Exploring an AI-Powered Survey Interviewing Agent for Individuals Who Are Blind or Visually Impaired

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Outline

- Background and rationale
- Overview of our research project
- Key insights from our works so far
- Challenges & Potential Solutions
- Future steps and final thoughts

Research Team

- Project: Developing an AI-powered survey interviewing agent for people who are blind or visually impaired
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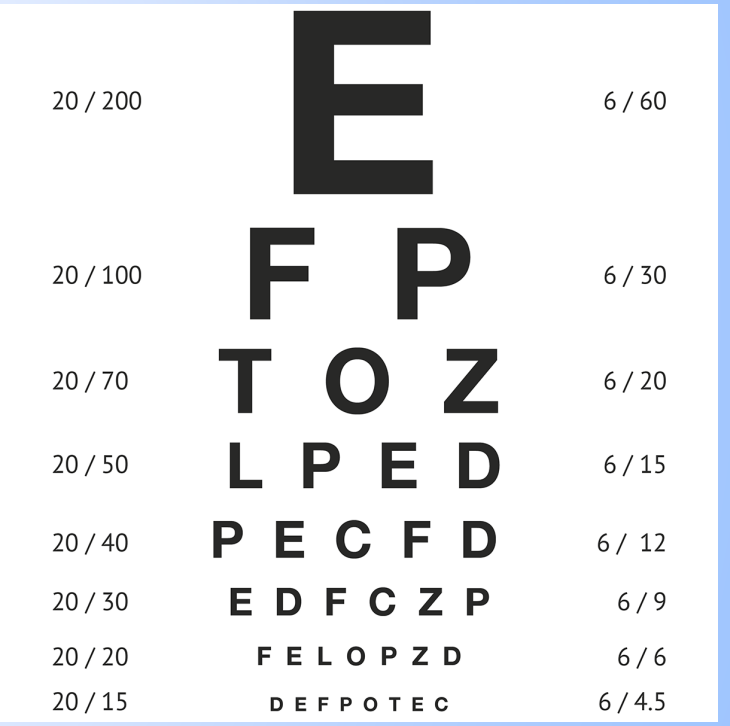
  - Haomiao Jin h.jin@surrey.ac.uk
  - Jenny Harris jen.harris@surrey.ac.uk
- In collaboration with the Center for Economic and Social Research (CESR) at the University of Southern California

Blindness and Visual Impairment

- ICD-11 definition of visual impairment, based on presenting visual acuity (i.e., with corrective lenses)
  - Category 0: No or mild visual impairment – better than 6/18
  - Category 1: Moderate visual impairment – between 6/18 and 6/60
  - Category 2: Severe visual impairment – between 6/60 and 3/60
  - Categories 3-5: Blindness – worse than 3/60 or no light perception
- **Blind or visual impairment (BVI)**: Categories 1-5
- Epidemiology
  - About 285 million worldwide (4.0%, WHO)
  - 90% living in LMIC
  - Over 80% aged 50+



Barriers for People with BVI to Engage in Digital Surveys

- Adapted from American Foundation for the Blind (AFB)'s report (https://afb.org/research-and-initiatives/bdis-series)
  - **Inaccessible interfaces**: existing digital platforms lack compatibility with assistive technologies like screen reader or braille displays
  - **Unlabelled buttons and links** (e.g., arrows instead of "Next"/"Previous")
  - **Poor contrast, inappropriate colour schemes, small font sizes**
  - **Inaccessible formats**, such as dropdown menu or visual based tests
  - **Excessive time and cognitive load** (matrix questions)
  - **Frequent website updates**
  - **Reliance on assistance from sighted persons** (privacy, social desirability bias)

