on within our virtual lab, so people can go back, re-watch, slow down, or speed up the activities within our virtual workspace.

Slide 16

4. Co-design process

As we think about the co-design process, one of our key ideas is something called presuming competence (Slide 17). We do not say that an individual cannot participate; we figure out how that person can participate.



Slide 17

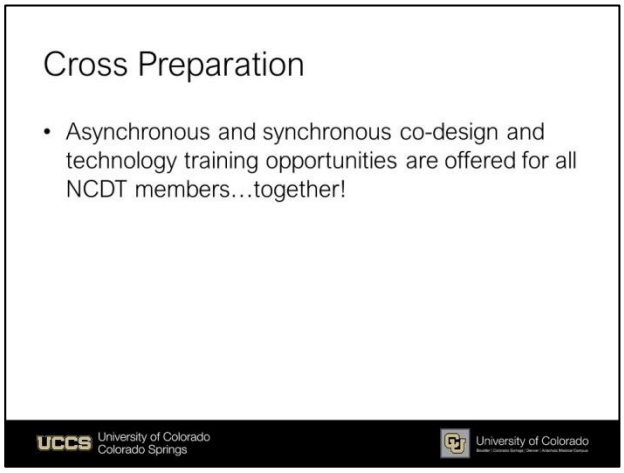
I will share an example of one of my longest collaborators and friends, Joe. Joe communicates with eye blinks by blinking for "yes" or keeping his eyes open for "no." We have co-developed over 10 different software and hardware applications. The device he has on his glasses is a camera switch system. Joe also teaches college classes. He is an engineer, a teacher, and also a great friend. I think that he is the best teacher of the importance of presuming competence. Just because he cannot speak, does not mean that he has nothing to say.

As we look at trying to develop an inclusive

workspace or lab, we try to go beyond standards and beyond laws (Slide 18). In the U.S., we have a wide range of laws. Section 508 requires that videos have captions, pictures have a description, and websites are built in an accessible format. If you have an interest in learning more about that, I can share our comparison of basic laws and how we go beyond.

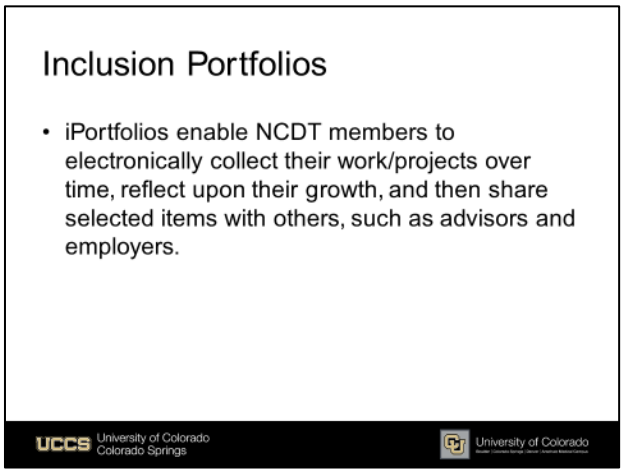
Slide 18

Another key factor in the co-design of our inclusive lab is something called cross preparation (Slide 19). For all of our NCDT members, we offer training opportunities to learn more about new technology, new features, and new ideas. For example, right now we have a project related to artificial intelligence for people with intellectual disabilities. We have different training and workshops related to artificial intelligence. Both engineers and people with disabilities take those workshops together, so it is a cross preparation.



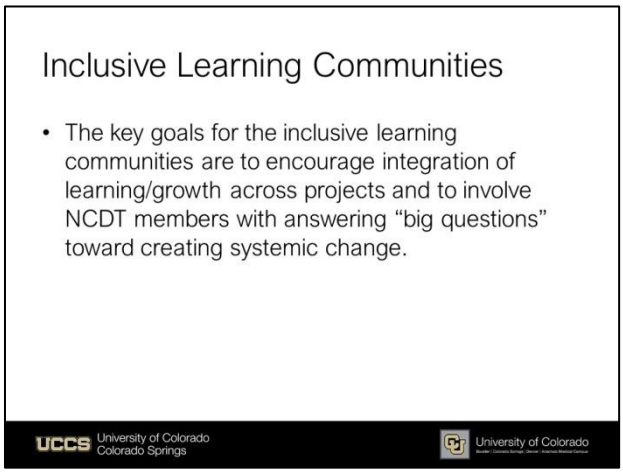
Slide 19

For all of our NCDT projects, we have something called inclusion portfolios or iPortfolios (Slide 20). These portfolios are a collection of each project, where from start to end, all of the activities and effort are collected. A really important part of trying to co-design an environment is the time to reflect upon projects. This portfolio gives us a chance to reflect upon a project and make changes for the future. If you would like to see any of those iPortfolios, it is an interesting insight into our process of developing new technology and we would be happy to share.



