

We have Jonathan Lazar with us. It's quite a pleasure to have this national expert on assistive technologies. He is from Towson University right outside of Baltimore. He's in the Department of Computer and Information Sciences and the founder and director of the Universal Usability Laboratory. Jonathan....

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Great, thank you very much. Yeah, well thanks everyone for coming out today. I'm thrilled to be here talking about web accessibility, and I already had a phenomenal day meeting with lots of students, meeting faculty, taking a tour of your incredible facilities here. My God, this place is gorgeous. You have great facilities here, so count yourself lucky.

So today I'm going to talk a little bit about some recent research projects that we've done related to web accessibility and also some of the recent policy changes related to web accessibility. Now, so it includes both interface design and public policy because really they're intertwined. And as you know, when you do a lot of research it involves a group of people. It's not just one person so I want to acknowledge Harry, Heidi, Paul, Libby, Abione (phonetic), and Greg and Brian who have taken part in all these research projects with me and are my daily partners.

So what does web accessibility mean, right? It means can someone with a disability technically use a website. Now, when we talk about web accessibility typically we mean people with perception or motor impairments so we're talking about people who are blind or low vision, people who are deaf or hard of hearing, people who have limited dexterity in their hands, people who have spinal cord injuries, right? And they tend to use different input or output devices so we're talking about things like refreshable Braille displays, we're talking about screen readers like JAWS, we're talking of types of pointing devices and keyboards or maybe no pointing device, right?

Now, why am I saying perceptual and motor impairment and not cognitive impairment? Because typically the guidelines that exist, the technical standards that exist and the public policies address perceptual and motor impairment, so you know, very often in computer science we get in this situation where we say "Oh well, we can't make it work for everyone so let's not make it work for anybody." And that's really a big mistake because we have existing guidelines. We have technical specifications. We can do this! We just need to convince people to do it, which is a totally separate issue.

Now, if you want an example of what I mean by web accessibility right, someone who's blind and has no residual vision so they can't use magnification, right? They type on a keyboard, right? They don't need to see the keyboard. Look, you rarely look at your keyboard so they can just type on the keyboard. They can't use a pointing device because they can't typically see where on the screen the pointing device is. They typically listen to output from a screen reader like JAWS, Window-Eyes or VoiceOver.

How many Mac users, anyone?

Any Mac users here, you probably have VoiceOver already on your Mac laptop, right? And typically a blind user would find information on a page using either keyword searches, right?

Where they, you know, search for a keyword using headings where they navigate through the headings or using what's known as a links list which will give you a list of all the links on a web page so if you think sometimes, "Oh, how do blind people listen to an entire webpage? My God that must take so long."

Guess what? Most blind people don't sit there and listen to a webpage. They have navigation strategies that they use. Now accessibility does not always mean usability. It doesn't mean ease of use, right? Because accessibility just means technical access whereas ease of use is obviously something a little bit different. Accessibility is the first step. Then we want to move towards usability.

Let me just-- let me just ask, how many people here would consider themselves somewhat familiar with the topic of accessibility in regulations like Section 508? How many people? How many people have heard of Section 508? Show of hands, how many people have heard of web content accessibility guidelines? Good, still a fair number. How many people have heard about the July 2010 memo from Vivek Kundra, the CIO with the Federal Government, about Section 508? We've got one person, yes! Okay, one person but, you know, it's really fascinating. A lot of the information out there about government policies is sometimes hard to find so I'll address that a little bit more.

Now, just this simple question. How do you make a website accessible? What do you do? Well, you use one of those technical standards that many of you already are familiar with, right? You use either the web content accessibility guidelines which are a standard from the World Wide Web Consortium or you use the Section 508 guidelines from the U.S. Access Board.

Now, the Section 508 guidelines actually cover more than just websites, but the web portion of the 508 guidelines are actually based on the World Wide Web Consortium and their web content accessibility guidelines. So please, if you only leave with one thing, leave knowing that there are technical standards that exist and you can use them and they're out there and in many cases they've already been out there for a few years, okay?

So the technical, the technical guidelines exist. You can do this. This is not, "Oh my God, what do I do? Do I make my website one way for someone who is deaf and one way for someone who is blind and what about people....?"

No, you follow one set of standards that works really well for most users with perception or motor impairment, but it's not only using technical standards because those are design standards. Yes, you should design to make sure that those standards are being followed, but what you also need to do is evaluate. You need to evaluate your webpages doing either usability testing, involving people with disabilities or expert inspections. We have experts in accessibility inspect an interface using assistive technology or even automated tools. There are automated tools. How many people are familiar with automated tools for testing for accessibility things like InFocus, Ramp, Deque, WorldSpace, Page Screamer? Just show of hands on people familiar with those. All right, we've got like five or six, cool.

How many people have heard of the old Bobby tool which doesn't exist anymore? The old Bobby tool for-- a few more people, good, all right. So in terms of evaluating for accessibility you need to do one of those things or hopefully more than one. It'll be great if you can do usability testing and expert reviews and automated testing, I encourage you to do all of them but, you know, you got to start somewhere.

Now, I'm gonna talk to you today about six research studies related to accessibility. Now, two of them are research studies about blind users, two of them are research studies about public policies and interfaces, one is about expert users with Down syndrome and one is about developing universally CAPTCHAs. Do most people know what a CAPTCHA is -- the Human Interaction Proof? Just raise your hand if yes. Okay good. You need to like do the wave from one side of the auditorium to, you know, ooh.

Okay let me start with the one that's a little bit different than the others. Expert users with Down syndrome. Let me ask how many people know someone with Down syndrome? Okay, awesome. So we're starting with this one because if you look at the research, the human computer interaction field has about twenty-five to thirty years of experience designing for perceptual and motor impairment. There's really been a lot out there of research, a lot of great research about perceptual and motor impairment. For people with various types of cognitive impairment there's only been maybe five to seven years of research.

And so the questions we ask are much more basic when for instance people with Down syndrome and interface design where there has been almost no research out there aside from what we've done versus blind people where there've been lots of research studies.