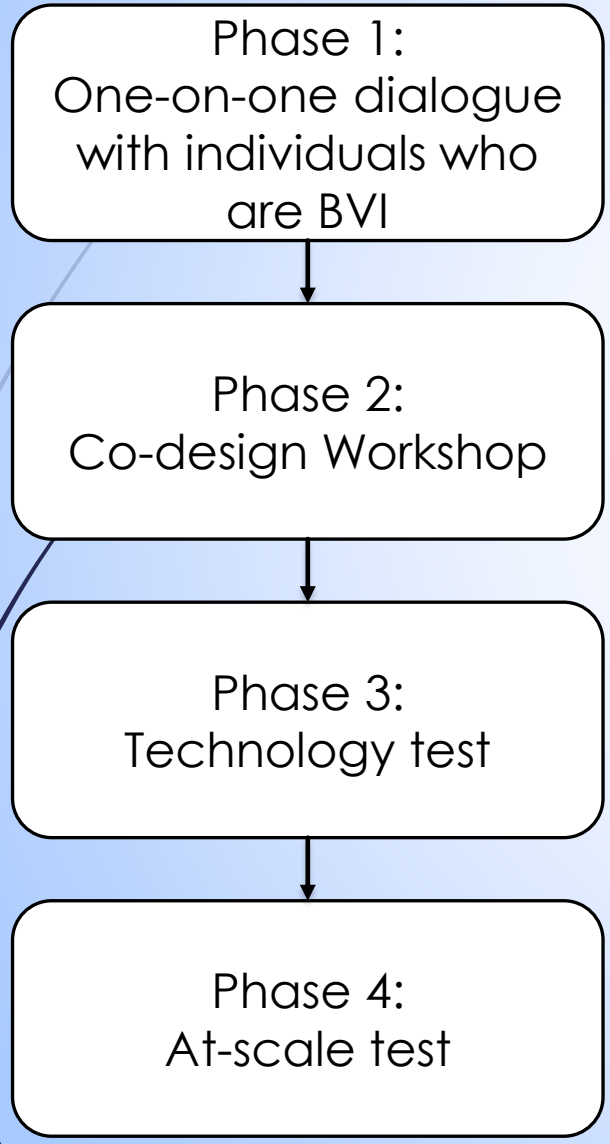
Challenges for Researchers Who Like to Use Digital Surveys for People with BVI

- How to engage BVI individuals in digital surveys?
  - What technologies are useful
- Cost of technology development
- Customisation and reliability
  - Assistance for BVI → customisation → reduced standardisation
- Mode effect
  - Technology-Assisted assessment for BVI vs. other mode(s)
- Validity
  - Do instrument validated on the general population work for BVI?

Potential Benefits of Using LLM to Power a Survey Agent for People with BVI

- **Conversational interaction** – deliver survey based on conversation
- **Adaptive format** – adjust format for people with BVI
- **Navigation** through long and complex survey (hopefully!)
- **Error handling and clarification**
- **Reduced reliance on assistance from sighted others**
- **Cost of using LLM for development is manageable/decreasing**

A Research Project on AI-Powered Survey Agent for People with BVI



- Understand how people with BVI use technology
- Understand their past survey experiences
- Generate **persona** (typical users)

- Team members working with BVI personas, survey researchers and other key shareholders to:
  - Identify key design points/areas
  - Seek solutions

- Test the developed AI survey agent
  - Achieve the desired functionality
  - User acceptability, satisfaction and perceived ease of use

- At-scale test to examine:
  - Mode effect
  - Reliability and validity in conducting common instruments

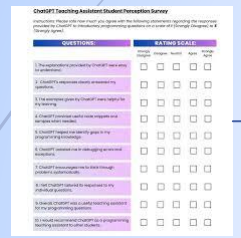
Phase 1: One-on-one dialogue with individuals who are BVI (Ongoing)

- Target to talk with 30+ people with BVI
  - Understand how people with BVI use technology
  - Understand their past survey experiences
  - Generate **persona** (typical users)
- What we learned so far:
  - People with BVI are amazingly tech-savvy
  - They rely on assistant technologies and have their own preference
  - LLM is being incorporated into some assistant technologies
    - JAWS+ChatGPT, NVDA+Claude (ask questions, summarise TV shows, general life assistant, supports daughter in her homework)
  - They primarily utilise verbal expression for communication
    - multi-sensory reading experience, hear and see, for people with some vision
  - Their experiences with digital surveys are not good

