Voting System Event Log Contents and Semantics

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Outline

- Pending Questions
- Case Study
- Research
- Conclusion

What's the scope?

- The public release of election info varies widely
- In UK, secret ballots are a state secret
  - A valid event log could record every voter interaction
    - Incompatible with US, where complete privacy is expected
- What should be the "default" level of released info?
  - Design in terms of future public release
  - Design with the assumption of state secret

What's the purpose?

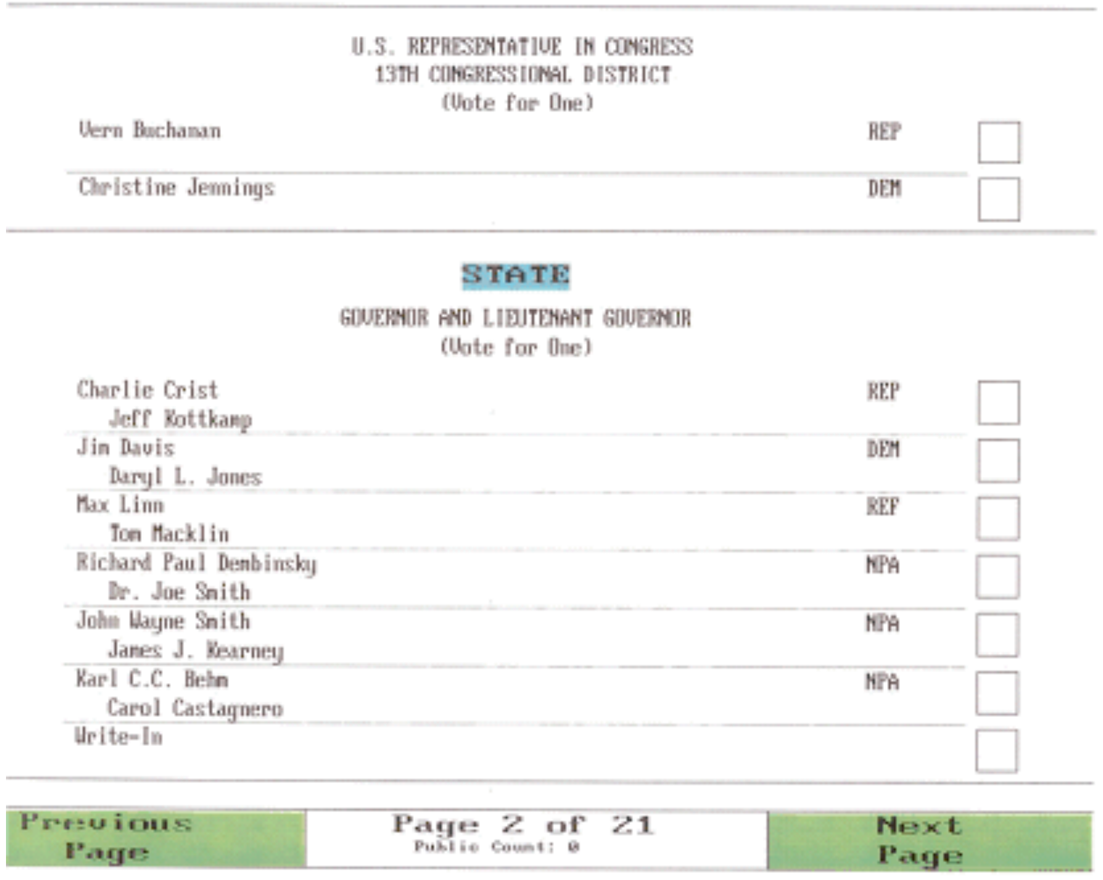
- Record of system events
  - ex. Open ballot, Cast, Close polls
  - Few jurisdictions use data recorded in event logs
- Complete account of voter intent
  - Can this be safely released to the public?
  - If so, what parts?
- Data for researchers
  - Election security
  - Usability

Case Study: Sarasota CD13 (2006)

- 14.8% touchscreen undervote rate, still no conclusive explanations

- 90-100% statistical confidence wrong person awarded the seat (Frisina, et al., 2008)

- Compliance with VVSG event log standards is insufficient.


