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INFORMATION
TECHNOLOGY

Improving Human-Centric Software Defect Evaluation, Reporting, and Fixing

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HUMANISE

GROUP OF EIGHT AUSTRALIA

Outline

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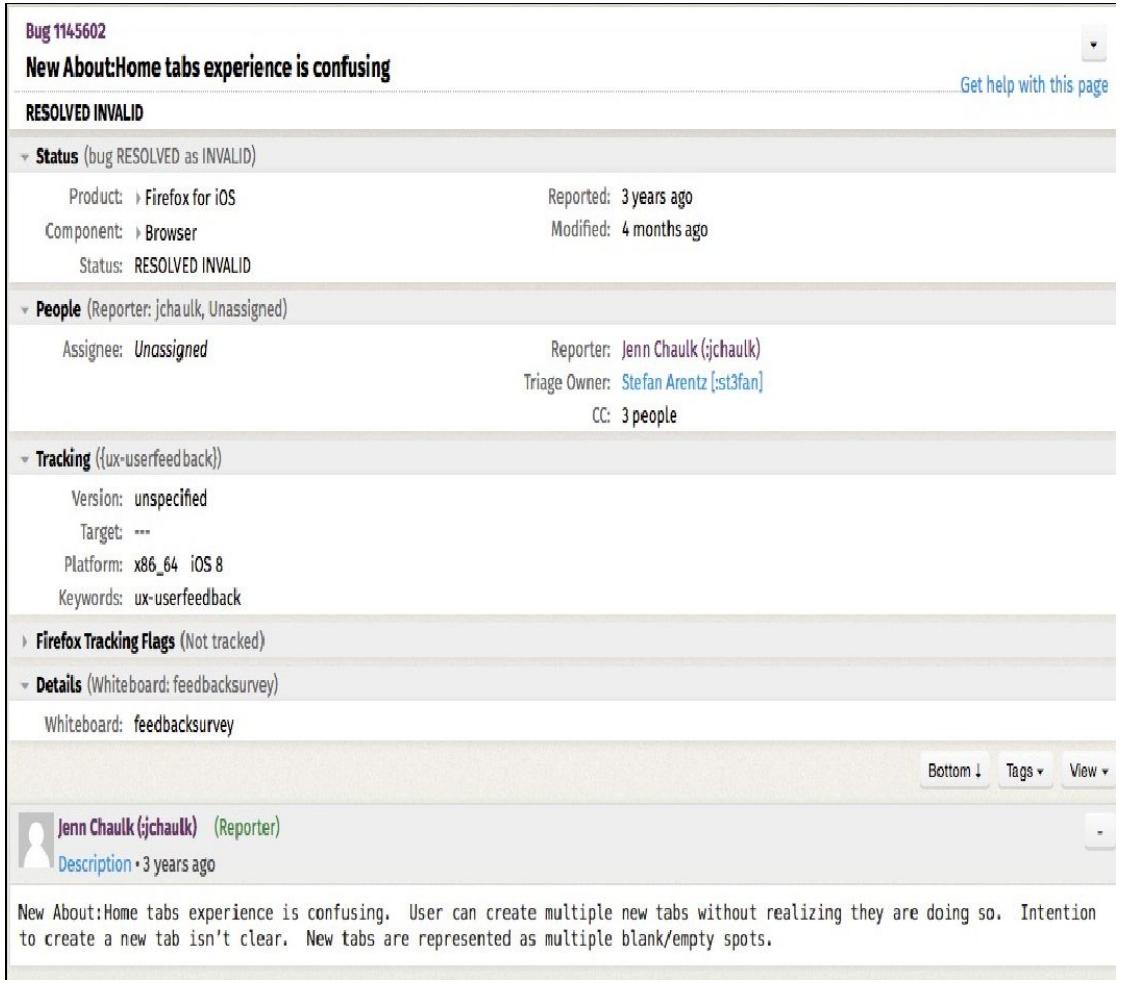
- Motivation
- Research Questions
- Approach
- Personas
- Prototype
- Usage Examples
- Evaluation
- Future work
- Summary