So we had done a survey that was published in 2008 in the assets conference about young adults with Down syndrome. And it was a survey of over 560 people. One of the things that we kept hearing in the survey is ... there are these expert users with Down syndrome, right? 'Cause typically when you think of people with Down syndrome when you look at our findings, the kids had a lot of trouble typing and, you know, there's trouble using passwords and things like that but we kept getting feedback--oh, but you should see this one user, they are phenomenal and so we're curious you know? Is there really a lot of diversity within people with Down syndrome as it relates to computer skills? We know there's diversity in general so we kept getting these reports about expert users with Down syndrome.

We decided to investigate so what we did is we basically got grant funding from the National Science Foundation. Yea, NSF, right? We rely on them. We got grant funding from the NSF to study expert users with Down syndrome first and then to study new applications such as security features and social networking for people with Down syndrome.

So we tried to find and it was hard at first, but we found 10 users with Down syndrome who are at least eighteen years or older, have five years of experience with the computers--with computers, sorry, use a computer minimum of five days a week and at least ten hours a week and have experience with three categories of applications that are used in the workplace. Why are we concerned about expert users with Down syndrome? We're really interested in whether or not this could be a potential workplace tool, right? Cause one of the problems, one

of the challenges is that if you have a disability very often people say "Oh, you can't do anything, right?" And we know. Most people with Down syndrome wind up being employed either cleaning out garbage, working at fast food, doing gardening, things like that and well, if they're these people with advanced levels of skills, maybe this could be a job skill for them.

So we looked at people again which had experience with communication, software, Facebook, e-mail, office automation like Word processing and also web searching. Now again, let me say this is not representative of everyone with Down syndrome, but what we found first of all for the users that we observed, our expert users, they tended to jump back and forth between multiple computers. They'd be sitting at a desktop, then they'd go over to their laptop, then they'd grab their iPhone and they would just go--they would jump back and forth seamlessly to different operating systems, right?

Every single one of our users had previously taken a formal computing class--at least one. That was fascinating because all of our users, our expert users with Down syndrome, all type with multiple fingers on both hands, and you say "Well, so what, big deal!"

Guess what? In our survey, young adults with Down syndrome, most of them did not, right? Most of them did either one finger or two finger, hunt and peck. Everyone we observed were all excellent at typing and they had all taken keyboarding classes. And so we even found that four of our users actually did work in database management, right?

So as part of their work they did--some of them was paid employment, some was unpaid employment and then we go the thing that was totally surprising is that most of our users were obsessive about keeping their inboxes clean, right? So they didn't use folders. What they did was they deleted things immediately, right? They responded to an e-mail, they deleted it, then they went to the sent mail folder and deleted out of the sent mail folder, right?

And we kept seeing this pattern like the first person, "Oh this is interesting". Second person "oh, that's funny," right? And then the pattern kept reoccurring. In fact, one person had at her work place, this is someone who works at a publishing company she had a sign on her desk, right, the user with Down syndrome. She had a sign saying do not delete e-mail on her desk, because her bosses put it there because she deleted so much e-mail, right?

So in researching then the literature we actually found that people with Down syndrome have high--a high percentage of them have obsessive compulsive disorder which was fascinating, you know, it's just very interesting. I mean this is an area that no one's been studying and so these people who use database management, who have great typing skills, why can't they get jobs working in information technology.

Maybe that's not true of everyone with Down syndrome, but it should be an option. Surprisingly about it, they blew through visual captions at a very high success rate--over ninety percent higher success rates than people without Down syndrome typically, very good with key word searches and remember I said that typically we say people with perception or motor impairment they tend to use assistive technology.

Our users, none of them use any type of modification, no assistive technology, no different keyboards. They use standard out of the box stuff and we actually found five different tasks that they were already doing in their various work places, right? And we think "Well, this is important." People with Down syndrome were already doing data entry and data migration and inventory management, contact management, document management, there's evidence here that people with Down syndrome are capable of doing computer related work, right? And it's something we're here investigating more and next studies right now relate to security features and social networking for adults with Down syndrome. But it's fascinating because no one had addressed this. No one had investigated it. Okay, so that's one study, on to another one.

Sort of the, you know, and now I'm something totally different. Evaluating federal home pages, okay last year we evaluated a hundred federal home pages, why? Because that's the Justice Department's job but they haven't been doing it for years so I just figured we'll do it, right? So what do we do? We took a hundred federal home pages we evaluated them for Section 508 compliance. Again, Section 508 that's a federal regulation requiring that all federal technology purchased, developed, procured, built, right, must be accessible to people with disabilities which essentially means that it follows the regulations, the design guidelines in Section 508. That doesn't mean it'll work for everyone with a disability. It just means it's following design guidelines.

So we went to usa.gov most of the websites on usa.gov were in the executive branch so we made sure that we had representation from all three branches. We started by doing an expert inspection using a structured method so we used the JAWS screen reader and we evaluated me and one of my doctoral students. We evaluated every page using a structured method that I use for evaluating webpages. Then we also used two automated tools we use from Deque, WorldSpace and we also used the AChecker because obviously the automated tools--a few of you said you've used them before, the reality is very often that, you know, the results are a little bit misleading but it'll get you part of the way there, you know, and really you need expert inspections or user based evaluation.

So, we evaluated a hundred federal websites. Now, here's what we found. Tad-ta-da! The results are not very good. So of the one hundred home pages that we inspected with the human inspection, 96 of them actually violated Section 508 and we used two different automated tools and both of them found 92 of them. So I feel really comfortable saying over 90 percent of them, you know, I'm sure we may have missed one or two things. I'm sure the tools missed more than a few things so over 90 percent of the homepages we looked at violated Section 508, but they tended to only violate two of the guidelines. On average it was a little bit above two.

So it's not that they're that horrible on all Flash based and there's nothing-- no, there are some good things, but there are still some changes that need to be made. The types of problems we saw very commonly no skip navigation. You know what skip navigation is where there has to be a link according to Section 508 where you can just take that--it's just a simple anchor link, you can take it around to the main content so you don't have to listen to all the navigation, really easy from a coding point of view. There were a lot of graphics, forms and Flash without mark ups so you had thing like, you know, forms where you had form one, form two, where you had your various edit box and all that were unlabeled. You also had a lot of links with

meaningless names, unfortunately the White House was actually guilty of that too, where it's like one, two, three, four or click here, which if you are blind and listening to it, click here doesn't mean anything. You hear the link, click here, what does that mean? It doesn't tell you where you're clicking to. But again, we use the 508 guidelines which is rest--perception and motor impairment. There were also some videos, right, on a number of the agency websites that did not have captioning, which is required as part of Section 508.

