Inclusive Design
[Develop]

There is no average user

Inclusive Design

- Create products that understand and enable people of all backgrounds and abilities
  - Example, early on for selecting race: it would be radio buttons, and didn't include South Asia

- Similar terms:
  - Universal design (more for tangible environments)
  - Accessible design (physical abilities)

Elements for variations

- Physical measure of static human dimensions
- Measures of dynamic actions
  - Reach, speed of finger presses
- Human perceptual abilities
  - Vision
  - Tactile perception
  - Audible cues and tones
- Culture, language, norms
- Environment of use
- Cognitive styles
- …

People vary physically by size and ability

Logitech MX 610 Laser Cordless Mouse

Universal Design Goal

- Make your application usable to as broad an audience as possible

hardware/software diversity

- Designers must also cope with both hardware and software differences
  - IPhone apps on Ipad
  - Microsoft applications on Mac

Browsers do not render all pages identically

Inclusive Design Goal

- Take a target market & maximize the product performance indicators' for that target market

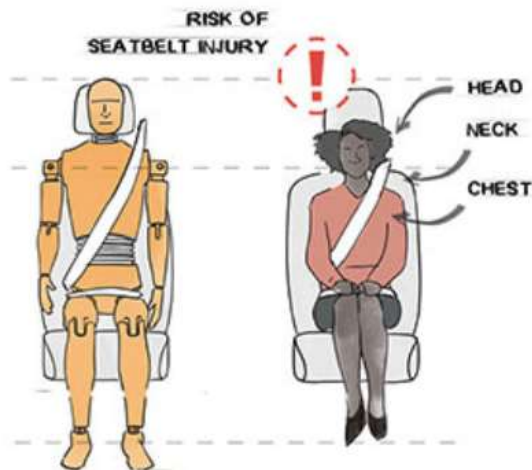- What are some of the inclusivity dimensions?

Here, we cover

- Gender
- Culture
- Age
- Physical ability
- Cognitive diversity
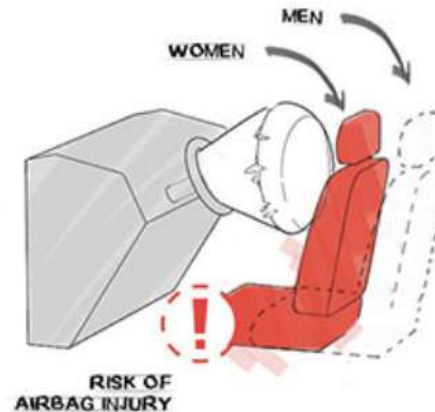
Gender differences ?

PASSENGER SEAT SCALE

RISK OF SEATBELT INJURY

HEAD
NECK
CHEST

CRASH DUMMY, BASED OFF OF 50th PERCENTILE MALE

FEMALE, REPRESENTING 50th PERCENTILE HEIGHT

DISTANCE FROM AIRBAG

MEN
WOMEN

RISK OF AIRBAG INJURY

SEATS DESIGNED FOR LARGER USERS REQIRE MANY WOMEN TO MOVE SEAT FAR FORWARD TO REACH PEDALS AND STEERING WHEEL
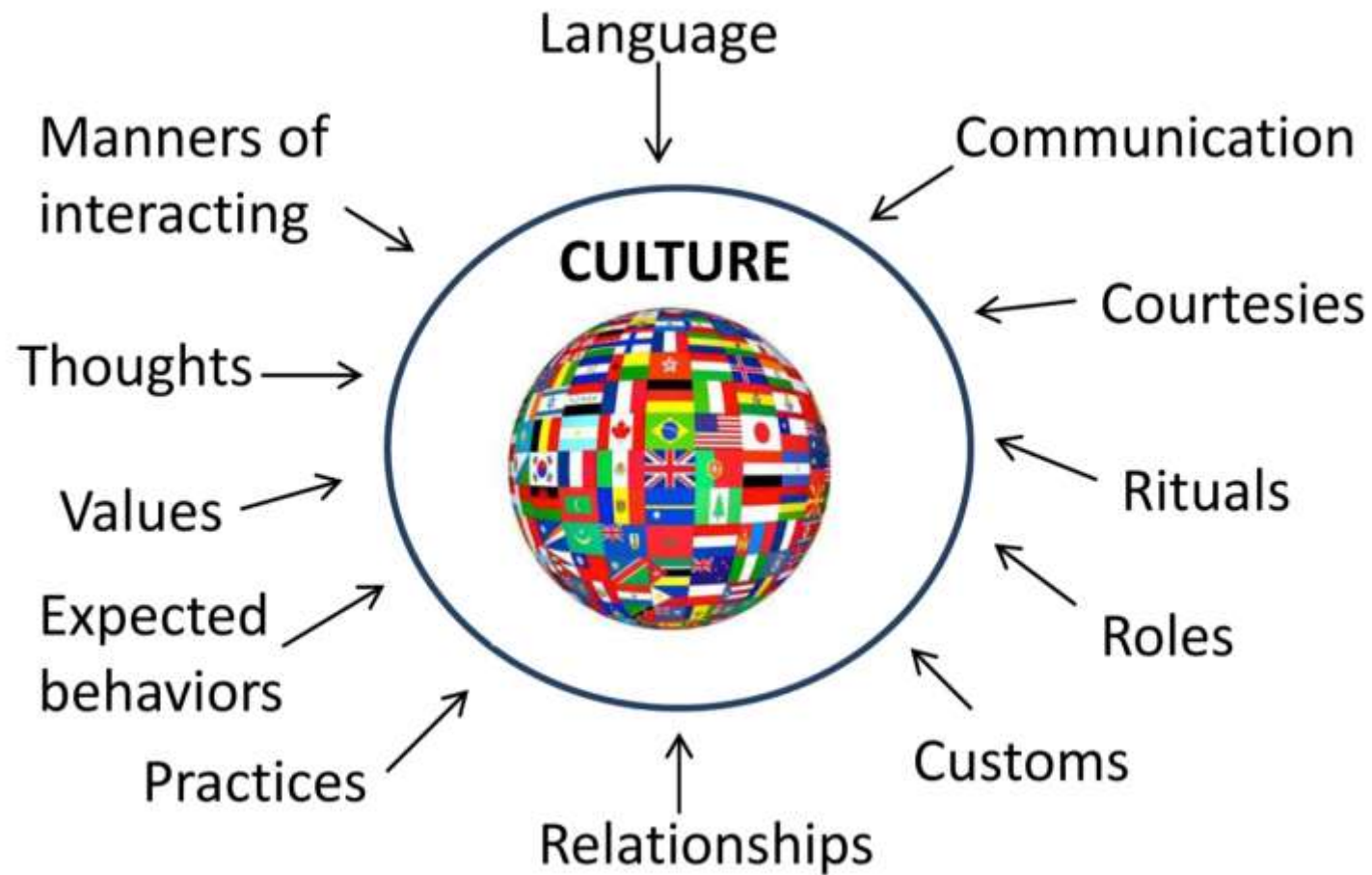
LACK OF ACCOMMODATION FOR PREGNANCY

DATA GAP

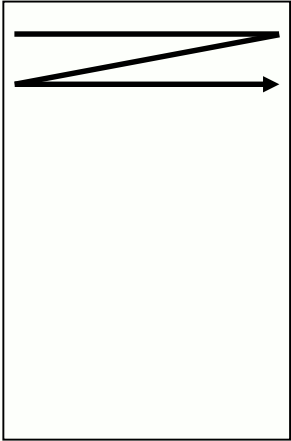62% OF WOMEN IN THIRD TRIMESTER OF PREGNANCY DON'T FIT STANDARD SEATBELT DESIGN

Illustration by Andrew Jernberg, Evoke

Culture

Upside down World Map

How will a user's eye scan the page?

