ISIS: Interactive Systems for Individual with Special needs

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Research Question
• How can we make health-related & leisure activities more enjoyable for those who need just a bit more help?

Assistive Technology
(Assistive Technology Act of 1998)
• Anything to increase, maintain, or improve the functional capabilities of individuals with disabilities
• Mediates and decodes the technology and information for users with disabilities
• Precursor to universal accessibility/inclusive design
• From software applications to games to mobile technology
• The research presented focuses on software application or using off-the-shelf hardware solutions to complement the software
• My research focus is on “fun” assistive technology
• My user group ranges from people with disabilities, the aging population, children, those w. low literacy/socioeconomic status and those from third world countries

Human-Computer Interaction
• Cognitive ergonomics of interactive computer systems
  – Ergonomics: The study of people’s efficiency in their working environments.
  – Cognition: The mental action or process of acquiring knowledge and understanding through thought, experience and the senses.
• Believe in user-centered (participatory) design
• Founded on the idea of usability (effectiveness, efficiency, satisfaction – ISO 9241), and adoption
• In summary: designing AT for and with the target user population
Why marry HCI and AT?
• We are all disabled one day
• Disabled »« accepting stigmatism
• Many AT become mainstream products

Non-verbal vocal input
• Useful for people with combined motor and speech impairments
• Developed systems
  – Cursor control through whistling, humming, fricative (pitch extraction)
  – Keyboard control using Morse, mapping and gesture
  – Humming Tetris
  – Speed determined from the difference between the pitch at the start of the tone and any given instance
• In the process of turning this to therapy tool for people with neurogenic communication disorder → melodic intonation therapy

Drawing software for children
• Intended as edutainment software for children at cognitive age of 2-5 years old
• Allows creativity with no goal forming necessary
• Amoeba = for switch users
• Splatters = for multiple key presses but no line drawing ability
• Kaleidoscope: boosting children’s confidence that they can produce something beautiful
  – We found that it also boosted parents’ confidence
Hidden Creativity

Cleft Lip and Palate
- Occurs when lip or mouth do not form correctly
- One of the most common birth defects in the world
- Corrective surgery is a very lengthy and complex process
- Speech therapy begins at 2 years; goal is to finish by kindergarten

Speech Therapy
- Speech therapy requires the patient to practice at home
  - Parents are unable to motivate their children to practice
  - Parents don’t really know how to assess progress
- Speech recognition requires perfect speech
  - Discouraging for children
- Solution: Develop a game that will motivate the child to practice, with a custom-made speech engine
  - Detecting lateral lisps (the /l/ and /z/ sounds are produced with air escaping over the sides of the tongue)
  - Detecting plosive (a consonant in which the vocal tract is blocked so that all airflow ceases: [t], [d], [k], [ɡ], [b], [p])

Speech Recognition Engine
- OpenEars
  - Open-source speech recognition framework for iOS devices
  - Uses PocketSphinx, a recognition engine developed by CMU and optimized for mobile devices
- PocketSphinx components:
  - Acoustical Model: information what their phonemes the waveforms represent
  - Dictionary: maps phonemes to phoneme groups
  - Language Model: Hidden Markov Model to ensure that sentences are syntactically correct
Proof-of-Concept and Prototype

- Engine and game size
- Processing time
- Recognition accuracy
- Acoustical Model Adaptation

Blind Photography. Why?

- A memory of something that is emotional
  - Ex: a fun time at Mt. Fuji with your friends
- For future reference
  - Ex: a bottle of wine you liked a lot
- To share your environment and event
  - Ex: show your family your new apartment without them having to be there
- Creative expression
  - The easiest way to express visual creativity (and cheapest)

Do blind people take photos?

- YES! With similar reasons to sighted people
  - To find out what is going on
  - To share experiences, record important events
- But of course it’s challenging
  - Sighted help (email)
  - Public services (VizWiz, oMoby)
  - Usually the quality is poor
- More work on photo taking, but about photo sharing and organizing?

Blind Photography Project: Phodio

- Technical goal:
  - Helping photo browsing without sight using smart phone accessibility features (ex: VoiceOver)
- Design goals:
  - Organize photos to allow for fastest photo browsing by blind users
  - Provide information about photo beyond GPS and head counting
  - Provide tools to assist in aiming camera
Phodio

- Designed specifically for users who are blind (secondarily for sighted users)
- Users can capture a frame of time for personal enjoyment, as well as to share with others
  - Users take a photo with audio, time, date and location is saved with photo
  - Face detection to assist in photo aiming
- Users browse photos by listening to audio, accessing time, date, and location.
- Users can send photo to a crowdsourcing service to ask a question and receive an answer about the photo