Slide 20

Another interesting part of our co-design of work space is something called an inclusive learning community (Slide 21). This gives NCDT members time to integrate our projects into real needs within the community.



Slide 21

Another element is our service learning projects (Slide 22). We do not only develop new technology. We want

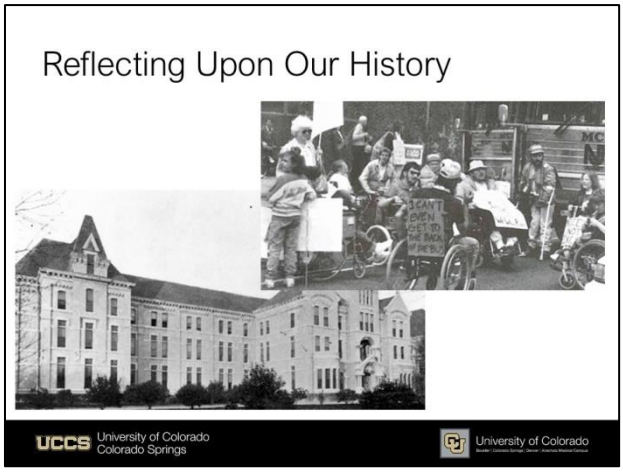
to look at the change that the technology is making within the community. This helps us keep the connection with the actual use of technology, rather than just trying to develop a bunch of technology that is not being used. Oftentimes, new technology that we develop can lead to systems change advocacy, policy change, and other real tangible efforts.

Slide 22

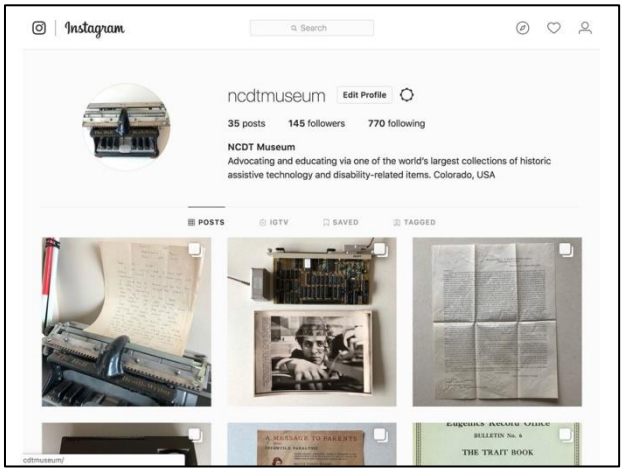
We also have something called model demonstration projects, where we can engage other members outside of our NCDT membership (Slide 23). We try to engage other people into projects like school districts, employers, and other people to help enrich and demonstrate our technology.

Slide 23

Lastly, as I reflect upon our co-design of an inclusive lab, something that has really helped us is to reflect upon our history (Slide 24). For example, our engineers take disability-history-related coursework to learn about disability within the context of history. We have one of the largest collections of historic assistive technology on our campus (Slide 25). Feel free to follow us on Instagram. We have a unique perspective about technology, a historical perspective on where we have been and where we are going.



Slide 24



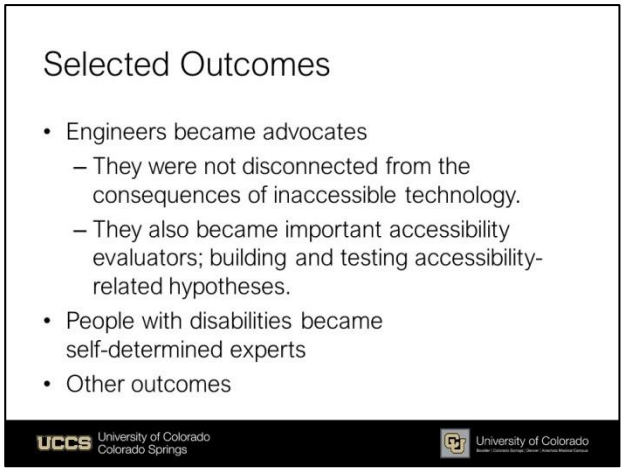
Slide 25

5. Outcomes and trends

To wrap up, it has been interesting over the past 10 years to watch what our outcomes have been (Slide 26). We have engineers becoming advocates and advocating for change on their own and people with disabilities becoming self-determined experts who know what they want and how to get what they want. Some of our new emerging efforts within the co-design of technology is preparing the next generation of collaborators. Tied to STEM education, we have an elementary, middle, and high school technology development cohort or group where we include students in

the technology co-design development process. One other trend is looking at low-tech and low-cost build-it-yourself technology and the co-design within that non-high-tech environment.

I want to thank you again for this opportunity.



Slide 26