English, French readers

Arabic, Hebrew readers
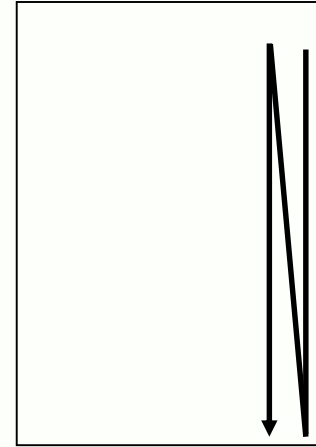
Chinese, Japanese readers
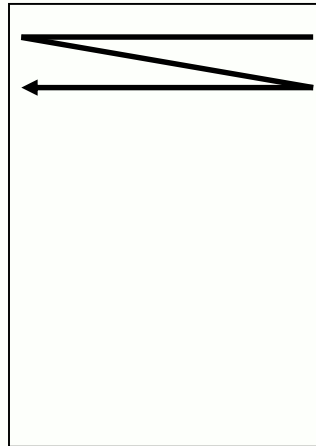
Algorithmic Photo Checkers

X The photo you want to upload does not meet our criteria because:
- Subject eyes are closed

Please refer to the technical requirements. You have 9 attempts left.

Check the photo requirements.

Read more about common photo problems and how to resolve them.

After your tenth attempt you will need to start again and re-enter the CAPTCHA security check.

Reference number: 20161206-81

Filename: Untitled.jpg

If you wish to contact us about the photo, you must provide us with the reference number given above.

Internationalization (i18n) issues

- Internationalization of UI, docs, …
- Date & time representation
  - 3/14/2013 vs. 14.3.2013
  - 2:32pm vs. 14:00
- Weights and measures
  - Pound vs. Kg
  - Miles vs. Km
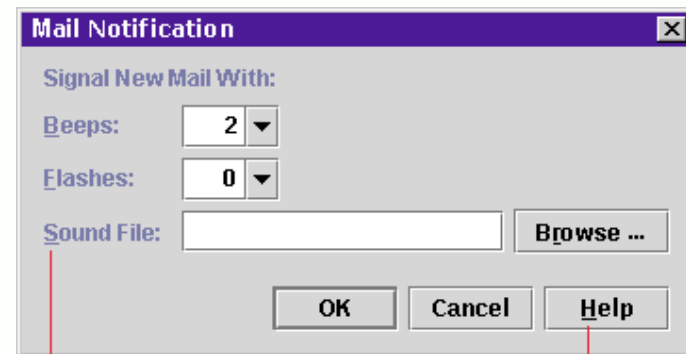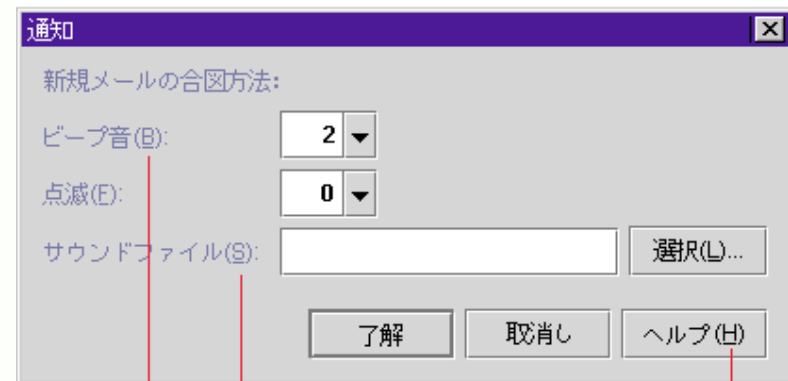
Many other internationalization (i18n) issues

- Currency (what's on your keyboard)
  - $, €, £
- Numbers conventions
  - $10.50   USA
  - 10,50 €   Most Europe
  - £10.50   UK
  - €10.50   Ireland
  - R$ 5.100,50 Brazil
  - INR 1,32,768.50   India
- …

Apple Researching Keyboards With Adaptive Displays on Each Key

Tuesday December 29, 2020 8:02 am PST by Hartley Charlton

Apple is researching keyboards with small displays on the keys to dynamically change the label on each key, according to a newly-granted patent filing.

What about names?

TAXSLAYER SUPPORT

Search for a question or a keyword...

What if my last name has a hyphen or dash in it?

When you e-file your return, the information has to be specifically formatted so that the IRS and state processing systems can properly handle your return when it is received. One of the conditions of this formatting is that the data cannot contain special characters, with the exception of a hyphen. Apostrophes or other special characters are not permitted.

When the IRS receives your information, they verify your SSN (Social Security Number) against the first 4 letters of your last name. To ensure that your return is accepted by the IRS, you may want to contact them (or the Social Security Administration) to see what they have on file for your last name. The IRS can be reached at 1-800-829-1040

Start for $0 today

Get your maximum refund with all the deductions and credits you deserve

GET STARTED

LOGIN

TaxSlayer's support page communicated Last Name field limitations, which were due to IRS formatting requirements.

Age

Age Inclusive Practices

Designing for children

Designing for children: Communication

- Simple terms, provide explanations
- Multiple media: text, images, video/ audio

DID YOU KNOW?

- A Venus day is the equivalent of 243 Earth days, although a year is roughly 225 Earth days.

- Venus rotates in the opposite direction—called retrograde rotation—of most planets.

- Venus has more volcanoes (more than 1,600) than any other planet in the solar system. Most lie dormant.

SPACE VIDEOS

OUTER THIS WORLD

weird but true! fast facts

Source: National Geographic Kids

Designing for children: Interactivity

- Allows kids to engage deeper, play around
  - Interaction/animation
  - Multiple senses: colorful graphics, music/sound effects, tactile feedback, but…
  - Keep controls easy to execute

Tap what you hear

| Tôi | hộ chiếu | giáo viên |

| tiếng | nói | anh ấy | | Anh | Minh |

Correct solution:
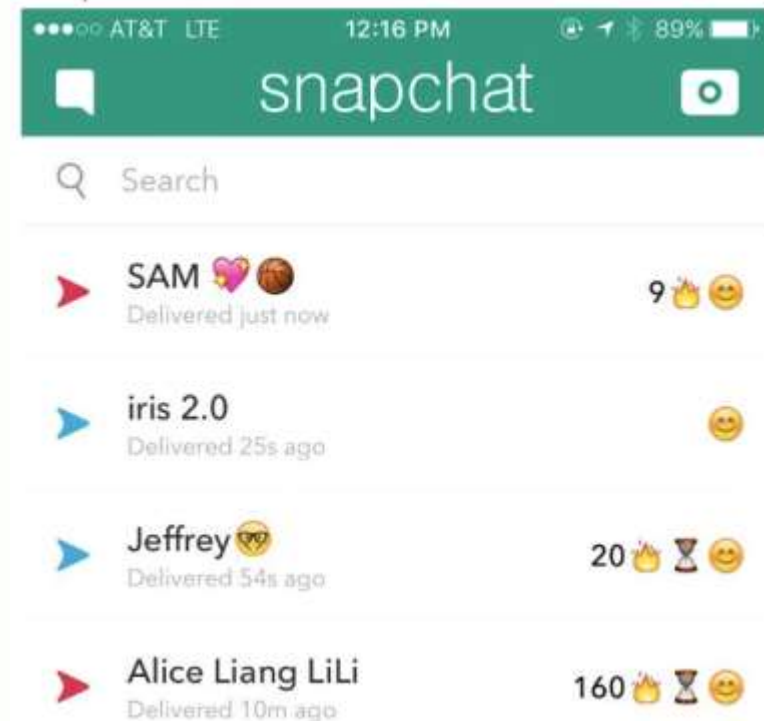Tôi nói tiếng Anh!

Meaning:
I speak English!

