Developing an Accessible Indoor Navigation Application

Perceptions of Legally Blind Adults

Opening Code: pap116s1

By: Paul Ponchillia
Song-jae Jo
Kim Casey
Indoor@SenderoGroup.com

Contents of this PowerPoint were developed under a grant from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR grant number 90BISB0003-01-02).

Learning Objectives

At the completion of the presentation, attendees will describe:

1. The Sendero Indoor Navigation Project.
2. The survey research findings.
3. The implications of the research

The Indoor Navigation Problem

- Signs keep travelers oriented and lead to destinations.
- Most signs are not accessible
- GPS devices enhance wayfinding
- Indoor wayfinding not possible with GPS
- Dependent on others for information

The Technology Problem

- Apps developed at an amazing rate
- Apps often use similar technologies, but info databases are proprietary
- Wayfindr and the ITU working to standardize apps (# of notifications, alert distance)

Project Overview

2-Year NIDILRR SBIR grant to develop and study indoor wayfinding for people with visual impairments

Project team:

- **Accessible indoor**: Boni Global, Blindsquare
- **Mainstream beacons**: indoo.rs, Radius Networks
- **Blindness Organizations**: National Federation of the Blind, San Francisco Lighthouse, Chicago Lighthouse

Project Objectives

- Evaluate existing apps and databases.
- Survey user needs and preferences.
- Develop the iPhone App.
- Create an open source standard for databases.
- Combine third-party databases into a single accessible entity.
- Conduct Usability research.

Major Indoor Navigation Technologies

- Beacons – fixed transmitter, placement mapped, triangulation
- WiFi – strength of WiFi signal, Apple Venue maps, fingerprinting
- Third-party observation and feedback – AIRA, BeMyEyes
- Others: varied and uses all kinds of sensors

About the Survey Research

- Purpose
- Online survey using “Survey Monkey Pro”
- Self-administered
- 27 items
- 7000 study population
- 700+ respondents

Survey participant: characteristics

- **Age**: <40 35%, 41-60 40%, >60 25%
- **Gender**: Males 60% Females 40%
- **Totally blind**: 72%
- **Age at onset**: 65% before 5 years
- **Employment**: 57% employed, 17% unemployed, 26% retired / not seeking a job

Survey participant: technology and O&M

- **Smartphone**: 89% iOS, only 19 people do not use a smartphone
- **Travel Confidence**: Confident 81% Cautious 19%
- **Technology** : 80% Used GPS, 39% Technology Trainers, Confident User 92%

What environmental information is most important for indoor orientation?

- Location of Points of Interest
- Room Numbers
- Presence and Location of an information desk

What features are the most important in an indoor application?

- Provide current location at any time
- Ability to create a route
- Ability to choose automatic announcements of points of interest when passed