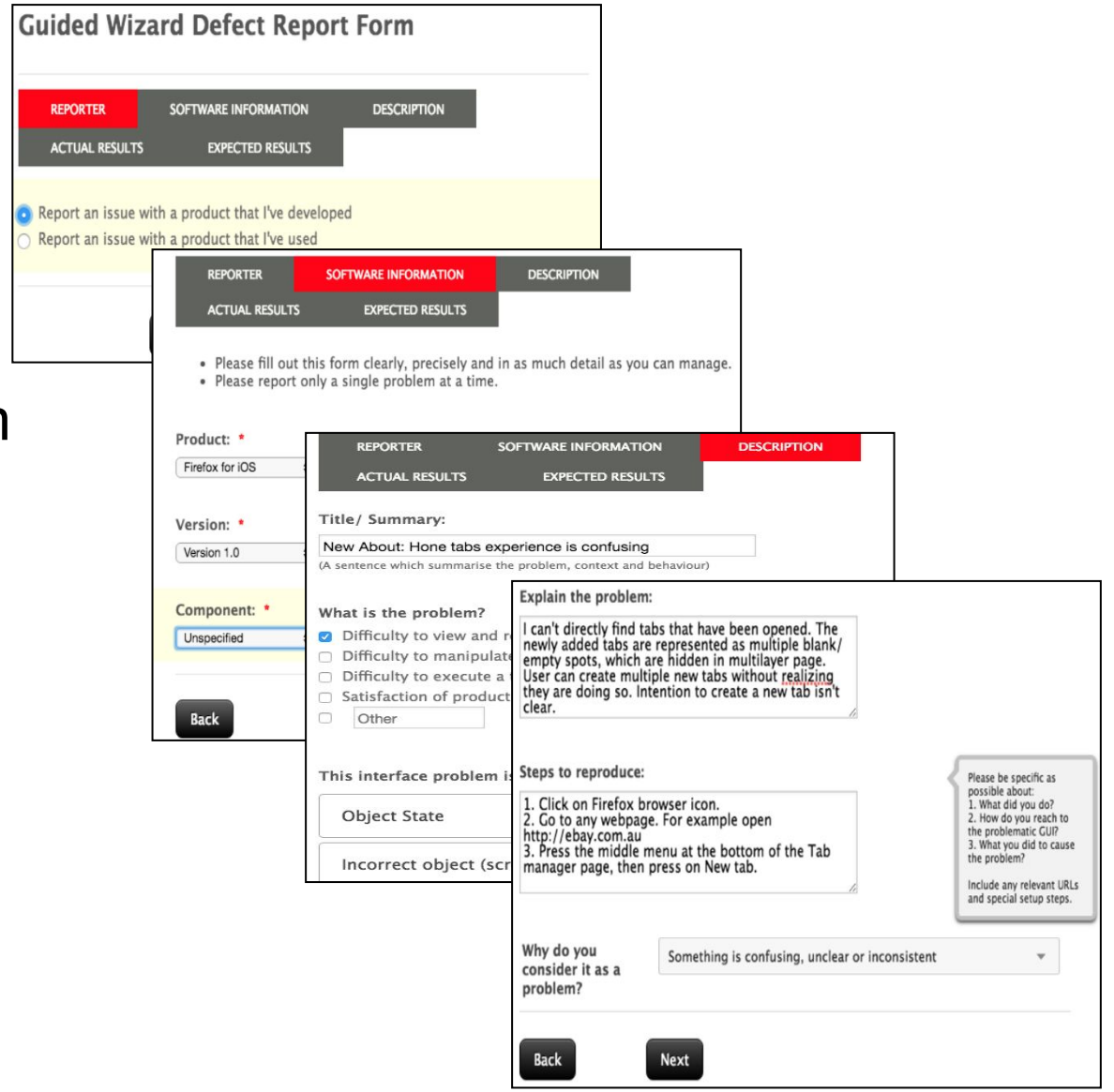
Motivation

- All software has defects when released
- End users need ways to report defects to developers
- Current defect reporting tools/mechanisms are too limited
- Example from BugZilla on right…
  - Too complex/simple
  - Lack guidance for user to report problems
  - Lack support for diverse end users
  - Lack “importance” for users
  - Developers have trouble understanding defects
- “Human-centric” defects (i) hard to report, (ii) hard for developers to understand…