REPORT

CONTINUE

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Designing for children: Feedback

- Provide positive reinforcement: rewards, messages, sounds to engage/motivate them
  - Gamification, but…
- Allow self-exploration, but also provide instructions

Designing for children: Storytelling

- Narrative where they can face challenges that can lead to rewards to improves engagement
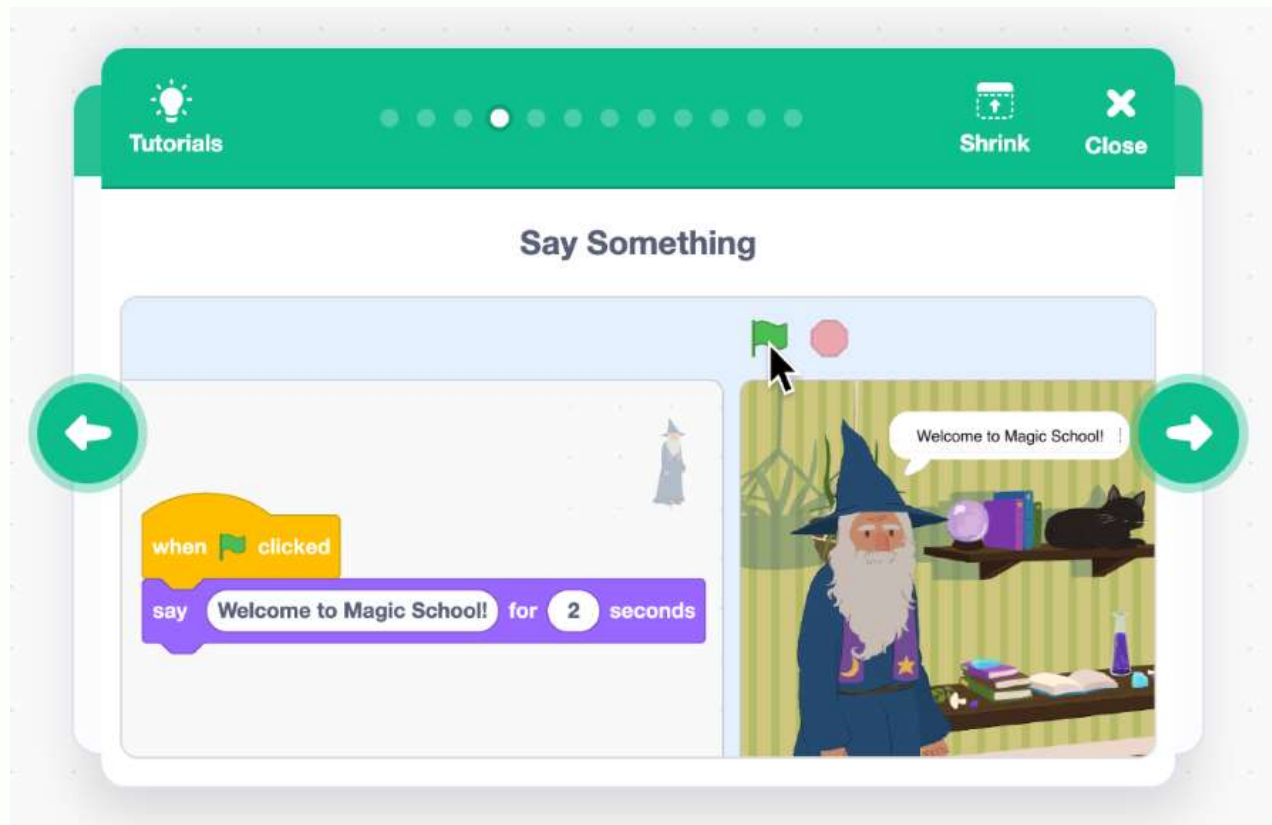
Seniors

When working on designs inclusive to older users, we need to be aware of the facts that **hearing, vision, memory, attention, and manual dexterity decline with age**. All of these factors affect how older users use and interact with our designs.

Designing for older adults: low vision

- Readability:
  - Font size : 16 px
  - Font type
  - Contrast
    - Use Contrast checker: https://webaim.org/resources/contrastchecker/

Foreground

Hex Value

121578

Color Picker

Alpha

1

Lightness

Background

Hex Value

970202

Color Picker

Contrast Ratio

11.08:1

permalink

Normal Text

WCAG AA: **Pass**
WCAG AAA: **Pass**

The five boxing wizards jump quickly.

Large Text

WCAG AA: **Pass**
WCAG AAA: **Pass**

The five boxing wizards jump quickly.

Graphical Objects and User Interface Components

WCAG AA: **Pass**

✔

Text Input

Normal Text

WCAG AA: **Fail**
WCAG AAA: **Fail**

Large Text

WCAG AA: **Fail**
WCAG AAA: **Fail**

Th

Graphical Objects and Us

WCAG AA: **Fail**

Text Input

Designing for older adults: Cognitive Load

- Simple navigation
  - Back button on every page
  - Wizards, audio input
  - Visuals in a navigation menu
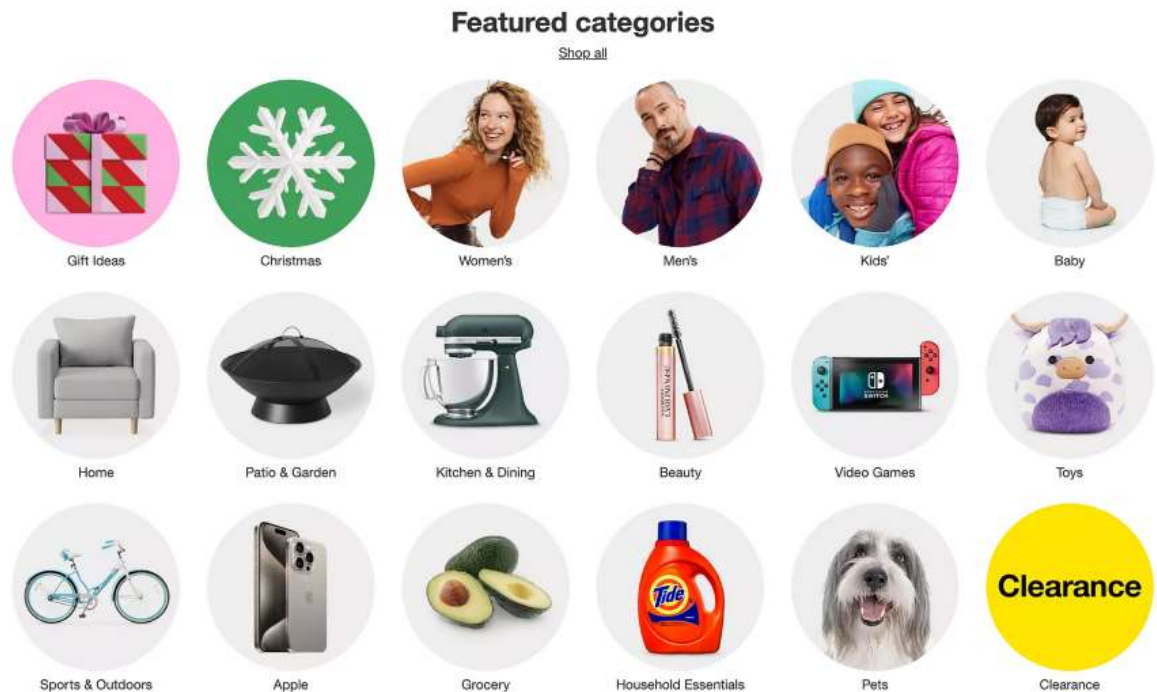
Featured categories
Shop all

Gift Ideas · Christmas · Women's · Men's · Kids' · Baby

Home · Patio & Garden · Kitchen & Dining · Beauty · Video Games · Toys

Sports & Outdoors · Apple · Grocery · Household Essentials · Pets · Clearance

Designing for older adults: Cognitive Load

- Simple navigation
  - Back button on every page
  - Wizards
  - Visuals in a navigation menu
- Progressive disclosure

**Frequently Asked Questions**

| Can I cancel my subscription at anytime? | + |

| Can I change my plan later on? | × |
| Absolutely! You can upgrade or downgrade your plan anytime. The money paid for the previous subscription will be recalculated to the new plan. | |

| Will you renew my subscription automatically? | + |

| Do you offer any discounts? | + |

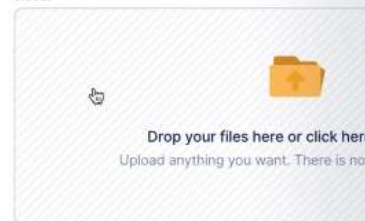| Can I request a refund? | + |

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Designing for older adults: Memory

- Easily recognizable icons, use (real world) metaphors
- Include colors (stronger memory connection)
- Assistance to remind to complete tasks
  - When success/fail
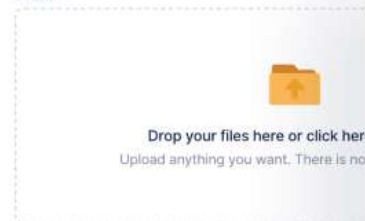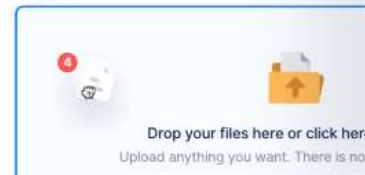
Designing for older adults: Additional Guidance

