Human Factors and Privacy: Progress Report

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Overview

- Review of HFP Changes from the Previous VVSG Draft
- Summary of significant changes from VVSG 2005
- Usability benchmark progress report

There are 13 significant changes since the March Plenary.

- **Privacy emphasized**
  - Section title includes “privacy”: “Usability, Accessibility, and Privacy Requirements”
  - Privacy section moved up to **3.2.3**

- **Removed human assistance performance**
  - Dropped “**3.2.1.1-D** Ability to Vote without Human Assistance” from Performance Requirements
  - Captured as part of usability testing

Vendor Test Reporting split into conducting the test and documenting the results.

Example:

3.2.1.2-A Usability Testing by Vendor for General Population

The vendor shall conduct summative usability tests on the voting system using individuals representative of the general population. See requirement IV.2.6.2-A XREF for associated reporting requirement.

Volume IV: The vendor shall document all the usability testing performed as required in Section 3 and report the test results using the Common Industry Format.

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21-22 May 2007 Plenary Meeting

Added cast ballot notification. Proposed new wording:

3.2.2-D.1 Notification of Successful Ballot Casting

If (and only if) the ballot is cast successfully, the system shall so notify the voter.

DISCUSSION The purpose of this requirement is to provide feedback to the voter to assure him or her that the voting session has been completed. A precipitous confirmation of successful casting that is contradicted by an error that occurs around the same time would be misleading and non-compliant behavior.

3.2.2-D.2 Notification of Ballot Casting Failure (DRE)

If the ballot is not cast successfully, including storage of the ballot image, a DRE shall**L** so notify the voter and provide clear instruction as to the steps the voter should take to cast his or her ballot.

DISCUSSION If a DRE fails at the point of casting a ballot, it must clearly indicate to the voter and to election officials responding to the failure whether or not the ballot was cast. Otherwise, election officials may be unable to provide substantial confirmation that the vote was or was not counted, possibly resulting in disenfranchisement or the casting of two ballots by a single voter. A device that is observed to "freeze" when the voter attempts to cast the ballot, providing no evidence one way or the other whether the ballot was cast, is assessed a disenfranchisement failure (see Xref: Manageable failures per election), the most serious type of failure.

3.2.2-D-3 Notification of Ballot Casting Failure (PCOS)

If the ballot is not cast successfully, including reading of the ballot and transport of the ballot into the ballot box, a PCOS shall so notify the voter.

Scope of ballot broadened to include other visible records.

3.2.3.1-A.1 Visual Privacy

The ballot, **any other visible record containing ballot information**, and any input controls shall be visible only to the voter during the voting session and ballot submission.

3.2.7-A General Support for Alternative Languages

The voting system shall be capable of presenting the ballot, ballot selections, review screens, **vote verification records**, and voting instructions in any language declared by the vendor to be supported by the system.

3.3.3-E Ballot Submission and Vote Verification

If the voting station supports ballot submission **or vote verification** for non-blind voters, then it shall also provide features that enable voters who are blind to perform these actions.

3.3.4-C Ballot Submission and Vote Verification

If the voting station supports ballot submission **or vote verification** for non-disabled voters, then it shall also provide features that enable voters who lack fine motor control or the use of their hands to perform these actions.

Instruction completeness clarified.

3.2.3-A Completeness of Instructions

The voting station shall provide instructions for all its valid operations.

- rather than “system” – implying that the instructions can’t simply be posted on the wall.

Moved VVPAT requirement to VVPAT section

3.2.4-H Visual Access to VVPAT Visual Access to VVPAT
When the voting system asks a voter to compare two distinct records of his/her vote (as in VVPAT systems), both records shall be positioned so as to be easily viewable and legible from the same posture.

Moved to:

6.3.4-B Ease of record comparison
The format and presentation of the paper and electronic summaries of ballot selections shall be designed to facilitate the voter's rapid and accurate comparison.

Visual scope now includes poll workers.

3.2.5-D Minimum Font Size

All voting systems shall provide a minimum font size of 3.0mm (measured as the height of a capital letter) for all text intended for voters **or poll workers**.

3.2.5-H Contrast Ratio

The minimum figure-to-ground ambient contrast ratio for all text and informational graphics (including icons) intended for voters **or poll workers** shall be 3:1.

Accidental activation discussion clarified.

3.2.6-C Accidental Activation

Input mechanisms shall be designed to minimize accidental activation.

DISCUSSION: There are at least two kinds of accidental activation. One is when a control is activated as it is being "explored" by the voter because the control is overly sensitive to the touch. A second issue is the problem of having a control in a location where it can easily be activated unintentionally. An example would be a button in the very bottom left corner of the screen where a voter might hold the unit for support.

Rewrite of Accessibility Subsection intro emphasizes that Usability Subsection applies as well.

- This subsection 3.3 - Accessibility Requirements covers *only those features that are unique to the Acc-VS.* For instance, an audio interface would be of interest mainly to those with vision or other reading disabilities, but not to those who can use a visual interface. The preceding subsection 3.2 – General Usability Requirements covers the features that are applicable to systems for **both** the general population and voters with disabilities. Those requirements apply to all voting systems, including the Acc-VS. Therefore, to determine what features are required of the Acc-VS, one must examine both subsections 3.2 and 3.3.

End-to-end accessibility requirement clarified.

3.3.1-A Accessibility throughout the Voting Session

The Acc-VS shall be integrated into the vendor's **complete voting system** so as to support accessibility for disabled voters throughout the voting session.