Now, we also examined federal website accessibility statements. Now, federal websites are not required to have an accessibility statement but many of them do and we're kind of curious what they said. So of the hundred websites we looked at, 58 percent of them had accessibility statements and 42 percent said we are 508 compliant. Remember we found that less than 10 percent of them were 508 compliant, so that might be a little bit misleading. 22 percent of them actually gave features and said we have the following feature for people with disabilities. But when it came down to describing how they keep their websites accessible, right, what process they use to know that they're 508 compliant, only three sites did and that was [usa.gov](#), [data.gov](#) and [recovery.gov](#) where they gave information about how often they test, what method they used to test, right? Because keep in mind websites are not like buildings, you know, when this building was built. What year was this building built here? 2002? 2002? Mid-'90s? Okay, so it was covered by ADA, right? It was covered by the Americans with Disabilities Act. You know what? Either if it's anywhere late '90s or early 2000's it would be covered. But once you've built the bathroom to be accessible and follow the government standards you don't have to go back and re-inspect the bathroom every day or every month or every year because it's not gonna change. Once it's built wide enough for wheelchairs, right, it's accessible.

Now website changes for most of the federal websites almost every single day, so you need to have maintenance processes. The fact that it's accessible today doesn't mean it'll be accessible next week. So that's why we're really interested in the maintenance processes used and most federal websites do not openly describe the maintenance processes that they use, okay? So we're gonna jump this 'cause I want to mention a lot of things and talk about public policy but each one these you can imagine I would love to talk for an hour about each one of these.

So, next we did a study about blind users and screen readers. And what type of information architecture was best? Okay, let me just jump ahead a slide or two. Are most of you familiar with the findings from the HCI literature that in general broad shallow trees, and so we see broad shallow trees on the bottom, broad shallow menu structures are superior to narrow deep ones, which you see on the top, right? So generally you want more choices on fewer levels and that's considered to be the best for user performance rather than fewer choices on more levels than narrow deep, right? So it's like the old tootsie roll commercial, you know, how many licks does it take to get to the center of a tootsie roll pop? Three, because you don't want to go down like 10 levels. So how many people, just show of hands, are familiar with this finding that broad shallow tree structure are superior? Okay. But of course, this research wasn't done involving any users with disabilities. So what would happen then is that typically you'd have some researches as they tend to do saying "Well, I think some blind users use audio-based interaction. They listen to webpages so therefore narrow deep structures must be superior because they have to listen serially. How do I know? I know because I understand people with disabilities. That's unfortunately what happens very often. People make assumptions because

they think they understand how people with various disabilities--by the way, all of whom themselves are different, you know? If you had any disability that doesn't mean you're like any other person with the disability. You want an extreme example? Someone with Alzheimer's disease and someone who's blind are both considered people with disabilities despite the fact they have absolutely zero in common except that they have been labeled as someone with a disability, right? So I mean I talk generally but know that there's a lot of diversity within groups as well.

So there's a well known study from 1998 Ken Larson and Mary Trawinski (phonetic) from the CHI Conference the Proceedings of CHI about the broad shallow tree structure issue on webpages. So previous studies have been done before that, they kind of took the idea and did it on webpages. How many people are familiar with that study by the way, the Larson-Trawinski? Yes! We have two people. I'm telling you I'm so impressed, right?

So basically what we did we ran their exact same study, we just replicated it using blind users who are using JAWS and so Mary Trawinski gave us all the materials. When I say we replicated it, we used all the same materials, right? And what did we find? We found that broad shallow tree structures actually work well for line users as well, okay? So sometimes the best advice is just to go and collect data and find that blind users don't need anything different in terms of menu structures.

How do you design it differently for them? You don't. They like broad shallow tree structures just as much, right? They were superior to narrow deep structure. So, what's on the bottom is better than what's on the top. You don't have to change the design in way but that's important because we don't want to make assumptions, unless you spent the lot of your time around people with disabilities of various types of disabilities probably your assumptions are going to be wrong and I can tell you, right, as someone who has spent a lot of time and done a lot of research sometimes my assumptions are wrong too, okay?

Doing the study of users with Down syndrome, right? We had one user who actually was, you know, a very--again, a very experienced user and we're asking about social networking and he said, "Oh yeah." He said, "I use Skype, does that count as social networking?" And I said, "Well, you know, not really, it's more like Facebook." But he's like, "You want to see me use Skype?" I said "Sure." He's like, "I'll go find a cousin of mine," right? He finds online a cousin of his in Brazil and he starts speaking Portuguese to him through Skype, right?

I guarantee you that wouldn't have been something I guessed, but I was blown away and very impressed. And that's the key, let people with disabilities show them what, they're--show you what they're capable of doing, don't assume, don't limit them. They may surprise you and that's a good thing.

Next, we looked at e-mail applications. Why e-mail? Because if you're gonna be an employee at any type of company organization you need to use e-mail. You can't really be employed most places if you don't use e-mail. It's an integral part of employment and of workplace communication. So what we wanted to do is examine a bunch of different desktop base, when I say desktop I mean operating system based ones like Outlook Express and Microsoft Outlook

and also web-based ones like G-mail, Yahoo, and Hotmail. So what we did is we had fifteen blind users taking part and each blind user evaluated one desktop and one web-based e-mail package. And again, why did we do this? Because it's an important part, if there are pro--it's an important part of employment.

If there are problems with the e-mail application usability where a blind user can't use it, you know what's gonna happen unfortunately? People are going to say "Oh yeah, look at that blind user. Unfortunately, they're not capable of doing the same quality work." When in reality that's usually a stereotype and the problem has to do with the fact that it's a really poorly designed interface.

Like if, as we found, if the calendaring feature doesn't work well with screen readers, right, guess what? Someone who's blind might miss a meeting. People will often say unfortunately "Oh yeah, they're not hardworking. They're blind, they missed the meeting." When the reality is it has nothing to do with their work ethic, right? They probably just didn't get the information because the calendaring functionality didn't work with the screen reader, right? And that's the key.