In previous usability defect reporting work…

- Developed a wizard-based guided defect reporting form
- Used new taxonomy of usability defects to guide
- Used rich information gathering from user to inform developers of issues
- Provided easier-to-use, user-centric reporting interface
- BUT – only focused on usability defects and didn't support differently-abled users (somewhat ironically!)



Research Questions

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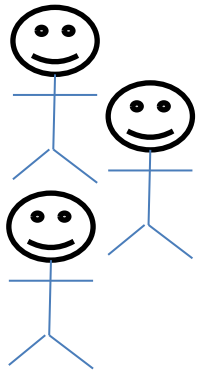
- In this work focused on better supporting diverse end users to report issues
- How can we improve defect reporting for people with diverse usability issues?
  - How can we improve defect reporting for people who are visually impaired/hearing impaired/have issues in reading? (interface issues) [RQ1]
  - How can we improve defect reporting for people who have trouble physically interacting with the application/software? (interaction issues) [RQ2]
- How can we assist developers in better human-centric defect evaluation and resolution?
  - Does educating users about defect reports improve a developer's understanding of the defect? [RQ3]
  - Does capturing the user's frequency of application use (and/or frequency of encountering the issue) affect or increase the perceived severity of the issue by a developer? [RQ4]
  - How does increasing the defect form's complexity/fields affect the developer? [RQ5]

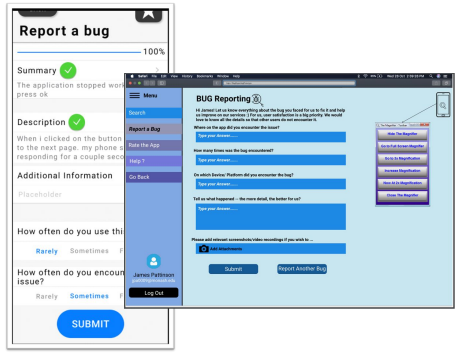
Approach



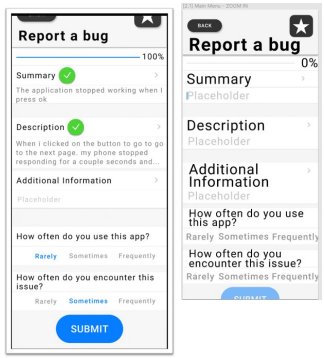
1. Develop diverse personas of end users and developers

2. Design set of reporting interfaces

3. Design set of adaptations to different persona needs



4. Design set of display interfaces for developers



5. Cognitive Walk throughs with end user and developer personas

6.Refine designs based on findings

Personas

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- Developed several personas to represent different users and developers
- Idea was to
  - Anonymously report defects to developers using persona(s) in place of real user information
  - Represent different defect reporting users characteristics to developers
  - Developers use defect report + persona(s) of user(s) reporting defect to help them better understand the users' issues having with software
  - Developers use persona(s) to help (i) diagnose defects found; (ii) identify ways to fix defect taking into account user challenges; and (iii) use persona(s) to assist in testing that defect has been fixed
  - Developer personas might be used to help direct defects for fixing ; explain defect in human-centric way to different developers
- Developed 5 personas in total: colour blind, dyslexia and aphasia, hearing impaired, mobility or dexterity impaired, screen reader user
- Cognitive walkthrough of several apps to identify issues for each – Skype, Moodle, Snapchat, Grab