- Onboarding experience
  - Carousal slides explain features
  - Tooltip walkthroughs
- Easy access to help
  - FAQ
  - Documentation
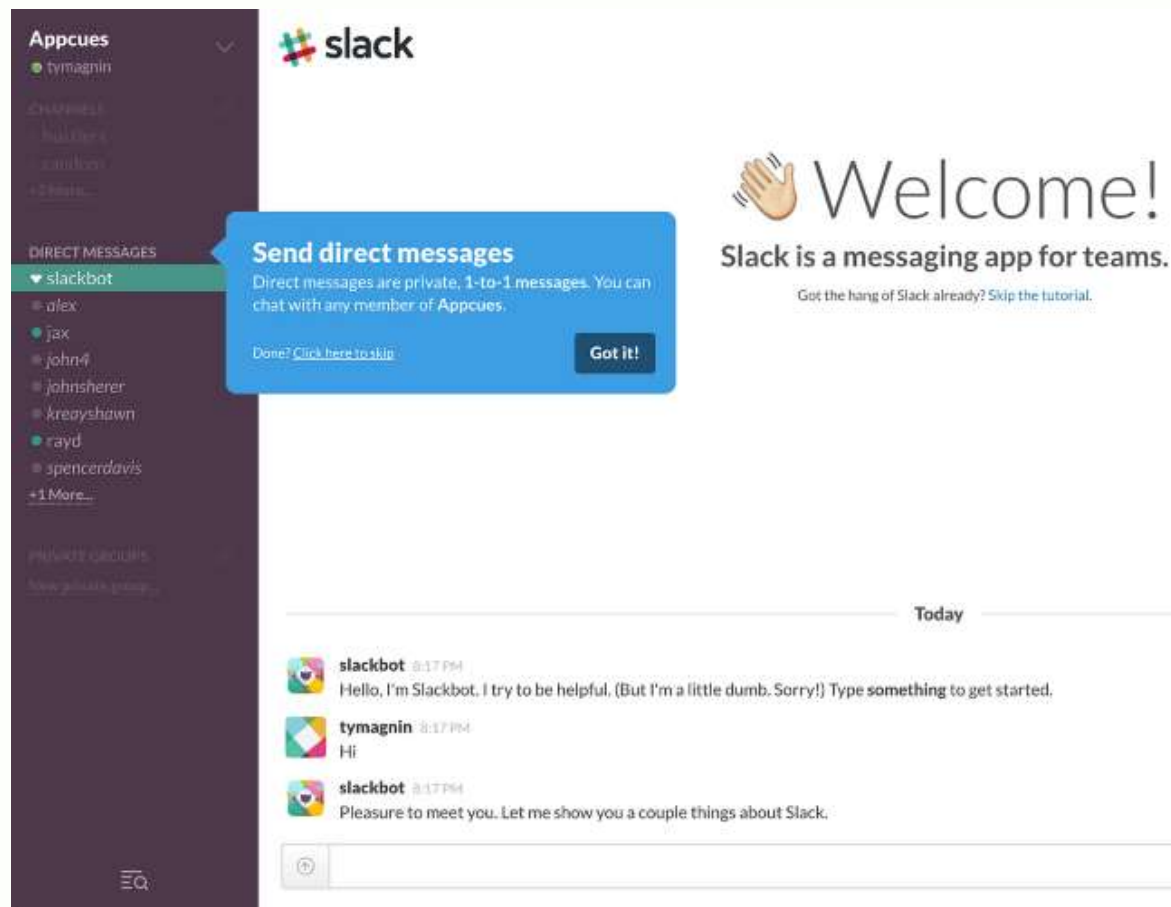
Other design guidelines for older adults

- Make software configurable
  - e.g. "Sticky" keys make it easier to hit multiple keys at once
- Provide large clickable areas
- Give them more time to complete tasks
- Don't force them to explore

Design for impaired human capabilities

Businesses must comply with the "Americans With Disabilities" Act for some applications

Introduction to assessing demand

An initial assessment can be made by rating the demand on each capability on a scale from Low to High. To do this, there are various factors that should be considered:

- For **Vision**, consider the size, shape, contrast, colour and placement of the graphical and text elements.

- For **Hearing**, consider the volume, pitch, clarity and location of sounds produced by the product.

- For **Thinking**, consider how much demand the product places on a user's memory, how much it helps the user to interpret its interface, how much attention it demands, and how much prior experience it assumes.

- For **Reach and Dexterity**, consider the forces, movements and types of grip required to use the product. The demands will increase if tasks have to be performed with the hands reached above the head or below the waist.

- For **Mobility**, consider whether the product requires the user to move around. If designing an environment or service, consider whether it provides suitable features to assist balance and support mobility aids.

More information about each of these factors can be found by following the links above.
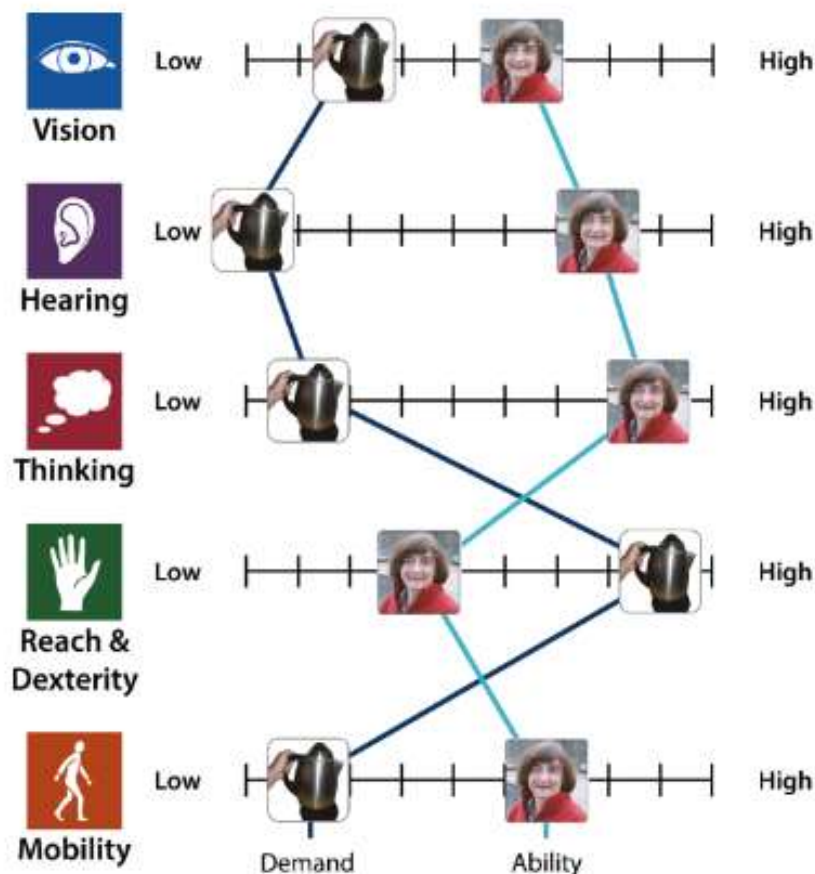
The level of demand that a product places on various capabilities can be assessed. This can be compared with the ability of the users in the target population. In this example, the product demand for reach and dexterity is higher than the ability of the example user.