So what we did is we created seventeen common e-mail tasks, okay? Things like creating and sending a new e-mail message, things like searching for a phone number, adding a new contact, deleting an appointment. And we noted user experience with the different applications, so certainly that did have an impact. Okay, and what did we find? The task differences were enormous between 91 percent task success rate for Outlook Express all the way down to 35 percent for Yahoo Mail Classic. Why did we use Yahoo Mail Classic? Because if you go to Yahoo's website they say if you're--if you have a disability you need accessibility features, don't use our new Yahoo Mail, it's not accessible. Use Yahoo Mail Classic which itself brings up a whole set of issues about that.

But so, yeah, G-mail had a very low task success rate, Hotmail did, but interestingly enough the Outlook products actually did pretty well. So the task that had the lowest task success rate from the users were view appointment, add appointment, and delete appointment, okay? Most of the users could not successfully complete those tasks. And again, that relates to work place employment. Guess what? As more universities, as more companies are moving towards web-based and cloud-based e-mail, this is gonna be a problem. They need to think twice about that or realistically what they need to do is they need to pressure Yahoo and Google. There's nothing inherently cloud-based that's inaccessible. It's just the way they've designed them. It's just the way that they've designed these applications.

So you wanna know what some of the common problems were? Some of the common problems, I like this one, you remember Yahoo Mail Classic is the accessible version but if you're using Yahoo Mail there's a link for all new mail. Many of our users thought that meant "Oh, I should click here to check for mail." When they checked for all new mail and they clicked on that, guess what happened or when they hit Enter on that. What happened is that they were taken to the new Yahoo Mail version which is totally inaccessible. It doesn't take them to their inbox. It takes them to the new and improved but inaccessible interface so really it's not really improved, okay?

G-mail, Outlook, web access they all had similar problems. They're funny because they seem so silly and technically easy to solve like the add content link was listed within chat and blind users couldn't tell that, right? Even close button was located at the top. Blind users expected it to be at the bottom. So there are a lot of problems like and most accessibility problems are not technically hard to solve you just need to take the time to solve them. It's things like tab order, things like labeling, terminology, clear confirmations, placement of buttons, right?

And by the way, we've done other studies. There's one coming out this summer that we did where we put in basically some new design features into the calendaring features of G-mail and guess what? Right, we had a much higher task success rate for our blind users. So there are a lot of things that you can do. These are not hard things technically. You just need to focus on them.

Okay on to CAPTCHAs. So, we started with a focus group in 2007 at the National Federation of the Blind to learn about security features and what security features are problematic for blind users. We kept hearing it again CAPTCHAs, CAPTCHAs, CAPTCHAs. You all know what a CAPTCHA is, right? A CAPTCHA are those things that I have up there that's a visual CAPTCHA. It's a real funky acronym which basically it's a Human Interaction Proof. It's twisted or--for at least the most prominent one, it's text that has been twisted and distorted so it's supposed to be able to determine whether you are a human or whether you are a bot and the idea is a bot or a virus could solve the CAPTCHA--could not solve the CAPTCHA and you can of course, we know first of all to test the vision and second of all many bots can actually solve these.

So they're not really perfect but just show of hands, most people now know what I'm talking about when I talk about a CAPTCHA? Okay? Yes? Okay good. So it's a completely automated public touring test to tell computers and humans apart also known as a HIP. It's a real dorky acronym. So web-based services like, you know, G-mail. I understand they need to avoid bots and viruses. I'm not saying don't use them, right? I understand places like Ticket Master you need to use that otherwise the scalper could use an automated system and just go in and buy up every ticket.

Now, how many people have heard an audio CAPTCHA before? Okay, only four or five. I'm gonna take one quick second here to do this. Please make sure that the volume is up. Okay, now let's just do here, this is an existing audio CAPTCHA this is live this is not a saved one this is from reCAPTCHA which is now owned by Google. You hear it? Louder please. (Audio Clip) You're not getting all the background noise as loud as it normally is, that background noise by the way is much louder on your own computer I think probably with the awesome here it probably takes out the background noise. Maybe if you want to break one of these you should come in here to do it. But can we put the background noise back up can I do it? Can we try that once? Yes, is it up? Good. You're working on it? Go? Okay.

(Audio Clip)  
(Background Noise)

You can hear the background noise a little bit more now. I won't (inaudible).

(Audio Clip)

Okay and you can turn it back down and thank you, okay so those are the audio CAPTCHAs they really work poorly. Most blind users in previous studies could never even get to a 50 percent task success rate. So we started working in trying to come up with improvements, right? Improvements for the audio CAPTCHAs and so we basically just started trying out some different prototypes and trying out some different things and, you know, building prototypes and seeing what we've found.

So we finally build one and now the background information is that typically, users have to have at least a 90 percent task success rate and typically the bot should only be successful about a tenth of one percent of the time even though with our existing CAPTCHAs now, they're not foolproof.

There have been studies that show that they can be broken at over an 80 percent task success rate. So we started with this design idea here which was trying to come up with some non-textual sound and non-textual picture because typically what happened is image recognition, voice recognition they're much better at recognizing text and letters, right?

So we basically tried non-textual sound and non-textual pictures so things like this. Things like where you have here the piano playing and the glass breaking and the birds and so you would hear a set of sound clips and then we tried both pull down menus but actually the free text worked much better and we just used standard information retrieval techniques for dealing with the fact that people put in like bird, birds, things like that, you know?

And so we actually--the existing one here, we actually tested it from a usability point of view it was incredibly usable, as it turns out it wasn't secure enough but it was incredibly usable, right? So we at least met the--let me go to the table here that the blind users who took part actually took part and were successful over 90 percent of the time regardless of which version we used, whether we did three or four sounds and whether it was drop down menu or whether it was free text and our visual users loved it as well.