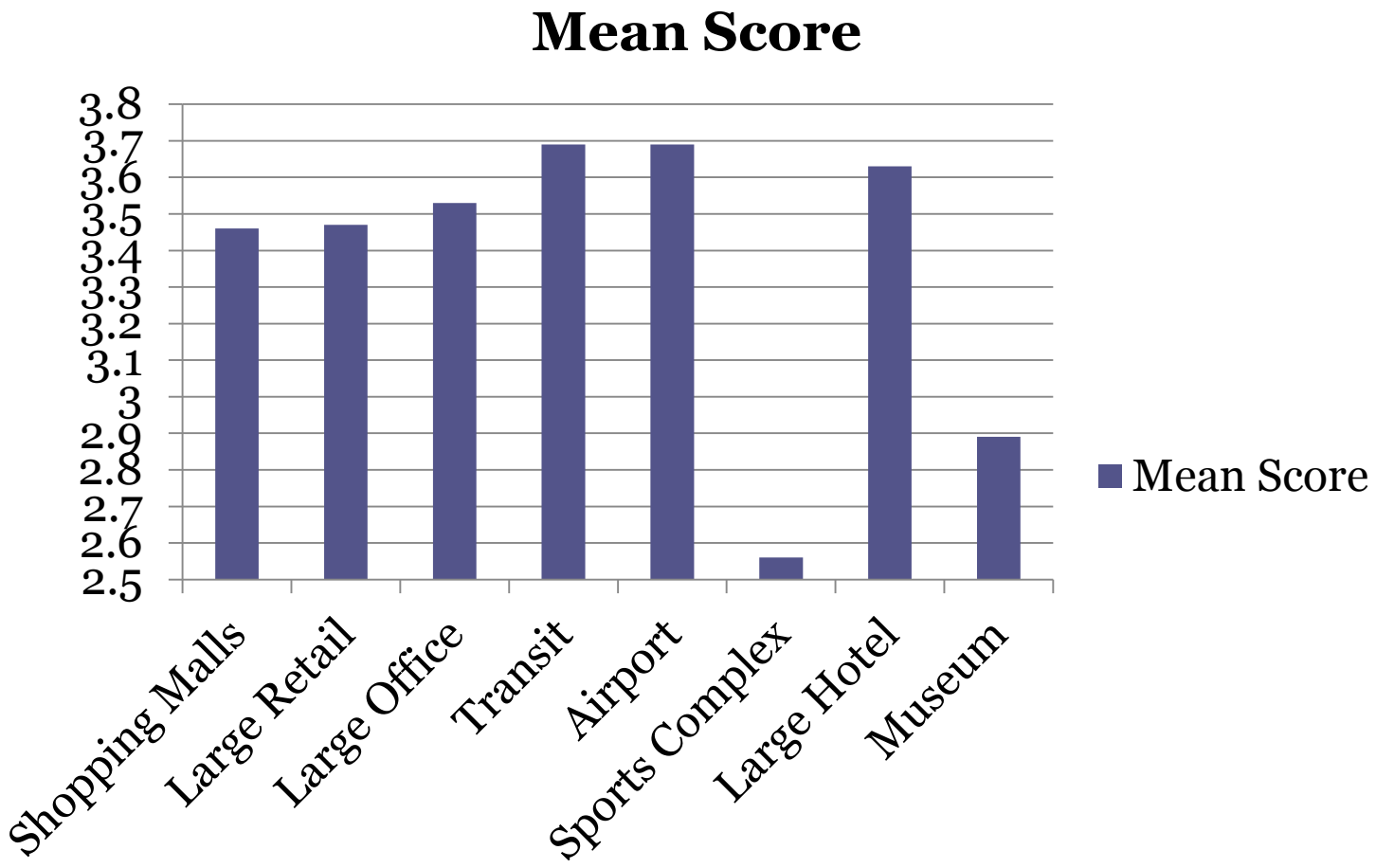
What is the preferred output method for an indoor wayfinding application?

- 98% preferred some type of verbal output
- highest ranked output was Verbal, with nonverbal auditory cues (tones) and vibrational cues
- Important: Ability to customize

What building types are perceived as most important?

- High importance overall (average score 3.37 out of 4)
- Bus/rail transit and airport buildings most important
- Large hotels and large office buildings followed in importance
- Sports Complexes and Museums ranked lowest in importance