U.S. REPRESENTATIVE IN CONGRESS
13TH CONGRESSIONAL DISTRICT
(Vote for One)

Vern Buchanan	REP	☐
Christine Jennings	DEM	☐

STATE

GOVERNOR AND LIEUTENANT GOVERNOR
(Vote for One)

Charlie Crist Jeff Kottkamp	REP	☐
Jim Davis Daryl L. Jones	DEM	☐
Max Linn Tom Macklin	REF	☐
Richard Paul Dembinsky Dr. Joe Smith	NPA	☐
John Wayne Smith James J. Kearney	NPA	☐
Karl C.C. Behn Carol Castagnero	NPA	☐
Write-In		☐

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Public Count: 0

Replayable Event Logs

- Cordero & Wagner, 2008
- Records all voter interaction with the system
    - Effectively creates an ordered set of screenshots with associated touch coordinates for each touch event
    - Provides detailed record of voter intent
- Timestamps not allowed because they associate voters and selections
    - Can’t be a standalone event logging scheme: VVSG requires timestamped logs

STATE

Governor

Vote for ONE.

PHIL ANGELIDES
Democratic
Treasurer of the State of California

ARNOLD SCHWARZENEGGER
Republican
Governor

ART OLIVIER
Libertarian
Engineer

JANICE JORDAN
Peace And Freedom
Counselor

PETER MIGUEL CAMEJO
Green
Financial Advisor

EDWARD C. NOONAN
American Independent
Computer Shop Owner

WRITE-IN CANDIDATE
Touch this box to write in a name.

PREVIOUS

NEXT

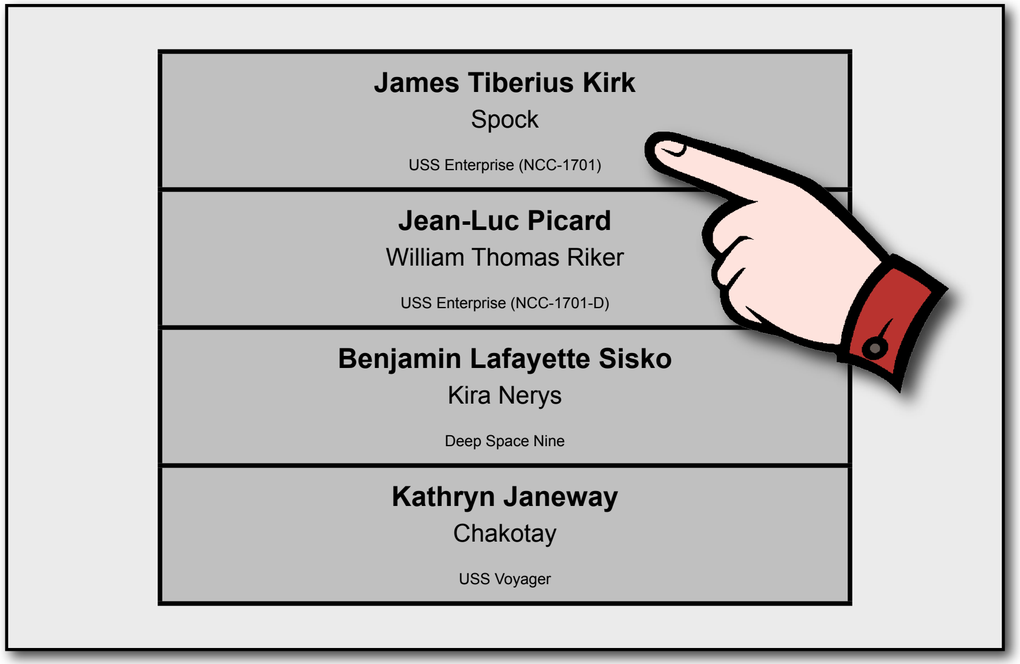
Our Solution

- Mascher, et al., 2009
- Investigated what timestamped user interaction events can be logged while preserving anonymity
- Simulated common user interface problems
- User study in progress

Our Solution

- Record relative coordinates for all touch events instead of screenshots
    - Non-selectable areas (background) recorded as a touch with no coordinate
    - Selectable areas (“buttons”) recorded as an (x,y) pair relative to upper left of the selected button. The button’s ID is not recorded