So from a design point of view this worked out really well, right? From a security point of view we did some security test afterwards and found that it still needed some improvement. It was a little bit too easy to break. So we've actually been working on a new version with our tech transfer folk at Towson University, and we received state money to do this and unfortunately that once you receive state money and its money that has to be paid back. They make you sign all types of confidentiality agreements, so I can tell there's a real cool new version. You're gonna be hearing about it soon but I can't talk about it yet unfortunately. So--but it's really good and this one's much more secure. You'll be hearing about it soon when they tell me I can talk about it. That's hard--as a professor you want to talk about everything.

So now on to government regulations related to transportation. Now I am the ACM SIGCHI

Chair of Public Policy. Most people are familiar hopefully with ACM's group on Computer Human Interaction, right? Raise your hand if you are, raise your hand if you're going to CHI this year in Vancouver. This is so great. You have such a great group. I will see you all there. I'll be there too. Look for me, right? In fact, there'll be three public policy related events.

So public policy actually has a very big impact on what we do in HCI and it doesn't at first seem like the most natural fit, right? You say like public policy what does that have to do with design? HCI, I don't get it. I don't have training in the policy. I'm trained to code and I'm trained in psychology to evaluate. I'm not trained to be a politician, right?

But it really does have a big impact, so there's been this regulation in place, the DOT regulation they actually put in place in 2008 but it went into effect in 2009 and it said that you don't have to make your airline website accessible for people with disabilities but if it's not accessible then you have to be able call up and say "Hi, I have a disability and I would like your lowest fare." And you have to be able to get the lowest fare. Of course when you call an airline what do they say? Lowest fares are available on our website. So if the website is not accessible and you call and you don't get the lowest fare, that's price discrimination. Oh, and don't forget also when you call the airline, they say we want to charge you twenty-five dollars for calling, right? And what happens is that that also becomes price discrimination. You can't charge people more 'cause they have a disability. You are not allowed to by law. So not that that stops airlines from doing it, but you're not allowed to under law. So basically you're--the airline website if it's not accessible you have to be able to call the airline say "Hi, I have a disability," right? And they have to give you the lowest fare available at the time and not charge you the call center fee. Well I heard that and I said, "You know, to me that sounds like a policy that someone needs to test." Someone needs to—someone needs to hold the airline's feet to the fire although to this day that's why United keeps losing my luggage (laughter) but--so we looked at the ten largest airline websites and determine that four of the ten largest airlines their websites were inaccessible and had accessibility problems. So Alaska, JetBlue, United and US Airways have problems on their website or they did when we did this study.

Okay, examples? (Inaudible) on here on JetBlue information was available through mouse overs not the keyboard. At the time we did this, JetBlue has since made changes. But when we did this study at the end of 2009 what happened is that you could not do keyboard access only to get to the--to even choose a city for JetBlue, right? And by the way, United and US Airways both had a lot of mouse overs where information about a flight was only available in a mouse over. So there was no other way to do it.

We tried-- I tried using every single technique I could in JAWS. So what we did then is we did a pilot study but created--I created sixty travel itineraries, fifteen for each airline which involved a specific date, arrival and departure city and a time. They were only round trip itineraries direct flights no overnight flights, no international flights, and I picked ones so that there weren't like twenty flights at the time. You know, if I gave you a day and a time and a location I wanted to fly to, there was only one flight by that airline that would match it, so we put together 15 travel itineraries for each airline.

So what I did is I had the students call. This was a great class project, right? This was actually done with one of my undergraduate classes. I had the students call and identify themselves as blind. Why as blind? Well, logically it doesn't make sense to call and identify yourself as deaf, right? And also if you call and say I'm in a wheel chair, they're gonna be less concerned about pricing than they are about okay, how do we get you down the Jet way and the reality was it was just the easiest thing to say we're blind.

And they're like "Okay, well you can go on the airline yourself, no problem." I had two students--one checking the price online the other student actually on the phone saying I'm blind I want to fly from here to there. And the goal was to find out if they were complying with the regulation. And keep in mind, when they said things like, "Well, we have to charge you the call center fee," the student said, "Well, no. According to this regulation by the Department of Transportation they gave the name of it, actually by law you can't." Typically what happened is the person would say "Hold on, I'll check. I'll go talk to my manager." They get off the phone a minute back later come "Yeah, we don't follow that regulation." I'm serious. The airlines would just say, yeah, we don't follow that like it's voluntary. Yeah, we don't follow that.

Okay, so what did we find? Dat-ta-da! So we found that basically Alaska and JetBlue generally did a good job. There was only—JetBlue once charged a higher fare and Alaska twice refused to waive the call center fee. United and US Airways did a horrible job, right? So basically five times out of fifteen United refused to waive the call center fee even after we told them that by law they have to and identify the law. US Airways not only did that but also twice charged the higher fare, right, than what was available on the website.

So the biggest problem wasn't generally with the charging the higher fares the biggest problem was the call center fee that they refused to waive. Now, if you want to know why I have 40 and 46 percent, it depends on how you actually want to calculate that. We had one phone call that actually resulted in two violations. There's one phone call where they charged you the call center fee and charged you a higher fare, so if you want to that as two separate violations we had seven. If you want to say it was only phone call, you know, it's actually 40 percent instead. Yeah, this is a big problem for airlines and that's why, by the way, separate but equal is never really equal, okay? If you say well, we're going to do this accommodation for you, you have a disability, you go through this separate door, guess what? Chances are good your experience is going to be not the same and it's going to be less and you're going to be discriminated against. This is an example of that, okay?

Think about how many e-commerce websites have web only specials, most of them. Guess what? Most of those of sites that have web only specials that they won't give you on the phone, they won't give you on the store. Those are inaccessible websites so that winds up becoming price discrimination. And by the way, the call center employees need a lot more training. We actually had two instances where one person at an airline call center when the person said that they were blind the person on the other end said, "Oh, I'm sorry I feel bad for you," right? And the other one, I kid you not, the other call center person started speaking loudly and slowly to a point my student finally said, "I'm blind. I'm not stupid, right? You don't have to speak slowly."

But this is the reality of--I mean this is the reality of everyday life if you have a disability. People act like this. People don't care about if their interfaces are accessible or not. And this is really important. And really it's very hard to actually with the DOT you actually would have to file a complaint. How many people are gonna file a complaint? What do they do? They wanna basically just get their airline fare at that time and get it cheap.

