

# Human Factors Public Working Group Update

Sharon Laskowski, NIST  
[sharon.laskowski@nist.gov](mailto:sharon.laskowski@nist.gov)

# Status

- Human Factors (HF) PWG Biweekly telecons since May 2016
- Completed
  - VVSG 1.1 HF gap analysis
  - Skeleton of HF core requirements using gap analysis
  - Draft core requirements for HF Principle 3, Guideline 3.1
- Drafts
  - 5 white papers on key issues
  - 2 more in progress
  - Received comments on Remote Ballot Marking guidance

# HF Definitions

- Principles: High level system design goals
- Guidelines: Broad system design details for election officials
- Requirements: Technical details for design and development
  
- **Core Requirements** apply to any interactive system or election function
  
- **Technology** or **System-specific Requirements** are extensions that apply to specific election systems or types of devices
  
- **Universal Design** is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design

# State of the Art



# Determinations for VVSG 2.0

- Initial focus on core requirements for electronic systems in the polling place
- All electronic systems must meet the accessibility requirements
- Universal design addressing large range of voters balanced with minimizing voter interface complexity
- Accessible process for voter-verifiable paper records
- No attempt to write design requirements for paper ballots layouts

# White Papers

- Text size
- Contrast
- Ballot navigation from the review screen
- Scrolling
- Assistive technology (AT) in the polling place
- Interaction Design Studio: select/deselect (in progress)
- Voter verifiable paper records & accessibility (in progress)

# Text Size

Small

Medium

Large

# Text Size

- Challenges:
  - Make it easier for voters to see the ballot
  - Ensuring size is not so large that it forces distortions in the ballot layout
- Recommendations:
  - At least 3 text sizes for primary information, if continuous zoom is not possible, with secondary information no more than 2 points smaller
    - 14-16 points (4.9 - 5.6mm)
    - 18-20 points (6.3 - 7.1mm)
    - 24-26 points (8.5 - 9.0mm)
  - Require san serif font



# Contrast

- Challenges:
  - Current VVSG 1.1. minimum contrast ratio of 10:1 is good universal design, but
  - Some voters need lower contrast, including people with dyslexia, people with some low vision conditions, or those who are sensitive to bright colors like light backgrounds
- Recommendations:
  - Three other options
    - High contrast on a white background
    - High contrast on a black background
    - A low contrast option

# Contrast

## Contrasts for text on white and grey-scale backgrounds

<b>3:1 Contrast</b>	<b>4.5:1 Contrast</b>	<b>7:1 Contrast</b>	<b>10:1 Contrast</b>	<b>15:1 Contrast</b>	<b>20:1 Contrast</b>	<b>21:1 Contrast</b>
3:1 Contrast	4.5:1 Contrast	7:1 Contrast	10:1 Contrast	15:1 Contrast	20:1 Contrast	21:1 Contrast

## High contrast black on white background colors

Text color <b>#060606</b> 20.26:1	Text color <b>#030303</b> 20.62:1	Text color <b>#010101</b> 20.87:1	Text color <b>#000000</b> 21:1
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## High contrast text colors on a black background

<b>#FFFF00</b> 19.55:1	<b>#FFFF99</b> 20.01:1	<b>#00FFFF</b> 16.7:1	<b>#64FFD</b> 17.26:1	<b>#FAFAFA</b> 20.1:1	<b>#FFFFFF</b> 21:1
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## Low contrast combinations

<b>#888888 on #222222</b> 4.48:1	<b>#6C6C6C on White</b> 5.25:1	<b>#97967E on Black</b> 6.97:1	<b>#BB99CC on White</b> 7.86:1	<b>Black on #BB9966</b> 7.86:1
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# Ballot Navigation

## Anywhere Ballot example

Contest navigation:



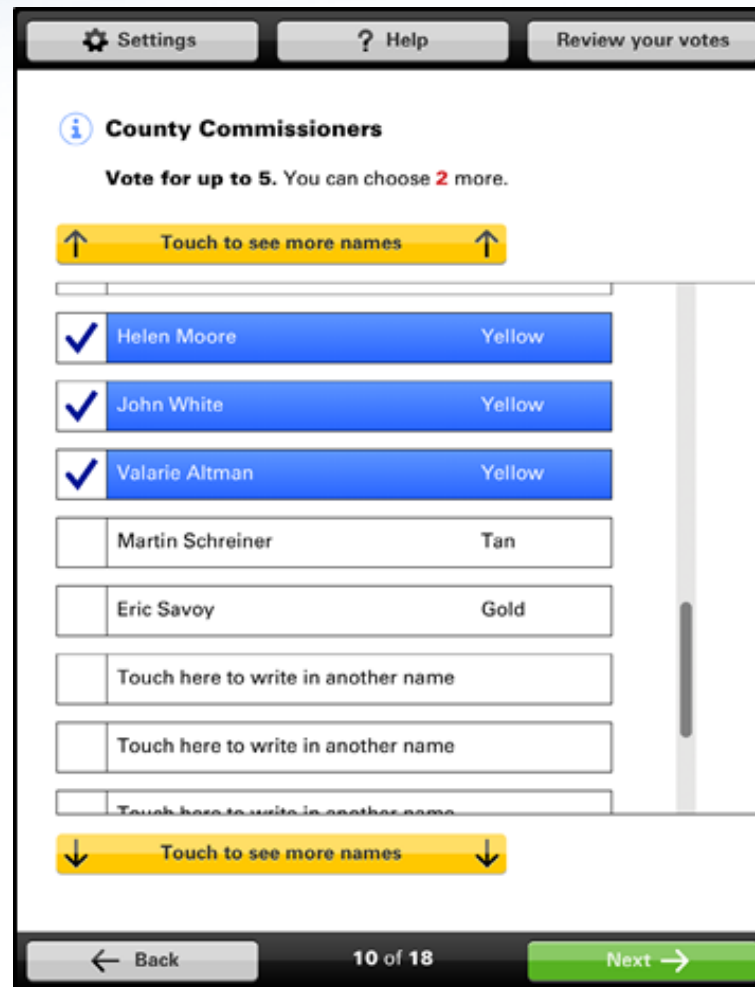
After change from review screen:



# Ballot Navigation from the Review Screen

- Challenges:
  - No VVSG 1.1 requirement
  - Interaction from the review screen is confusing to many voters
- Recommendations
  - Best practice is an “out and back” pattern from the review screen to a contest and back
  - Should work better for low-propensity voters, voters with low-literacy or low digital skills, and for audio ballot or larger text/magnification

# Scrolling: Anywhere Ballot Example



# Scrolling

- Challenges:
  - Contests often don't fit on a single screen
  - VVSG 1.1 says scrolling can't be the only option
  - No common convention for scrolling and can even confuse experienced computer users
- Recommendations:
  - Contest on a single page, with navigation within that page if the page spans several "screens"
  - Strong cues, including cues that the area scrolls
  - Navigation has directly perceivable controls and does not rely on scroll bars

# Assistive Technology (AT) in the Polling Place

- Challenges:
  - How might new and emerging assistive technologies, be used in the polling place?
  - Focusing on products or services likely to be widely available within the next 5-10 years
- Paper explores use of AT for voters:
  - Finding their way from the polling place from street to entrance
  - Navigating within the polling place
  - Identifying themselves at the registration desk
  - Receiving a ballot or authorization to vote
  - Marking, verifying and casting their ballot
- Recommendations:
  - Continue exploration of how AT products and research can be deployed to help voters in the polling place

# Interaction Design Studio

- Interaction Design Studio held 12/19 in Boston with Center for Civic Design and 16 top UX designers
- Focus: To generate several options for designs for how voters explicitly select and deselect choices in a digital ballot
- Paper in progress



# Selection-Deselection Logic

- Basic principle: Voting systems make no selections or changes to selections except under the direct control of the voter
- Challenges:
  - In a vote-for-one contest, the voter's choice can simply be changed to the most recent selection.
  - In a vote-for-n contest, which selected candidate should be de-selected?
  - Voters may not catch changes on a review screen
  - Long contests/small screens

# Design Studio to Explore Ideas

- Selection and de-selection interactions
- Alternatives to scrolling or paging
- Use of interface motion and audio to support understanding
- Avoiding modal error messages



# Voter Verifiable Paper Records & Accessibility

- Challenges:
  - Accessible voting system is now typically an electronic ballot marker
  - Paper record is the optical scan ballot or some other type of list of voter selections
  - Verification and handling of the paper record are not accessible

# Voter Verifiable Paper Records & Accessibility

- Recommendations (in progress):
  - VVSG 1.1 says that the voting system
    - shall allow the voter to verify that record using the same access features used by the voter to vote the ballot
    - shall provide features that enable voters who lack fine motor control or the use of their hands to submit their ballots privately and independently without manually handling the ballot
  - This is possible with currently available technology, e.g., OCR, QR codes, automatic depositing of the ballot into the ballot box

# Paper and Accessibility Issues

- If the voting system accommodates the accessibility of the paper record,
  - Other VVSG 1.1 requirements about paper can be removed, e.g., paper ballot font sizes, magnifiers for the paper ballot, etc.
- However, it is critical that
  - There are enough accessible voting stations in the polling place
  - They are easy to set up and use
  - Voters are encouraged to use them

# Issues: Accommodating More Voters with Disabilities

- Universal design broadens the range of voters who can vote independently
- But, there are other voters with disabilities who need their personal assistive technology and find it difficult to get to the polling places
- Accessible remote ballot marking can address this population
- Remote ballot marking guidance paper is being updated to include comments from the cybersecurity working group

# HF Core Requirements Skeleton

- Skeleton completed
  - Requirement identifier
  - Accessibility legal requirements noted: ADA, VRA, WCAG&508, HAVA
  - Abbreviated requirement
  - VVSG 1.1 references
  - Updates/considerations based on gap analysis
- Can pull out legal requirements in a separate document
- Possible technology specific requirements noted
- Principle 3/Guideline 3.1 abbreviated, draft requirements handout



# What's next for HF?

- Draft of VVSG 2.0 HF requirements
- Resolve a few open issues, e.g.,
  - Work with Access Board to update ADA kiosk wheelchair reachability
  - Update screen hardware requirements
  - Continue to work with HF Working Group
    - Open issues
    - Collaborations with other WGs as needed
    - Next topic is revising guidance for usability (user) test reports to help vendors and test labs
- Develop technology specific requirements



# Acknowledgments

Thank you to the HF PWG participants and the Center for Civic Design for all the expertise they have shared.

We look forward to their continued input in the coming months.