VOTER A

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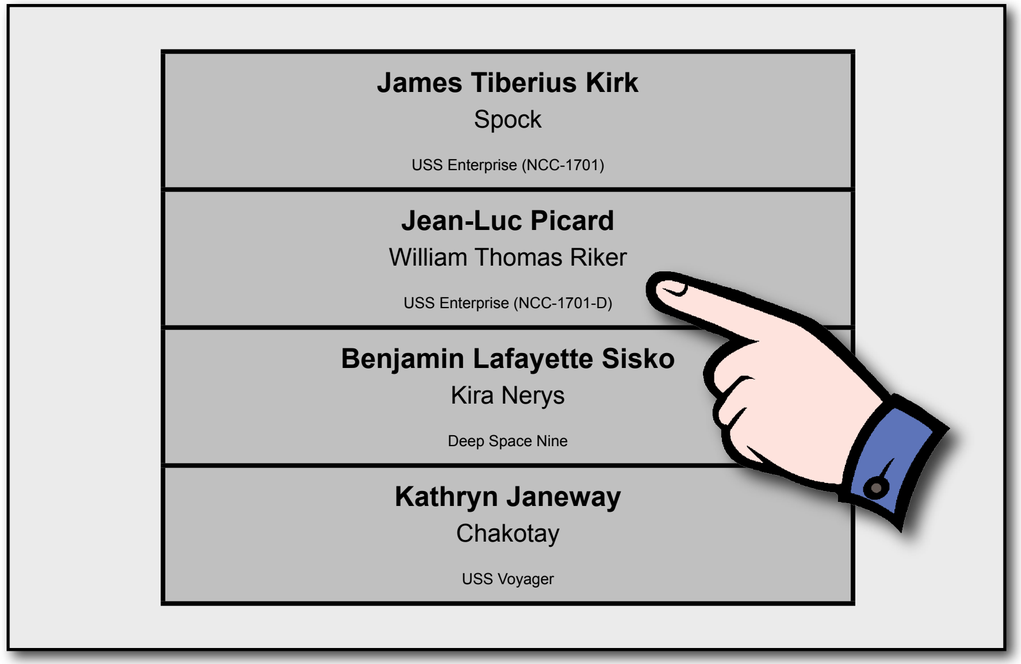
<INITIALIZE>
   <STYLE> United Federation of Planets </STYLE>
</INITIALIZE>

<UPDATE> 00:00:00.1337 </UPDATE>

<MOUSE-DOWN>
   <TIME>      00:00:09.7678  </TIME>
   <X-COORD>   257   </X-COORD>
   <Y-COORD>   049   </Y-COORD>
</MOUSE-DOWN>
```

VOTER B

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<INITIALIZE>
   <STYLE> United Federation of Planets </STYLE>
</INITIALIZE>

<UPDATE> 00:00:00.1337 </UPDATE>

<MOUSE-DOWN>
   <TIME>      00:00:09.7678  </TIME>
   <X-COORD>   257   </X-COORD>
   <Y-COORD>   049   </Y-COORD>
</MOUSE-DOWN>
```

User Study

- We developed a system that can simulate various proposed causes of voting interface problems
- For touchscreen miscalibration, touch events were intercepted and modified by a vertical offset.
- Other simulations: Insensitivity, Banner Blindness, and Dishonest (“flipped” vote)
- 90 subjects, all eligible voters in Johnson County, IA. Will continue study with at least 60 more subjects

Event Log Analysis

- Direction and magnitude of touchscreen miscalibration can be predicted with average relative vertical coordinates
- Navigation patterns and races selected indicate the extent of ballot difficulty
- Types of interface issues have distinguishable patterns

Conclusion

Interface issues can be detectable in privacy-protecting timestamped event logs. There should be further investigation into what auxiliary event log data should be in a common data format.

References

- Cordero, A., and Wagner, D. Replayable voting machine audit logs (2008)
- Frisina, L., Herron, M. C., Honaker, J., and Lewis, J. B. Ballot formats, touchscreens, and undervotes: A study of the 2006 midterm elections in Florida (2008)
- Mascher, A. L., Cotton, P. T., and Jones, D. W. Improving voting system event logs (2009)

Thank you!

Questions?