Now, some of the projects we're working on right now I've mentioned more usable approaches to accessible calendars, sonified weather map data for blind users so basically, you know, Doppler radar will tell you a lot about patterns and weather patterns but just the temperature itself, you know, it's 55 in Ames that won't tell you much. So we're working on sonified weather maps for blind users, documenting good 508 practices within the federal government. You know it's not enough to say the government's doing a bad job. We have to find out who in the government's doing a good job document it and say here are the patterns that you need to follow, okay? So we've got that and we are looking at museums websites. We are looking at how people with Down Syndrome interact with security features and social networking and we're also of course working on the CAPTCHA which is now called the Sounds Right instead of HIPO (phonetic) apparently in the computer science department, HIPOs were considered fun apparently the marketing people don't think HIPOs are that much fun.

So now on to public policy activity. I can tell you that this has been the most exciting year or at this point almost a year and half in public policy and accessibility in my mind ever. It's been exciting, it's been very busy. Why? 2010, 2011 there has been a lot of activity both public and private websites now. I personally think this is because 2010 was the 20<sup>th</sup> anniversary of the ADA. The Obama administration took a lot of actions federal agencies started taking their responsibilities more seriously. Just a background of 508 how many people consider themselves pretty familiar with Section 508? Okay so I see most people not raising their hands.

How many people consider themselves not familiar with 508? Okay, yeah, that's most people. Section 508, it's a regulation right? It actually went into effect in 2001 requiring that all technology not only websites but websites and you know, personal computers, hardware, software, anything acquired, procured, purchased, developed with federal dollars needs to be accessible, okay? The 508 regulations came out in 2001. They're getting a little bit older, they're in the process now of--and actually let me say they went into effect in 2001, they actually came out in 2000. They're in the process right now of being refreshed. It's known as the Section 508 Refresh. They actually came out with a draft of the new version of 508 March of last year, so they're about a year old. And obviously they're--if you're familiar with the rule-making process, these things take time so they're working on the new version, they took a lot of public comment but know that a new version will be out sometime soon you can look at the draft version which is already available on the web.

Now, how many people are familiar with the Web Content Accessibility Guidelines 2.0 WCAG? Okay, that's the international standard from the World Wide Web Consortium that's the international standard. And so it's been in existence, the--2008 is when the version 2.0 came out and the web portion of 508 is based on WCAG 2.0. We should base our things on international standards. Luckily we do so, but unfortunately we make some tweaks. But interestingly enough, the justice department has the responsibility every two years to collect

data on 508 throughout the government, right? But they stopped doing that about a decade ago even though by law they're required to.

So the last report posted is from 2001, right? If you look now, by the way, I encourage you on your laptop you can search on Justice Department 508, right? And you'll find a webpage that says later this year in 2003 we're gonna be collecting data, right? By the way the Justice Department actually is starting to collect data again now but they have not updated their website. But every two years they're required to under law. They actually haven't done so. This memo I'm talking about the 2010 July OMB and CIO memo they basically issued a memo saying okay, we acknowledge that we haven't been following the law--that's really what it said by the way. It's like we acknowledge that we haven't been following the law and doing our data collection every two years, but starting this year we're gonna start following the law Justice Department, yeah, right?

So they said they're gonna start collecting data again in September 2010. Actually they finally sent out the survey in 2011 in February. I have to tell you, by the way, I don't think that a survey is really the best way to collect data on Section 508 compliance. This is what it's like. You're the Section 508 coordinator. Is the website accessible? Uh, yes? Think about it. Is a survey really the best way to collect data on 508 compliance? Who's gonna write, "No, we're breaking the law. It's my fault. I'm the 508 coordinator." I don't think you're gonna get actually accurate responses. So at least they're starting to do data collection but, right, the DOJ website has yet to be updated with the fact that they're doing this and what I think was the most embarrassing thing in 2010 when the section508.gov website was redesigned, it became noncompliant with Section 508. (Laughter) The Section 508 website itself was not compliant.

Okay, to be fair they've made some changes and made improvements, but does that show how pervasive the problem is? This is not a small thing-- you know what? I really don't care if one agency on one day has one accessibility flaw 'cause if you have good management processes, good maintenance processes, good compliant processes, it'll be caught and it'll be fixed but the problem is it's pervasive throughout the federal government. Accessibility is a problem.

Okay, you see that with the study we did with a hundred federal websites, most of them are not compliant. They don't know how to do compliance, right? When you complain to an agency, you know what they say? "Well, tell us what's wrong with it. We'll fix it." Okay, don't you know what's wrong with it? If you don't know what's wrong with it, how're you ever gonna keep it accessible? You'll fix it today and make the same mistake tomorrow. Okay, so really it's a pervasive problem. Now, let's also talk about the ADA--the Americans with Disabilities Act. Have most people heard of the ADA. Show of hands? Okay, now as early as the mid '90s the Justice Department said that the ADA applied to websites. If you were a website of a public accommodations and that's defined in the ADA law, your website had to be accessible. They didn't do anything about it. They just said it has to be accessible. Now obviously ADA signed into law until 1990 there was no mention of the World Wide Web in there for obvious reasons. But again, the Justice Department is saying since the mid '90s, yes, ADA applies to websites, right? But really nothing happened on that until the National Federation of the Blind sued Target. How many people are familiar with that?

Okay, I'll mention one or two things, but that Target had an inaccessible website, National Federation of the Blind asked them to make it accessible. Target said no and so the NFB sued them. And a judge and a few preliminary rulings said, yes, the ADA does apply to the web and they certified a class action law suit and finally Target did settle out of court but, you know, I mentioned this to the group of students I was talking with earlier at lunch, a very interesting speech at the conference of the National Federation of the Blind last year, the head of Target.com got up and started with the speech about, "You know, I want to be honest we haven't always been friends" but he said "I wasn't here when that happened." He said, "I came in to head up Target.com and they said we're fighting this lawsuit. And I said why? Well, people who are blind want to buy from us and so we're fighting a law suit to stop them from buying from us." And he said, "Wait, how did that make any sense?" Well they want the website to be assessable and we don't want to make accessible and they're--basically we're fighting them in court so that they can't buy from us online, right?