3.1.3-A.1 Documentation of Accessibility Procedures

The vendor shall supply documentation describing 1) recommended procedures that fully implement accessibility for voters with disabilities and 2) how the Acc-VS supports those procedures.

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Proposed new wording for low vision; applies to all systems using paper; currently a "should"

3.2.5-G Legibility of Paper Ballots and Verification Records
All voting systems using paper ballots or paper verification records shall provide features that assist in the reading of such ballots and records by voters with low vision.

DISCUSSION While this requirement may be satisfied by one of its sub-requirements, other innovative solutions are not precluded.

3**.2.5-G.1** Legibility via Font Size
The system may achieve legibility of paper records by supporting the printing of those records in at least two font sizes, 3.0 - 4.0mm and 6.3 - 9.0mm.

DISCUSSION Although the system may be capable of printing in several font sizes, the use of various font sizes in an actual election may be governed by local or state laws and regulations.

3.2.5-G.2 Legibility via Magnification
The system may achieve legibility of paper records by supporting magnification of those records. This magnification may be done by optical or electronic devices. The vendor may either:
-- provide the magnifier itself as part of the system, or
-- provide the make and model number of readily available magnifiers that are compatible with the system.

DISCUSSION The magnifier(s) either provided or cited must, of course, provide legibility for the paper as actually presented on the system. For instance, if the paper record is under a transparent cover to prevent the voter from touching it, the means of magnification must be compatible with this configuration.

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The accessibility for voter verification req. has been reworded to clarify its scope.

3.3.1-E Accessibility of Paper-based Vote Verification

If the Acc-VS generates a paper record (or some other durable, human-readable record) for the purpose of allowing voters to verify their ballot choices, then the system shall provide a means to ensure that the verification record is accessible to all voters with disabilities, as identified in section 3.3.

Discussion: ……Verification is part of the voting process, and all the other general requirements apply to verification, in particular those dealing with dexterity (e.g. 3.3.4-C "Ballot Submission and Vote Verification"), blindness (e.g. 3.3.3-E "Ballot Submission and Vote Verification"), and partial vision issues (e.g. 3.2.4-G "Legibility of Paper Ballots and Verification Records").

3.3.1-E.1 Audio Readback for Paper-based Vote Verification

If the Acc-VS generates a paper record (or some other durable, human-readable record) for the purpose of allowing voters to verify their ballot choices, then the system shall provide a mechanism that can read that record and generate an audio representation of its contents.

Significant HFP changes from the VVSG 05

- Usability of the VVSG document improved
- Plain language guidance, cognitive requirements
- Accessible voter verification
- Low vision more fully addressed and moved to general usability section
  - Require availability of choice of font size and contrast on all VEBD-V machines, not just the accessible-VS.
  - Paper legibility
- General adjustability throughout voting session
- Poll worker usability
- End-to-end accessibility
- Timing requirements
- Performance benchmarks
- The safety requirement now refers to UL 60950

Progress Report on Performance Benchmarks

- Validity: tested on 2 different systems with 47 participants
  - Test protocol detected differences between systems, produces errors that were expected.
- Repeatability/Reliability: 3 tests on same system, similar results
  - 44, 48, 48 participants
  - Age 25-54
  - Some college, college, post grad
  - Mostly VA, some DC, MD
  - 60% women
  - Most had voted before
- To set benchmark: 4 systems, May 19-20, June 1-2
- [Reproducibility by labs across country: need to see how much variability across participants in different geographic regions is allowable—research will be performed as part of test method development]

Metrics: Success rate

- Success rate: straight counting method
  - 28 voting opportunities
  - count 1 if correct, 0 if wrong
  - Machine score is mean success rate
  - Also, % perfectly cast ballots-can set a lower bound
- Typical result: mean 92.3% SD 16.3; 40% cast correctly
- For benchmark, if >100 participants, can use the Process Capability Index
  - It is a measure combining the accuracy (average) and precision (standard deviation) of the measurements together with a (lower) specification.
  - The index can be set based on the data we have collected
  - You can then compare the index of the system being tested against this benchmark index.

Metrics: Time data

- Repeatable/reliable
  - Typical average time: 641 seconds, SD 180
- But is it a good measure of usability performance?
  - Time doesn't correlate to error rate
  - Is a slower but cheaper machine better than a faster, expensive machine?
  - But, a very slow machine is not good from the voter's perspective
- Do we set an upper limit on time or just report it?

Metrics: Satisfaction

- Subjective satisfaction questionnaire not statistically significant
- We used a modified Survey of User Satisfaction (SUS), 10 statements, 5 point Lickert scale, e.g.,
  - I felt confident that I used this voting machine correctly.
  - I think that I would need support to be able to use this voting machine.
  - I thought this voting machine was easy to use.
- HOWEVER, confidence appears to be meaningful and we could use it to set a lower bound on average confidence.
- Plan to modify questionnaire to have just one confidence question and a question like: “did you follow the instructions?”

Timeline (Completion dates)

- MAY 15 3 tests, data and analysis delivered to NIST
- May 22 Analysis checked by NIST statisticians
- May 25 Finalize counting method, create sample benchmark for errors, finalize decision on time and confidence as metrics. Short description of analysis for layperson from NIST statisticians
- June 8 Delivery of multiple system data and benchmark, short write-up of process and analysis
- June 17 HFP Discussions
- June 20 Checked by NIST statisticians
- June 25 Show results to TGDC, ready for inclusion in the VVSG
- July 1 Finalize HFP requirements and discussion, draft white paper on methodology based on the June discussions and writing.

Discussion