Overall inclusive design principles

- Clarity
- Simplicity
  - Avoid pop ups/count down timers
- Avoid "dark patterns" (trick users)
  - Ads without clear cancellation take advantage of users
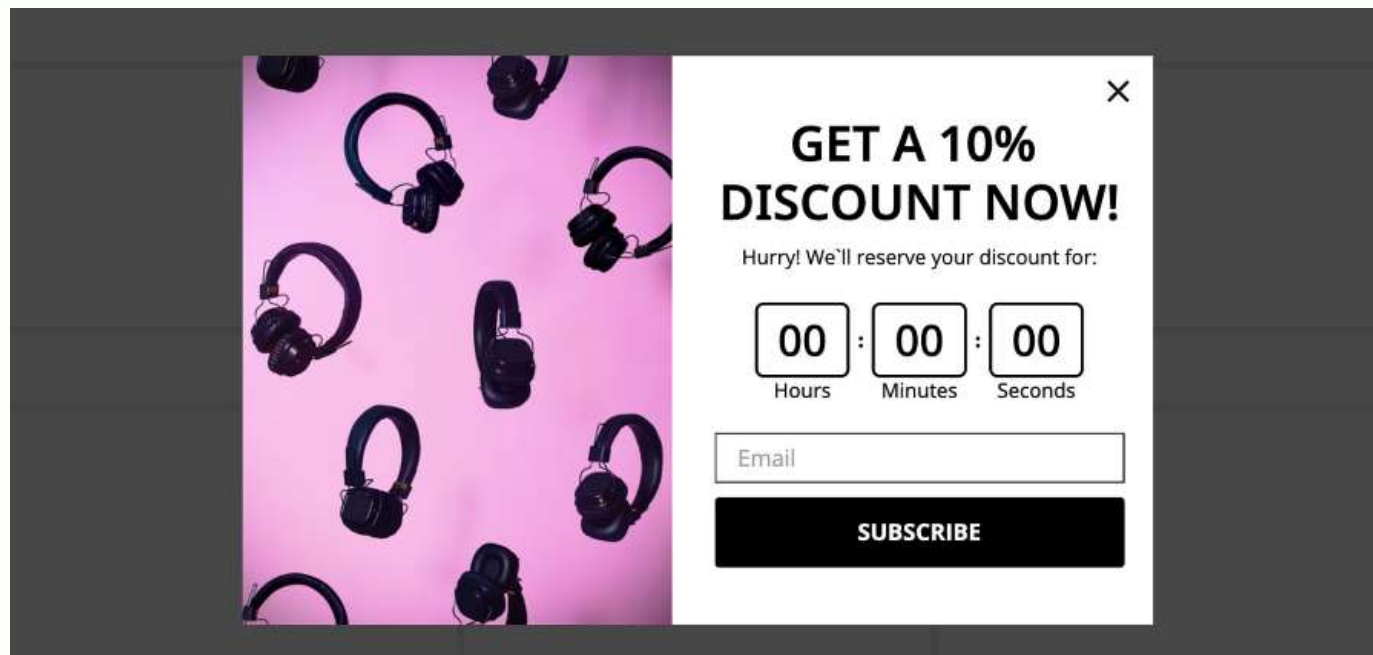
Overall inclusive design principles

- Clarity
- Simplicity
  - Avoid pop ups/count down timers/animation
- Avoid "dark patterns"
  - Ads without clear cancellation take advantage
- Readability
  - At least 16 px text
  - Serif over Sans Serif

Support customization
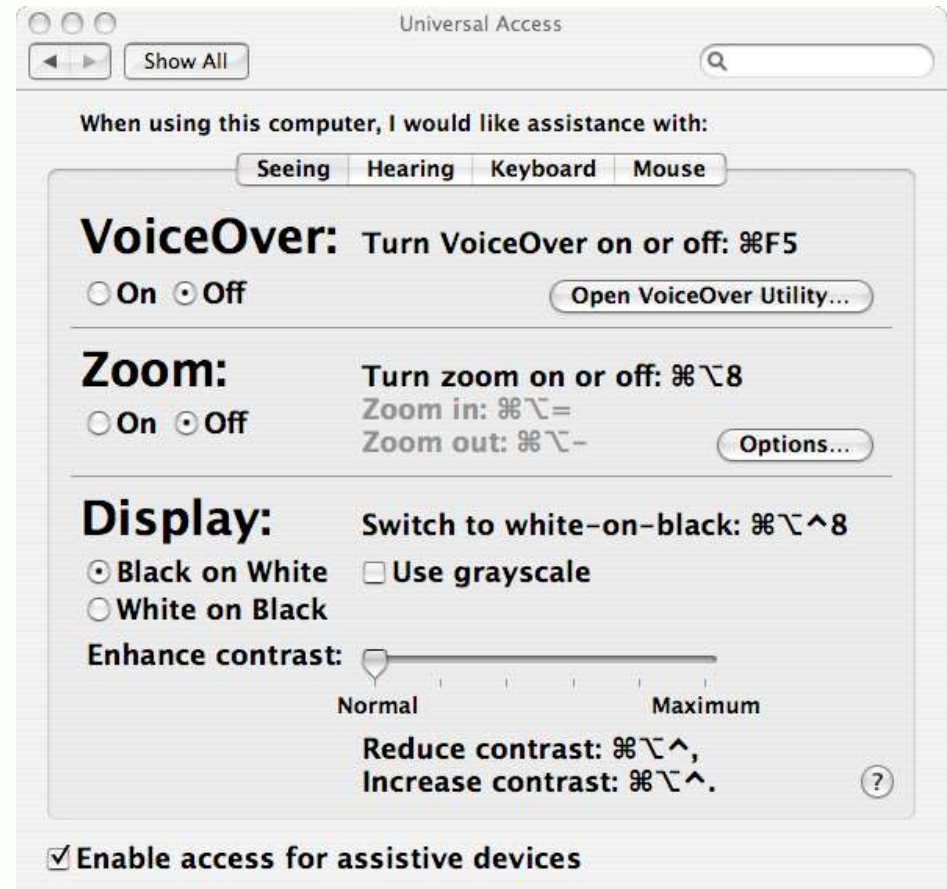
Apple

Inclusive Technology: cognitive styles

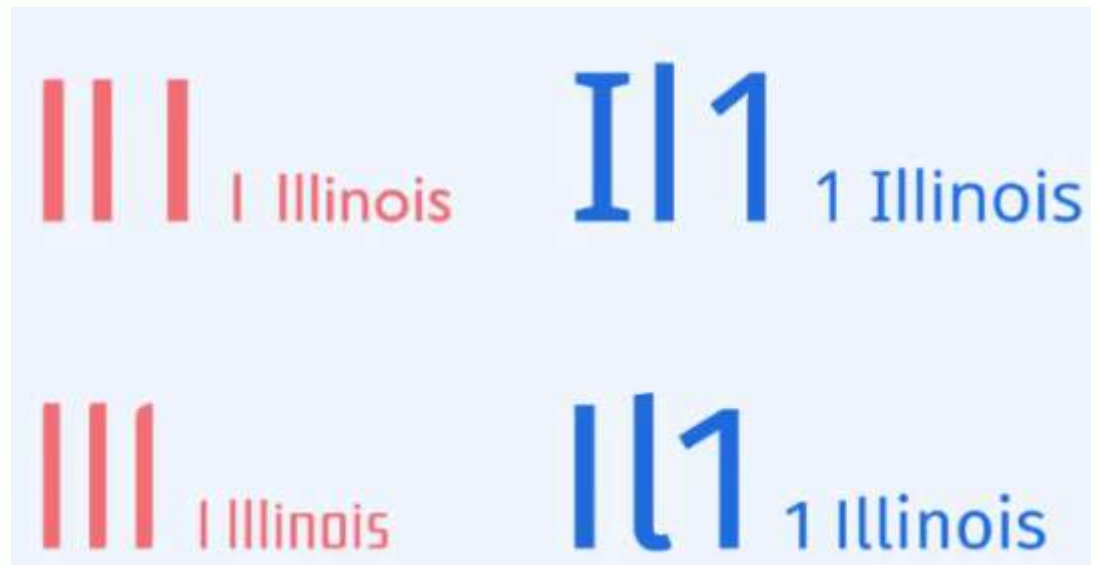## Cognitive Diversity, *i.e. variations in cognitive styles*

diverse ways users perceive, process, and interact with information & technology, as well as their approach to problem-solving