And when you hear it phrased that way, isn't that fascinating? They were actually fighting a law suit to stop people from buying from them online--fascinating! Crazy but fascinating, so in the end they settled out of court. It was a six-million dollar class action lawsuit, and Target agreed to become accessible and they paid six million for the class. And the judge said that the ADA does apply. In preliminary rulings, again it was settled out of court so they said judge said that it does apply to websites. But there's been more.

So the ADA in the actual ADA law from 1990 there were no technical specifications for websites and none have been developed. People have said, "Oh well, you know, just follow the guidelines that already exist." So the Justice Department in 2010 clarified and said yes, the ADA does apply to websites, right? And we're gonna start coming up with technical specifications for how to make your website comply with the ADA. So they put out what's known as an advanced notice of proposed rule making asking the business community or research community questions about, you know, what challenges they would see in a regulation like this. So they already closed the public comment tree on that. They are moving forward on coming up with technical specifications within the ADA and its things about how are you gonna measure--excuse me, ADA compliance, right? How are you gonna evaluate? How often? Which standards are gonna be used, right? And the Associate Attorney General for Civil Rights Tom Perez has said publicly again ADA applies to websites. We're gonna start enforcement soon, okay?

So now, ADA covers public accommodations that include most private companies, right, and employers, so basically 508 covers the Federal Government ADA covers state and local government and it covers most entities. Now there's been more, not only Section 508, but wait there's more, Section 504 and 503 were cited--the Justice Department and the Education Department sent out a letter in June 2010 to every university president in the entire country saying Kindle DX. How many people have an Amazon Kindle? Raise your hands if you have a Kindle. Okay, not many. Interestingly enough, the Kindle could do text to speech but all the menus were inaccessible. So if you were blind, you actually could not use it. Someone would have to set it up for you and then you could listen to it then you'd have to go back to them, right, which makes absolutely no sense. So the Justice and Education Department sent out a letter saying, "Guess what, universities? You cannot adopt the Kindle, right, unless you have

some types of other accommodation for print disabled users and by the way, print disabled users--that's just a sort of a category of users that includes people who are blind, people who are low vision, people who are dyslexic, or people who have trouble turning pages.” And the newer versions of Kindle actually now are accessible. But that letter was sent out, there was a new law signed in October by Obama called the 21st Century Communications and Video Accessibility Act. You might have heard it in early incarnations as the Marky Bill (phonetic) Who's heard of this? Wow! Okay.

So basically it deals with accessibility of things like smart phones, right? Things like 911 emergency warning information, broadcast shows that are actually placed and distributed online, on screen menus, right? And a number of other things not related to the internet, but it's related a lot to phones and entertainment and video and telecommunications, right?

So basically the FCC is now working on defining the regulations, so that got into effect and that was where some of the 508 regulations, right, the blind wind up suffering more typically with some of these--the deaf population, they're the ones who actually wind up with some more challenges because, again, it's things like video that doesn't have captioning, right? So, but really as long you follow good technical specifications, they cover multiple groups.

Now, and universities are starting to be filed against, right? So for instance in November, the FNB filed an administrative complaint against Penn State University because nothing of their campus IT was accessible. Their websites weren't accessible, their library catalogs, you couldn't pay your bills online, you couldn't apply online, you couldn't register online if you had a disability, okay? So course on management software class from IT nothing was accessible, so--and by the way, most campuses are in the same situation. It's not just Penn State and every other campus is perfect. There are a lot of campuses that have inaccessible IT. Okay, and in March the NFB actually asked the Justice Department to investigate New York University in North Western for their use of Google Apps, things like G-mail which have a number of accessibility flaws. And again, these flaws don't have to be there. These violations don't have to be there, they can be changed. It's not technically hard. It's getting people to want to do it, okay? So certainly we're continuing a lot of research on accessibility, but also the public policies are getting stronger and please understand the technical changes for accessibility given the technical standards that we have are not that hard.

But they need to be done. You have to be conscious of it. More research work needs to be done but we also need to get people to follow technical standards. They exist. We are capable of doing this, you know. It's like people say--we're still searching for a cure for cancer. Guess what? When it comes to perception and motor impairment we know how to make things accessible. We know how to make websites accessible. We just have to get people to do it. So we need to get people to use these technical standards to focus on it, to do usability testing, expert reviews, automated testing. We can do this! We can. We just need people to get interested in these topics.

So thank you again for coming, and I hope you take this seriously; you read the standards and you folks work on improving accessibility in all interfaces, yeah!

(Applause)

That's right, that's right, come on, yeah we're gonna do it! Woo!

(Applause)

questions.....That's right, I should mention by the way I gave up caffeine a year and half ago. This is me naturally. This is not caffeinated.

(Laughter)

There's a microphone over there or we can pass this one around. Who wants to improve accessibility first? Go for it.

*Any research on Linux operating system versus Windows versus OSX as far as inherent accessibility?*

You know not that immediately comes-- oh, sorry. Let me repeat the question in case people couldn't hear. He asked about the accessibility of Linux versus OSX versus Windows any version.

I haven't seen any, but typically what you can do if you want to find out more about the accessibility. There's something known as a VPAT, a Voluntary Product Accessibility Template. Anyone heard of a VPAT before? Any procurement folks in here? Procurement folks might have heard that.

So basically what it does and many companies including Microsoft and Apple have them where it's basically a template for documenting accessibility features and compliance with 508.

It was developed by GSA and the IT industry council, so if you are interested in knowing what portions are accessible and what are not, a good place to start is a company's VPAT. Again, Voluntary Product Accessibility Template. Google search on that. You can find it. The key is though know that sometimes companies lie about their VPATs, so sometimes they're not actually accurate but it's a really good starting place.

Next.

*I'd like to hear some specifics about what technically can be done to make websites more accessible.*

Okay, absolutely, the question was what can be done specifically to make websites more accessible. So the types of problems that occur most often are things like if you look at a homepage of a typical university or government agency okay they have--first of all they usually have video that doesn't have captioning, right? Or--and there's no transcript to the video, right? So basically you have a video that winds up being if there's, you know, if it's a video that has audio so a blind person can listen to it. But someone who's deaf will probably get not much out of it, right? Because they can't hear, they'll just see the person going, you know? So typically

captions are missing. Very often you have Flash with no equivalent. I'm not saying get rid of Flash. I'm not saying--but have equivalent links so there is an example of a bus system for instance locally in Maryland where the entire map of all the routes and learning about all the routes is in Flash, right? And it's-- basically this whole thing with, you know, you would mouse over and all, but guess what? That was fine because they had links on the bottom of the page for all the same route information, so that was fine then. That wasn't a violation, you know, but there are many sites that do that and don't have the equivalent.