Examples

Cognitive Walkthrough Outcome – Dyslexia and Aphasia

Persona

Name	Michael
Age	19
Gender	Male
Occupation	Junior Software Quality Tester
Disability Information	Dyslexia (Difficulty with processing written language) | Aphasia (Difficulty with processing spoken language) Michael has common issues a dyslexia person would have such as poor spelling, summarizing stories, remembering things such as a PIN or telephone number. Michael is also diagnosed with Wernicke's aphasia, he is able to speak fluently, however the sentences do not always make sense due to using imaginary words or irrelevant words.
Issues encountered	• Wants to use a bug tracking tool but could not distinguish between various icons • Some of the icons/buttons are not self-explanatory • Difficulty in writing a description of the bug due to poor spelling • Wants an in-built speaker/text to speech to be able to understand sentences better • Michael is not able to type out the words correctly however he knows how to pronounce the word, a speech recognition software would be useful here. • An autocorrect or spellchecking feature would be really helpful to help Michael write reports

Brief description of the disability

People with dyslexia have trouble processing written language, this is due to problems with associating words/letters with sounds. Sometimes this causes people with dyslexia to avoid reading, have problem with summarizing something, may have poor spelling (could possibly be an entirely different word from intended).

People with aphasia may sometimes form a lot of short sentences, gestures or drawing due to lack of words. They may have trouble expressing oneself (finding the right words) when speaking or writing. Being unaware of mistakes in one's spoken language. Mixing up sounds in words (saying "wog dalker" for "dog walker").

Cognitive Walkthrough Outcome – Mobility/Dexterity Impairment

Persona

Name	Roger
Age	55
Gender	Male
Occupation	Mature-aged student
Disability Information	Possesses issues concerning mobility or dexterity: • Unable to control a mouse or keyboard properly • Highly prefers less intense tasks • Prefers a multitude of methods to interact with functionality • Limitations in speed, strength, endurance, and coordination of limbs
Issues encountered	Issues encountered as a result of the disability possessed: • Difficulty traversing complex websites (websites with a relatively dense concentration of buttons and pages) • Difficulty adjusting to content that isn't comfortably presented • Difficulty completing tasks that do not offer alternative methods of interaction: through keyboard shortcuts or voice-recognition functionality • Difficulty interacting with functionality that requires precision