Attitudes towards risk	averse	tolerant
Computer self-efficacy	lower	higher
Motivations to use tech	task oriented	tech oriented
Information Processing Style	comprehensive	selective
Learning Style for tech	process	tinkering
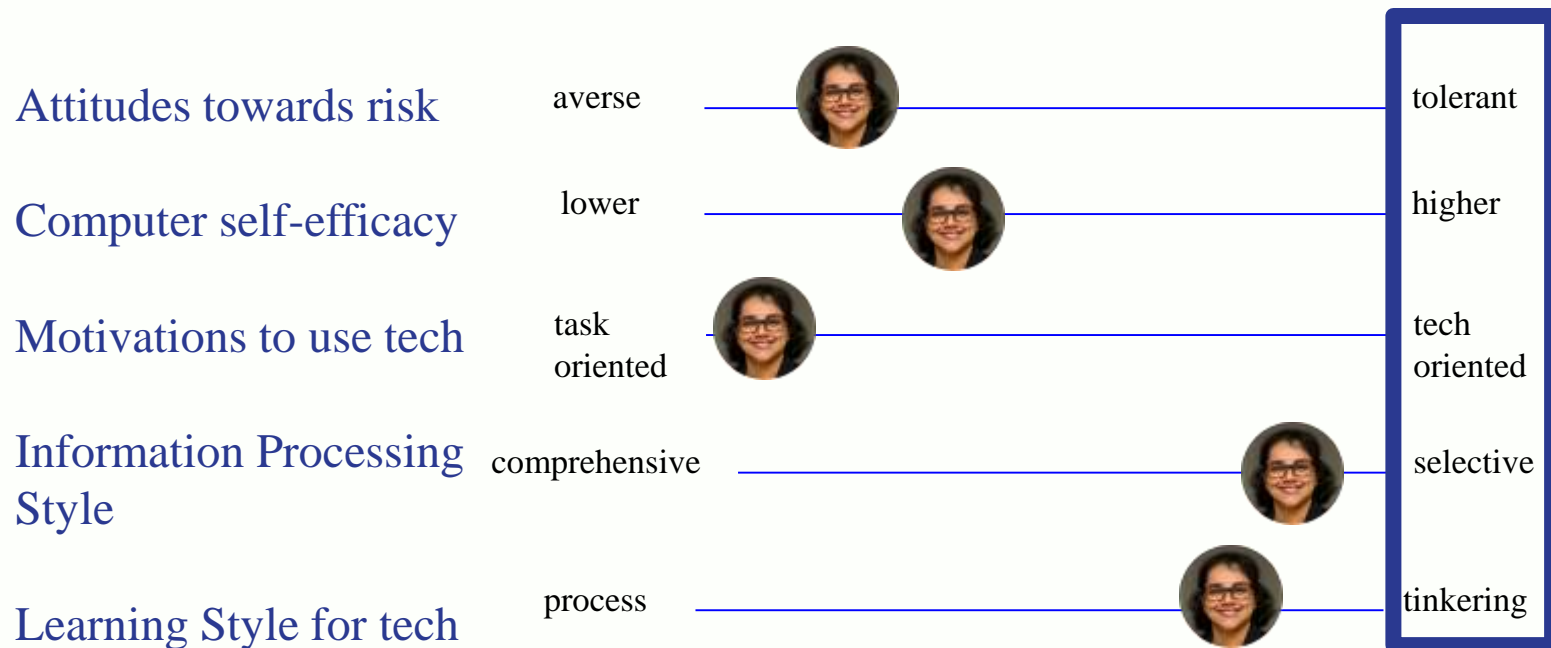
Burnett, M., Stumpf, S., Macbeth, J., Makri, S., Beckwith, L., Kwan, I., ... & Jernigan, W. (2016). GenderMag: A method for evaluating software's gender inclusiveness. *Interacting with computers*, *28*(6), 760-787.

Becomes a Gender Bias Problem
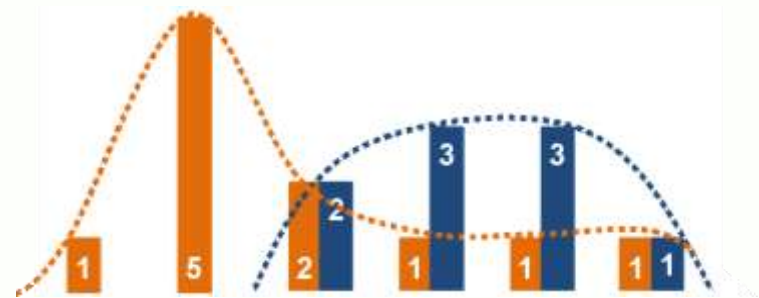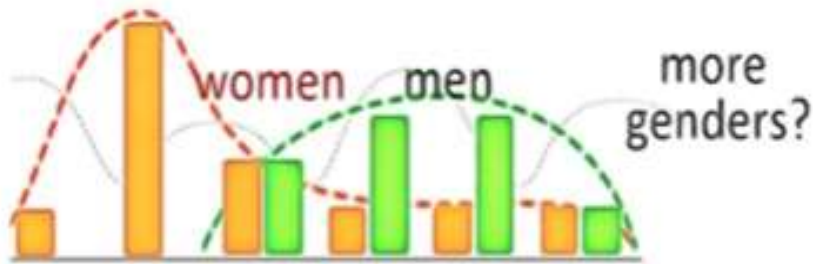
Individual differences in cognitive style values statistically cluster by gender;

Hence it becomes a Gender Bias problem

Cognitive Diversity + gender

diverse ways users perceive, process, and interact with information & technology, as well as their approach to problem-solving

Attitudes towards risk — averse ... tolerant

Computer self-efficacy — lower ... higher

Motivations to use tech — task oriented ... tech oriented

Information Processing Style — comprehensive ... selective
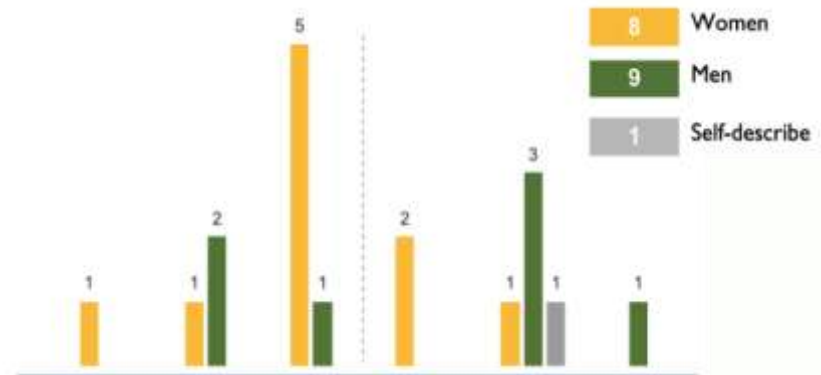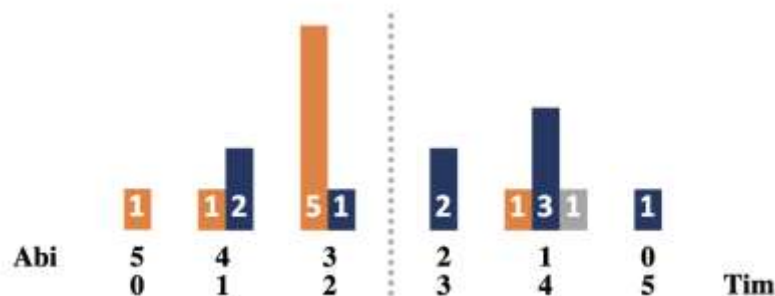
Learning Style for tech — process ... tinkering

Burnett, M., Stumpf, S., Macbeth, J., Makri, S., Beckwith, L., Kwan, I., ... & Jernigan, W. (2016). GenderMag: A method for evaluating software's gender inclusiveness. *Interacting with computers*, *28*(6), 760-787.