Experience of Surveys

- Difficulties with digital surveys, particularly with word limits on open-ended questions. **“Would like the ability to use another app to draft my response”.**
- **Matrix-type questions** were impossible to understand and navigate on how to complete.
- If speech-based, would like **“audible cues on when it starts and stops listening and then respond”.**
- **“In a survey I press enter to mean next line, but it goes to next question”.**
- **“I know ‘enter’ means next question”.**
- **The need for simplicity and choice (e.g. one question per page, compatible with existing accessibility software, allow choice between typing and speech)**

A preliminary technology roadmap



Questionnaire(s)

AI/LLM Engine

- Locally deployed? (for controllability, safety and privacy)
- Functionalities/features implemented by finetuning/few-shot learning with
  - Explicit instructions
  - Best practices
  - Examples of professional interviewing behaviours

Text-Based Interface

Assistant Technologies

End Users

Co-design Approach

- Co-design (or participatory design) is a research and development approach where end users actively contribute to the design process.
- Instead of designing for users, we **design with users**.
- It ensures the technology meets real-world needs by incorporating lived experiences and expert feedback.
- Particularly useful when developing accessible and inclusive technologies.

Who is involved in the Co-design process

- Blind & Visually Impaired (BVI) individuals
  - End users with firsthand experience of accessibility challenges.
- Survey researchers
  - Ensure methodological rigor and consistency.
- AI/LLM developers
  - Translate co-design insights into AI behaviour.
- Research team members
  - Organise the process in a structural way and translate findings into product

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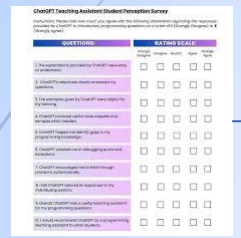

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Interface

Assistant Technologies

End Users

Phase 2: Co-design workshops (Under Planning)
- Team members working with personas (typical users), survey researchers, etc.
- Moderator-led, structural approach to:
  - Communicate respective goals, identifying consistent and completing ones
  - Think about solutions together

Challenges

- Many useful co-design tools (e.g., participatory systems mapping [PSM]) are visually based
  - Verbal brainstorming and structured discussions (well-planning is critical)
  - Text-based tool or use visual tool internally to the research team
- Balancing Accessibility with Standardisation in Survey Design
  - Surveys must follow standardised protocols for research validity, but BVI users may need additional clarification and flexible response formats.
  - Identify which aspects of surveys can be adapted without compromising reliability and validity.
  - Train the AI to offer clarifications neutrally while maintaining question integrity.
  - Work closely with survey researchers to define acceptable flexibility.
- Cognitive overload & information processing differences
  - Allow users to use their preferred assistant technologies (survey delivered through text-based interface)
  - Find solutions to complex question items (e.g., matrix items)
  - Fatigue management

A preliminary technology roadmap

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Interface

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Phase 3: Test the developed AI survey agent **(Under Planning)**
- Achieve the desired functionality
- User acceptability, satisfaction and perceived ease of use

Some Thoughts About Testing Plan

- Ensure the AI/LLM performs well as a survey interviewer
  - Does the AI read survey questions correctly?
- Verify the interface works seamlessly with assistive technologies
  - Does the survey interface work with screen readers?
  - Can users navigate, select, and input answers easily?
  - Are AI prompts clearly and paced appropriately for auditory comprehension?
- Identify and fix usability barriers for BVI users
- Gather user feedback to refine AI behaviour & accessibility features

Take-aways

- AI-powered survey interviewing agent has potentials
  - Conversational & adaptive format enhances accessibility for BVI individuals
  - Reduce reliance on assistance from sighted people
- A structured co-design approach
  - Engaging BVI users, survey researchers, and AI developers
  - Balancing accessibility with survey standardization is a critical challenge
  - Other challenges include assistive tech compatibility and cognitive load &fatigue management
- Next steps
  - More one-to-one dialogues with BVI individuals and co-design workshops
  - Develop and realise the technology
  - Thorough testing and continued iterations
- Final thoughts
  - By integrating AI with a co-design approach, we hope to improve survey accessibility for BVI individuals, contributing to better engagement of this hard-to-reach population in research.

Thank You!

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