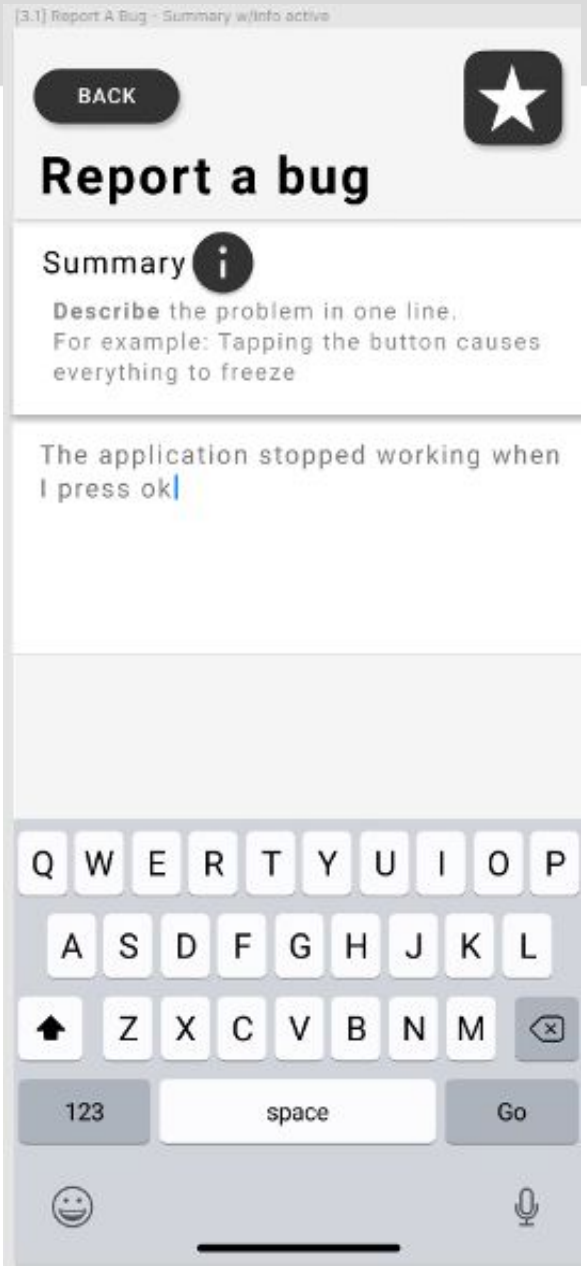
Brief description of the disability

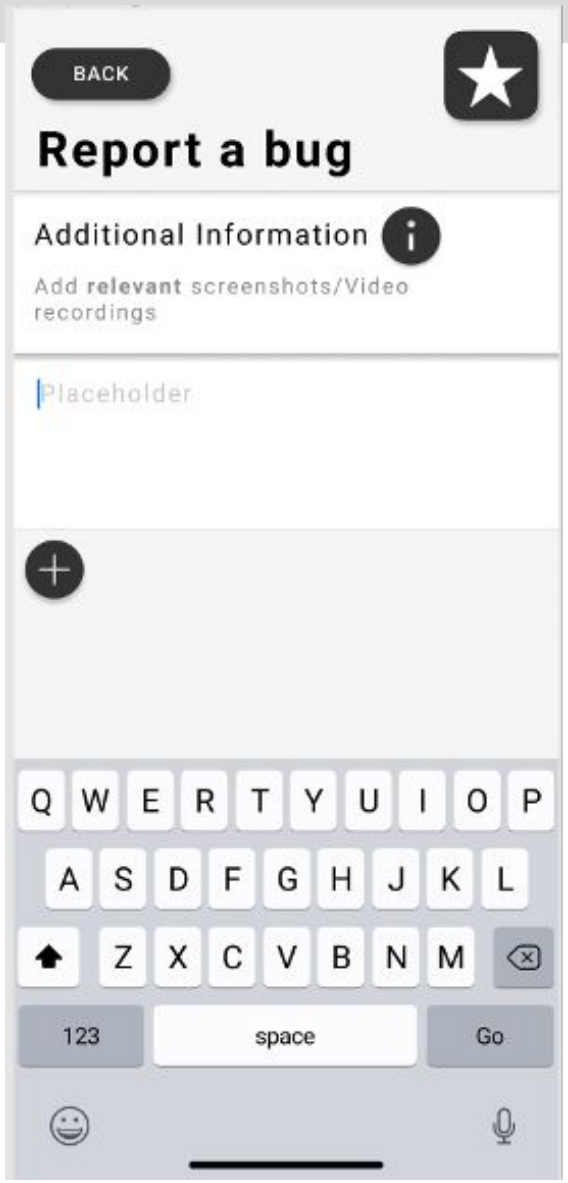
Mobility and dexterity impairments may arise from a multitude of conditions: arthritis, cerebral palsy, and essential tremor to name a few. Individuals with mobility or dexterity related impairments face issues that deal with extremity use and capabilities. These limit speed, strength, endurance, and coordination of limbs and result in difficulties traversing and interacting with real world entities, web pages, and applications.