So it's making sure that all of your graphics are labeled properly and not things like picture here, right? As unfortunately happens very often, you know, if you want to know by the way what would make it accessible or not for let's say a blind user, let me point out two things that....first of all, you can download a free demo version of JAWS a forty-minute version that will work for forty minutes. Then you have to reboot your computer at [freedomscientific.com](http://freedomscientific.com). There's also a great thing on the web called Web Anywhere. It was actually done as a project by doctoral students at the University of Washington, that is [wa.cs.washington.edu](http://wa.cs.washington.edu) and it's basically a screen reader. Is it exactly what a blind user would use on a regular basis? No. Will it kind of give you a sense for some of the things? Absolutely. And it's just a screen reader that works from the web.

And you can type in a webpage there and you can see what it'll sound like, you know? Here, I'll shut that then. There you go. So, yeah, sorry I didn't mean to spring that on you. So, yeah, so it's things like that that you can listen for. So it's graphics that are very often not either not labeled at all or not labeled properly. Its things like forms that are labeled form one, form two, form three, right? It's that basically there's no useful mark up and you need to have that useful markup. Let me show one the cool thing related to accessibility and policy so when you have a PDF file. PDFs, by the way, can be fully accessible just not if you take a printed out version, put it on a flat bed scanner and scan it. You need to instead take it from word and print it to a PDF where you have all your markup.

So a judge recently ruled that PDF files that do not have any markup or meta data do not fulfill Freedom of Information Act requirements either. So you can't fulfill a foyer request with a totally unmarked up PDF, right? Which is really the same thing as accessibility. You need to have an accessible PDF. But-- so it's things like PDFs that were just put on, you know, a flat bed scanner and scanned without doing any OCR on them. So it's just strictly a picture. It's things like images that don't have labels, have misleading labels like sometimes, you know, image 539821/5926-- right? It doesn't mean anything, you know? So it's things like that, it's content on the page that someone who is not, you know, who maybe doesn't have vision or doesn't have hearing. It's content that they can't access, and that's the key.

You don't have to take off the video. You don't have to take off anything. You just need to make sure that you have equivalence either captions or transcripts or appropriate tagging on the backend code. For a user without any disabilities, the webpage shouldn't look different if it's accessible or not. It should look exactly the same, right? The key is making sure you have in all that backend markup so then it is accessible, okay? This is doable. It's technically doable and it's really not technically hard either. I mean, you see, the types of things with the e-mail applications too, right, with the web-based e-mail? These weren't hard things to do. You know

all new mail interface instead of all new mail, right? A lot of them are wording changes, a lot of them are all text, things like that, making sure that forms have proper markup, making sure that if you have tables for data that the tables have appropriate heading markup so they're actually technically not hard solved. They're doable, just not enough people pay attention to them.

*Thank you, I have a couple--an observation that from what you were talking about. A lot of your kind of usability fails I guess specifically for the blind people as you were talking about are things that even I as a non-blind user find annoying and I was--like such as tab order or image text being annoying or—*

Right.

*But-- have you found that a lot those things that are-- make websites inaccessible to people with disabilities correspond to things that are in general kind of usability fails for lack of a better word? Or is there like a specific kind of set of things which are unique to accessibility in terms of this. Does it make sense?*

Yeah, no-- I know what you're saying. The relationship between accessibility and usability and you generally find that accessible website means it's very usable. Now I haven't seen any actual statistical evidence with any type of correlation, but I will tell you that originations that have usability staff on them, so government agencies that are well known for their usability tend to also be good on accessibility 'cause obviously the people who know one tend to know the other. So informally yes, there's no actual evidence of that but informally I've seen that where it's, you know, you have basically an agency where they have a big usability team and they do 508 and they know 508 and they're involved with it.

You also have some agencies like SSA where the usability and the-- sorry, Social Security Administration, that's one of Baltimore's biggest employers, so Social Security Administration is a separate accessibility and usability team. They're not combined.

Most agencies tend to have it in the same grouping. So yeah, I mean, it does make sense. You would think that they tend to be but typically if it is 508 compliant that doesn't necessarily mean it's easy to use and if it's easy to use it doesn't mean that it's 508 compliant unless you wind up where you have the groups who really know and I've seen it in some federal agencies. It's interesting. Truthfully, we're not really a great usability yet overall and so I think this like the first step because someone at lunch had asked about this I think.

There's really no guarantee in the law for good use or center design. There is a guarantee for accessibility. People with disabilities have rights. So, we'll start with accessibility, then on to full usability. How about that? Think of it, you know? Today Chicago, tomorrow the world!

Any other questions? Let's do one more. One more, okay?

*Are there any online like certificate programs? I know here in the HCI program they have a certificate course, and I was wondering if there were any online programs specific to accessibility 508, et cetera?*

Okay, can I just also—so he asked about any certificate or training programs related to accessibility. Let me just quickly first mention there are a lot of web resources out there now that [section508.gov](http://section508.gov) actually is compliant with 508. You can go to [section508.gov](http://section508.gov), you can go to [ada.gov](http://ada.gov), you can go to the World Wide Web Consortium Web Accessibility Initiative. A great site is [webaim.org](http://webaim.org). Web W-E-B-A-I-M dot org you ask about certificate programs. I believe that Cal State North Ridge has a certificate training program in accessibility.

The two big conferences you'll find every year related to accessibility, one is the Cal State North Ridge Conference on technology and people with disabilities is known as CSUN and then that's usually in March or April and the other one is the ACM Conference on Assistive Technology and Accessible Computing and that's assets. That's usually in October, but I believe CSUN has a training program actually in that.

So we're gonna wrap it now with Jonathan Lazar. Let's give him a hand.

Thank you.

Thanks again.

(Applause)