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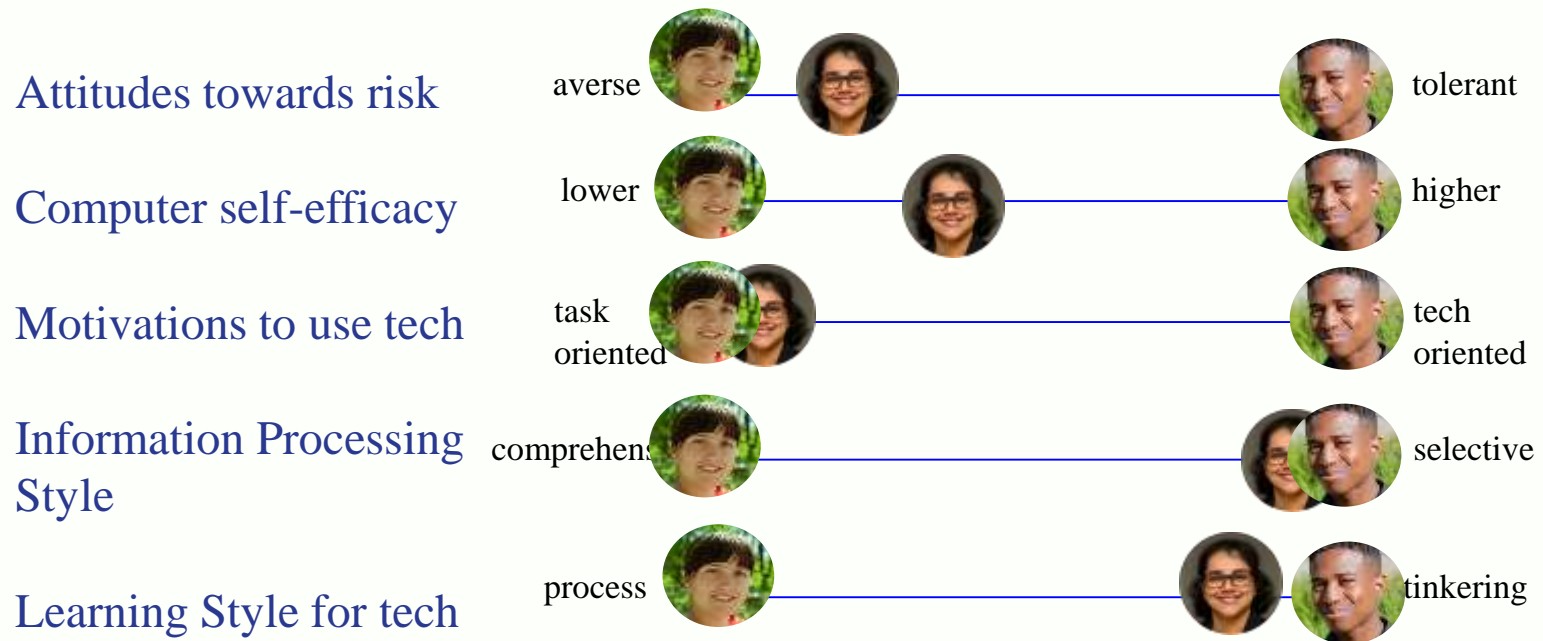
Gender differences in preferred cognitive styles

Abi (Abigail/Abishek)

Motivation: Uses technology to accomplish their tasks.

Computer Self-Efficacy: Lower self-confidence than their peers about doing unfamiliar computing tasks. Blames themselves for problems.

Attitude Toward Risk: Risk-averse about using unfamiliar technologies that might require a lot of time.

Information Processing Style: Comprehensive.

Learning by Process vs. Tinkering: Process-orientated learning.

Pat (Patricia/Patrick)

Motivation: Learns new technologies when they need to.

Computer Self-Efficacy: Medium confidence doing unfamiliar computing tasks. If a problem can't be fixed, they will keep trying.

Attitude Toward Risk: Risk-averse and doesn't want to expend time when they might not receive benefits.

Information Processing Style: Comprehensive.

Learning by Process vs. Tinkering: Likes to explore and purposefully tinker.

Tim (Timara/Timothy)

Motivation: Likes learning all the available functionality on all their devices

Computer Self-Efficacy: High confidence in technical abilities. If a problem can't be fixed, blame goes to software vendor.

Attitude Toward Risk: Doesn't mind taking risk using features of technology.

Information Processing Style: Selective information processing

Learning by Process vs. Tinkering: Likes tinkering and exploring.

Abi (Abigail/Abishek)

- 55 years old
- Employed as a Instructor
- Lives in Eugene, OR

Abi has always liked music. When she is on her way to work in the morning, she listens to music that spans a wide variety of styles. But when she arrives at work, she turns it off, and begins her day by *scanning all her emails first to get an overall picture before answering any of them.* (This extra pass takes time but seems worth it.) Some nights she exercises or stretches, and sometimes she likes to play computer puzzle games like Sudoku.

Background and Skills

Abi works as a part-time instructor. She is comfortable with the technologies she uses regularly, but she just moved to this employer 1 week ago, and the software systems are new to her.

Abi has never taught using Canvas before or have experience in flipped classroom She likes Math and knows how to think with numbers. She is confident making slides in power point and paper-based grading.

In her free time, she also enjoys working with numbers and logic. she especially likes working out puzzles and puzzle games, either on paper or on the computer.

Motivations and Attitudes

- ***Motivations***: Abi uses technologies to accomplish her tasks. She learns new technologies if and when she needs to, but prefers to use methods she is already familiar and comfortable with, to keep her focus on the tasks she cares about.

- ***Computer Self-Efficacy***. Abi has lower self confidence than her peers about doing unfamiliar computing tasks. If problems arise with her technology, she often blames herself for these problems. This affects whether and how she will persevere with a task if technology problems have arisen.

- ***Attitude toward Risk***. Abi's life is a little complicated and she rarely has spare time. So she is risk averse about using unfamiliar technologies that might need her to spend extra time on them, even if the new features might be relevant. She instead performs tasks using familiar features, because they're more predictable about what she will get from them and how much time they will take.

Attitude to Technology

- ***Information Processing Style***: Abi tends towards a comprehensive information processing style when she needs to gather more information. So, instead of acting upon the first option that seems promising, she gathers information comprehensively to try to form a complete understanding of the problem before trying to solve it. Thus, her style is "burst-y"; first she reads a lot, then she acts on it in a batch of activity.

- ***Learning: by Process vs. by Tinkering*** : When learning new technology, Abi leans toward process-oriented learning, e.g., tutorials, step-by-step processes, wizards, online how-to videos, etc. She doesn't particularly like learning by tinkering with software (i.e., just trying out new features or commands to see what they do), but when she does tinker, it has positive effects on her understanding of the software.

[1]Abi represents users with motivations/attitudes and information/learning styles similar to hers. For data on people similar to and different from Abi, see

http://gendermag.org/Foundations.html

Cognitive Diversity + Socio Economic Status

diverse ways users perceive, process, and interact with information & technology, as well as their approach to problem-solving

Access to reliable tech	Less/shared	abundant
Technology self-efficacy	lower	higher
Attitude to tech risks, privacy &security	Less tolerance	high tolerance
Communication: Literacy, education, culture	less aligned	more aligned
Perceived Contril & Authortiy	Less control, more deferential	more control, less deferential

Cognitive Diversity + Socio Economic Status

diverse ways users perceive, process, and interact with information & technology, as well as their approach to problem-solving

Access to reliable tech — Less/shared ———————————— abundant

Technology self-efficacy — lower ———————————— higher

Attitude to tech risks, privacy &security — Less tolerance ———————————— high tolerance

Communication: Literacy, education, culture — less aligned ———————————— more aligned

Perceived Contril & Authortiy — Less control, more deferential ———————————— more control, less deferential