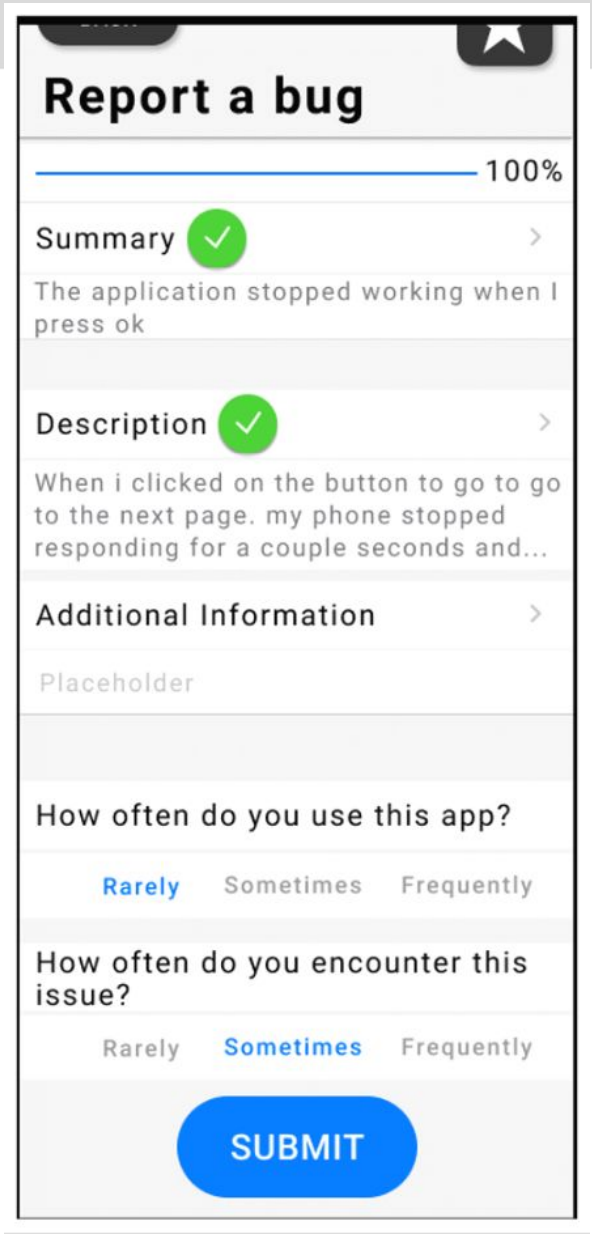
Prototype

- Developed prototype defect reporting and presentation tools
- End user mobile app defect reporting tool
- End user web defect reporting tool
- Developer web application defect reading tool
- Developed configuration support for different personas to better support them reporting defects
  - Support screen reader users
  - Support font type, size, colour settings
  - Support voice input
  - Support dark mode, large button input