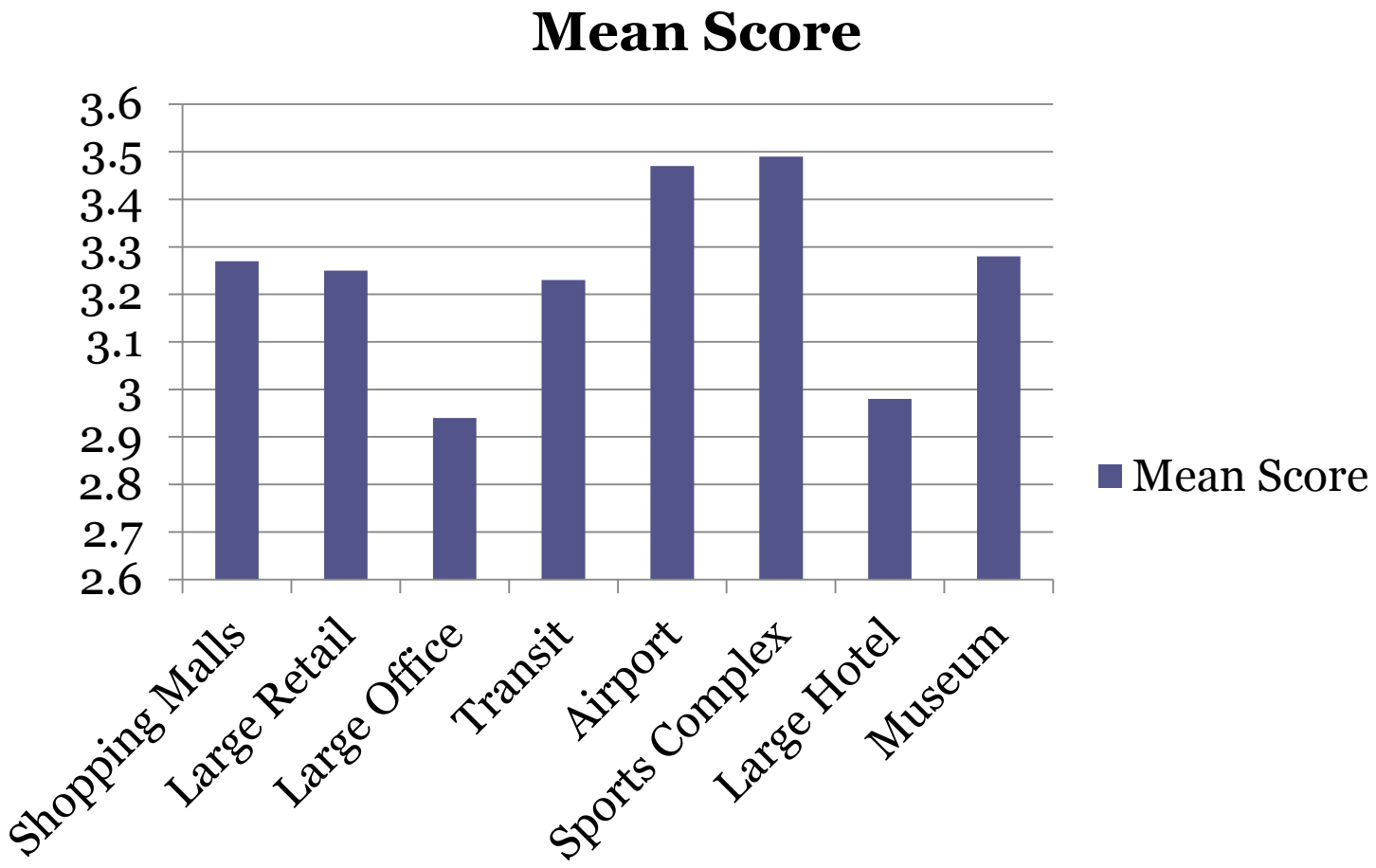
Building Type Importance Graph



What building types are perceived as most difficult?

- All considered difficult (average score 3.24 out of 4)
- Sports complexes and airports most difficult
- Museums and Shopping malls follow
- Large hotels and Large office buildings easiest