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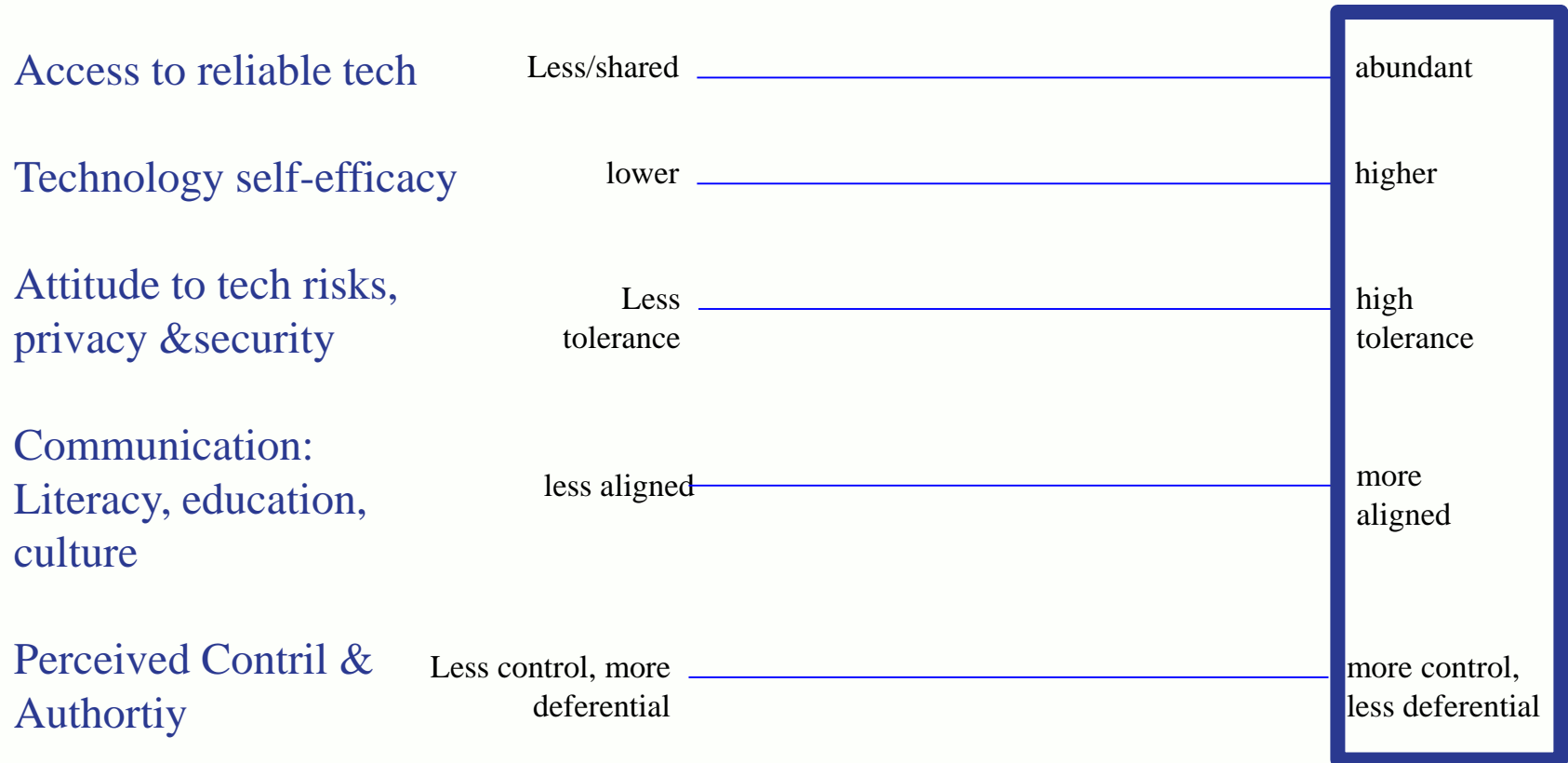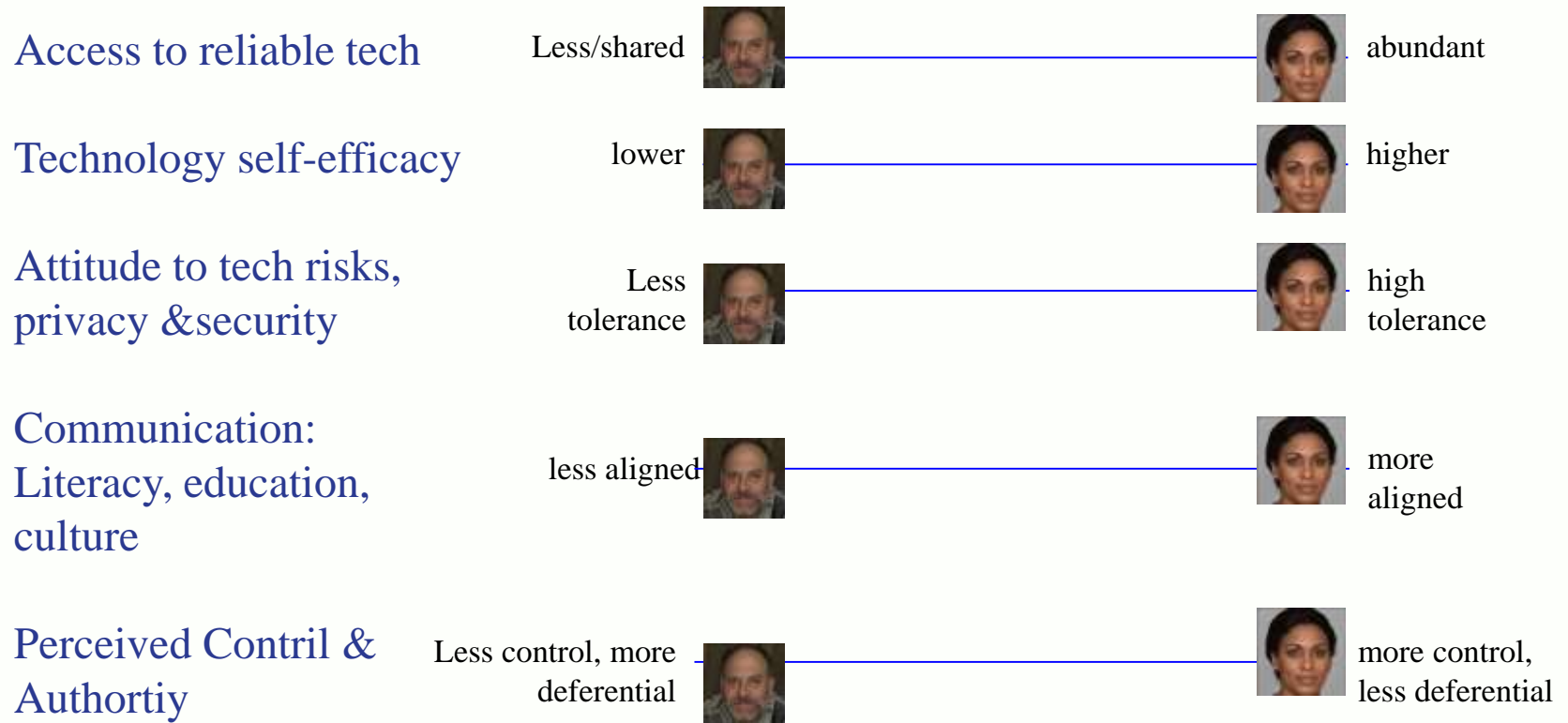
Dav (David, Davu, Davida)

Introduction

Dav is is 50 years old works as a cleaner in London.

Background/interests:

She grew up in a housing estate Hull and had to leave school early to care for her sick parents, who had immigrated from Bangladesh in the 80's.

She then became a single parent herself at age 19 and never returned to education or training. She moved to London to find work and stayed, even though she was far from her family and community. Dav works long hours, and she lives an hour and a half bus ride from where she works but she enjoys reading books that she borrows from the local library during the commute. Dav relaxes by cooking and baking and gardening in her community allotment.

Access to Reliable Technology: Dav has spotty access to reliable devices with reliable internet access, so relies mainly on a mobile phone for internet access. Dav also often uses shared devices or public devices to get work done. This affects how, when, and why Dav uses technology.

Communication Literacy/Education/Culture: Dav went to school in a low-SES community which offered only a basic education. Now Dav rarely chooses to read lengthy or complex text (e.g., newspapers), and some cultural/literary allusions are unfamiliar to Dav. Although the school had a few older computers, it offered little technology education.

Attitudes toward Technology Risks: Dav's life is crowded, so they rarely have spare time. So Dav is risk-averse about using unfamiliar technologies that they might need to spend extra time on, even if the new features might be relevant. Dav instead performs tasks using familiar features, because they're more predictable about what Dav will get from them and how much time they will take.

Technology Privacy and Security: Dav is very protective of their personal information, like their location and identity. Dav's caution stems from their privacy/security being particularly at risk because of having to share devices, prior negative experiences with high surveillance, prior experiences with credit card/identity theft, etc.

Perceived Control and Attitude toward Authority: Dav does not expect to have much influence over technology's outcomes. Instead, Dav views technology as if it represents an authority figure, so expects technology to treat Dav as other authority figures do.

Technology Self-Efficacy: Dav's prior experiences and education have produced a lower technology self-efficacy than their peers about using unfamiliar technology features. If problems arise with technology, Dav often blames themselves for these problems. This affects whether and how they will persevere with a task.

Activity

Design keyboard

Take 5 minutes to design your vision of an ideal keyboard

https://www.tiktok.com/@duckeycaps/video/7331422168388996395?lang=en

Your keyboard design

Apple Researching Keyboards With Adaptive Displays on Each Key

Tuesday December 29, 2020 8:02 am PST by Hartley Charlton

Apple is researching keyboards with small displays on the keys to dynamically change the label on each key, according to a newly-granted patent filing.

https://www.macrumors.com/2020/12/29/apple-researching-keyboards-with-displays-on-keys/