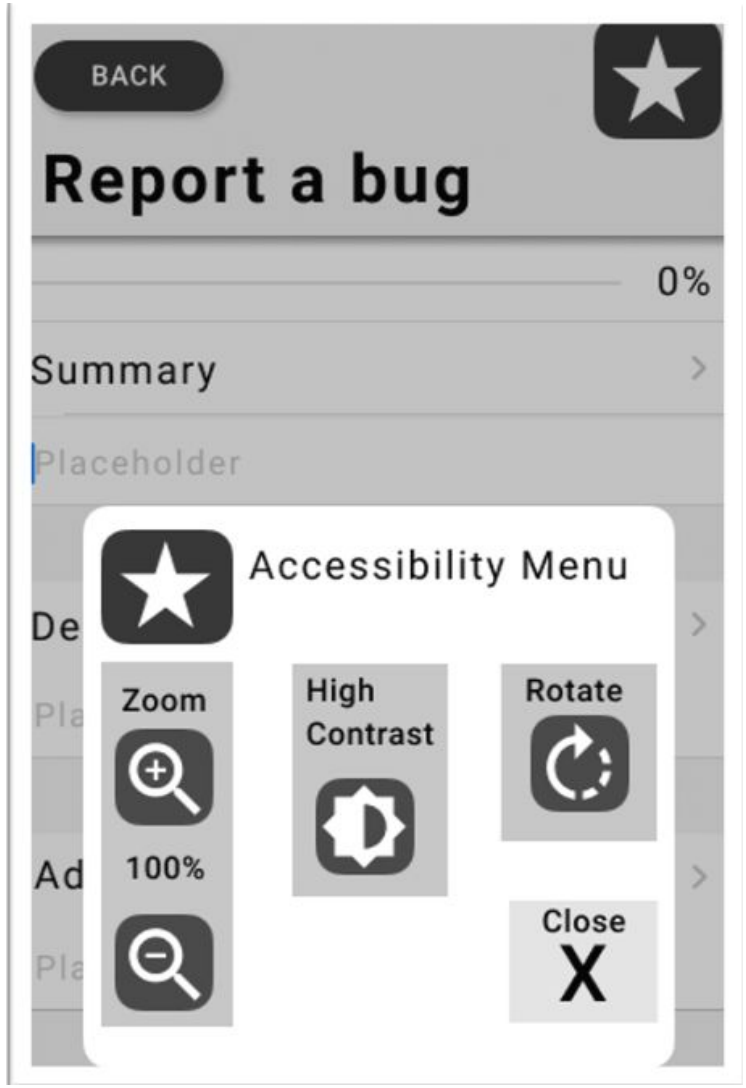
Usage Examples

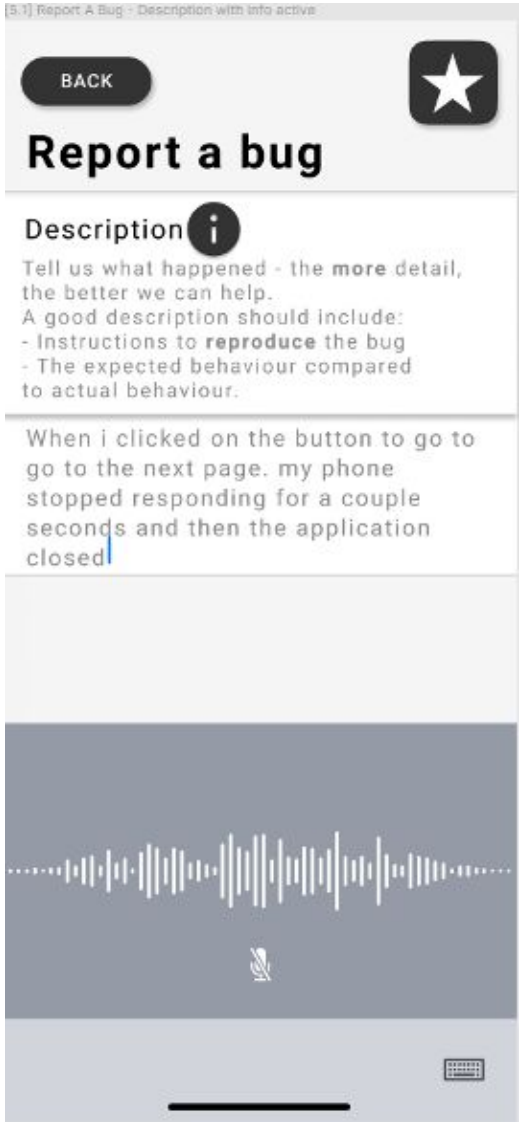


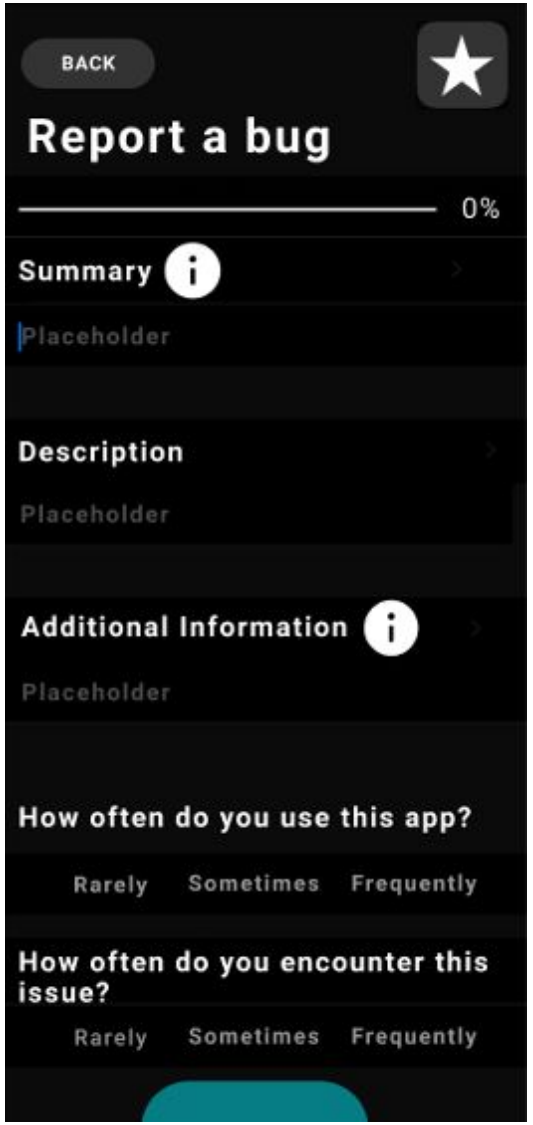


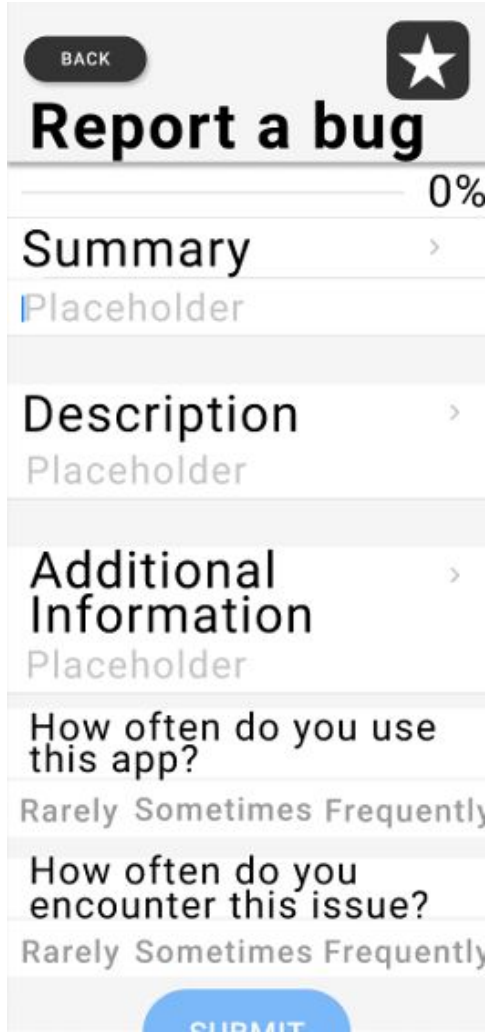


End user challenges supported









Desktop prototype

Evaluation

- Wanted to evaluate with real users with persona-like challenges
- COVID-19 meant real challenges recruiting, doing evaluations
- Used recruited users to do cognitive walkthrough with personas and mimic challenges including using overlays, colour and font changes etc
- Used user personas for defect reporting
- Used developer personas for defect understanding, actioning

Key findings

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- RQ1 – better supporting visually challenged users – need a range of changes to the defect reporting interface incl to better support screen readers
- RQ2 – better supporting people with interaction issues – better navigational aids, shortcuts, avoid scrolling, allow change screen orientation
- RQ3 – does educating users help – using guided defect reporting form assists in more richer information capture, providing persona of reporter assists developer to understand context of use
- RQ4 - does frequency of use help – unclear – frequency doesn't always identify critical defects, frequency of defects may aid more
- RQ5 – defect form/information complexity for developers – want balance between detail and over-burdening reporters, some human-centric efects require more information than others to diagnose/fix

Future Work

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- Need real end user evaluation
- Need more diverse, nuanced personas
- Need more information in some personas about challenges especially for developers unfamiliar with them
- Other human-centric issues needed in personas e.g. age, gender, culture, educational attainment, language proficiency, personality, cognitive style, …
- Need to evaluate on further application domains
- Amount of detail for different kinds of defects and different end user personas needs refinement
- Unclear how well developers use reporter personas when provided, if or how they improve human-centric defect understanding and fixing

Summary

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- Current defect reporting tools not human-centric
- Ironically, many are difficult for end users to use
- Don’t support variety of end user challenges, human-centric characteristics
- Making defect reporting tools more human-centric likely to improve uptake, improve quality of defect reports
- Representing persona(s) of defect report(s) to developers may aid them in diagnosing, appreciating, fixing human-centric (and other) defects
- Want to further use developer personas, richer end user personas, understand more deeply how human-centric defect reporting tools and improve software defect fixing and quality

“Defect free software does not exist”

-Wietse Venema