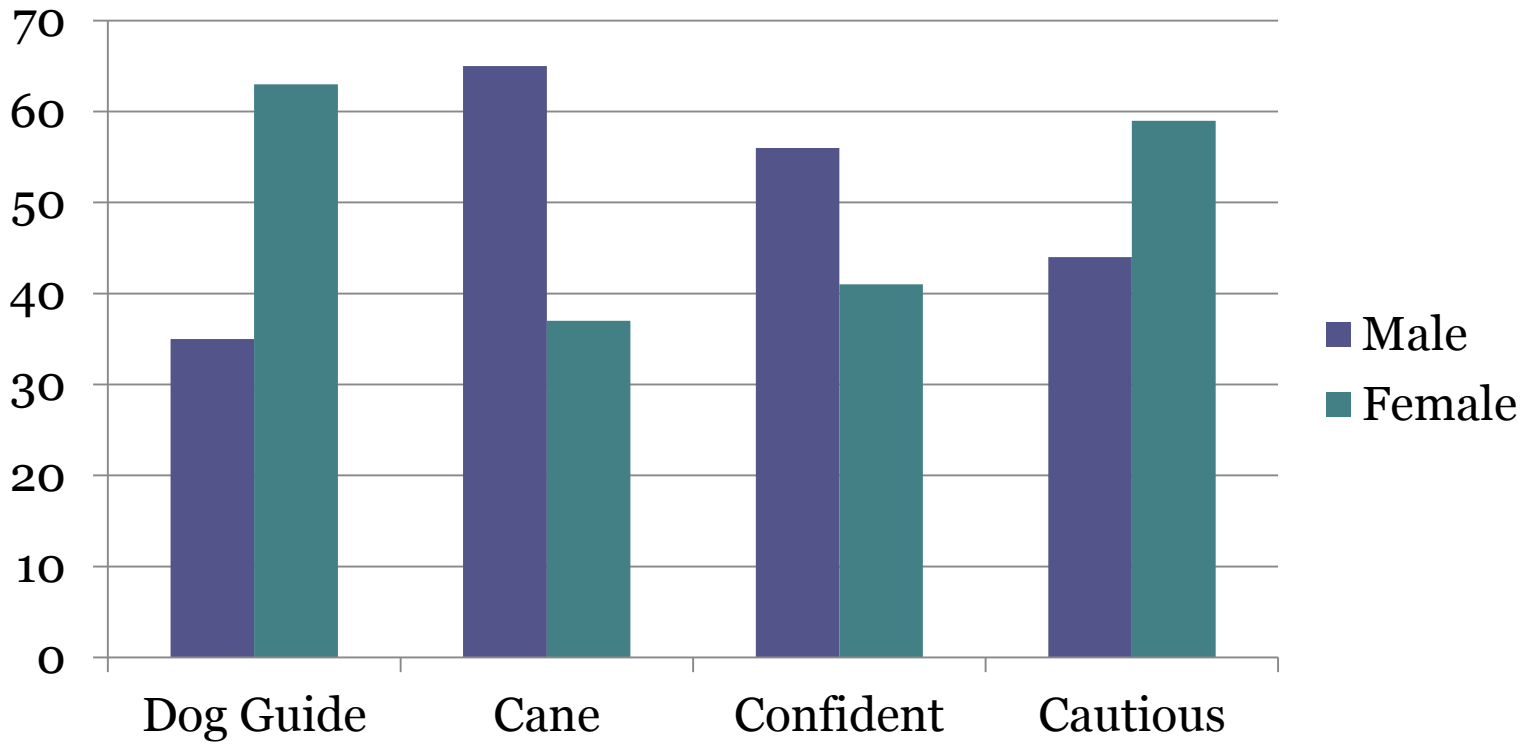
Building Type Difficulty Graph



What other Building types are perceived both important and difficult?

- Hospitals
- Educational Facilities
- Theaters/Concert halls
- Grocery Stores

Exploring relationships: Gender



Travel Device (dog guide vs long cane)

Level of confidence (confident vs cautious)

Exploring relationships: Accessible GPS Use

- **Confidence**: many used accessible GPS (510 vs 104), Accessible GPS user 52% confident, non user 40% confident
- **Age**: 41-60, 88% users, 18-40, 78% users.
- **Degree of vision**: no usable vision 85%, print readers 73%
- **Employment Status**: Employed 86%, not employed 79%

Differences in perceived level of importance

- **Buildings overall**: Male, confident travelers
- **Shopping Malls and Large Retail Stores**: GPS User
- **Large Office Buildings and Large Hotels**: Employed
- **Sports Complexes**: Between ages of 41 and 60, Cane user, Acquired vision loss

Differences in perceived level of difficulty

- **Buildings overall**: Older than 60, No usable vision, Cautious traveler, and GPS User
- **Airports, Bus/Rail Transit Buildings**: Dog Guide Users
- **Shopping Malls**: Employed

Implications: App Design

- User identified app features – Location, routes, auto announcement
- User identified output type – verbal with nonverbal & vibrations

Implications: Future Development

- Prioritize airports
- Prioritize transit facilities

Implications: Professionals

- User identification of most desired indoor information: POIs, room numbers, & info desk
- GPS use is widespread among this population – 80%
- GPS use is positively related to travel confidence and employment
- Dog guide users view airports & transit buildings as more difficult
- Indoor navigation is developing like wildfire – Be prepared
- Keep an eye on Apple's progress in the indoor mapping arena

Thank you for attending!

Closing Code: •718014

www.Wayfinding.org

Email: indoor@senderogroup.com