Smart Phone Technology
Poll 1

How do you serve patients with vision impairment?

A. Optometrist
B. Ophthalmologist
C. Vision Rehab Teacher
D. TVI
E. O&M
F. OT
G. Social Worker
H. Other
Categories of Low Vision Technology

• Video/Digital Magnification (i.e. CCTV)
• Computer-Based
• Smart Phone and App-Based
• Augmented Reality
• Tech for Students
• Sensory Substitution
• Mainstream Tech with Applications in LV
Smart Phone/App Based Accessibility
Poll Question 2

What type of cell phone do you use?

a. iPhone
b. Android
c. Something else
Cell Phone Accessibility: Built-In Features

• Voice Activation
  (available even on flip phones)
Android Accessibility
Android Accessibility: Display Modifications

• Increase overall size of the display
• Increase font size
• Use magnification (either always on or as a shortcut)
  – Triple tap to magnify
• Magnification goes up to 8X

• High contrast text (still under development)
• Color inversion
• Dark mode
Android Accessibility: Talk Back

• Highly customizable
• Braille keyboard connectivity
• Single finger gestures are on all android devices
• Multi finger gestures are included in newer updates
• Key features:
  – Screen search
  – Switching languages with gestures
  – Hide/show screen (for privacy)

• Reading Controls
  – Characters: Read character by character.
  – Words: Read word by word.
  – Lines: Read one line at a time.
  – Paragraphs: Read one paragraph at a time.
  – Headings: Jump to the next or previous heading, if available.
  – Controls: Jump to the next or previous items, like buttons, checkboxes, or text fields.
  – Links: Jump to the next or previous link.
  – Speech rate: Change how fast TalkBack speaks.
Additional Android Features

• Time to Take Action
  – Lets you adjust the time to show messages that need action (i.e. codes that pop up)

• Lookout
  – Info about surroundings with 5 different modes: text, explore, food labels, documents, currency (US only)
  – Multiple languages available: Bengali, Czech, Danish, Dutch, English, Filipino, Finnish, French, German, Hindi, Hungarian, Indonesian, Italian, Norwegian, Polish, Portuguese (Brazil), Romanian, Slovak, Spanish, Swedish, Turkish, and Vietnamese
  – Set country/language for most effectiveness
Android Accessibility

- Will vary by device and software version
- https://support.google.com/accessibility/android#topic=6007234

- Android Accessibility Suite
  - Can be downloaded if not already available on the device
iPhone Accessibility
iPhone Accessibility: Display Modifications

- Color filters and button shapes can be customized
- Text/fonts can be enlarged and made bolder. Will carry over to any apps that support this
- Magnifier (works much like a portable video magnifier)
- Dark mode
- Smart inversion
- Overall screen zoom
iPhone Accessibility: Speech

- VoiceOver—most sophisticated screen reader
- Rotor controls for easier webpage navigation (functions like a trackpad)
- Braille screen input is available on the iPhone screen
- Can also be connected to Braille keyboards
- Speak Screen (available in 35 languages)
- Can control pace of reading precisely
- Audio descriptions available in iTunes and Apple TV
- Photo/image descriptions
There’s an app for that!
Apps that Magnify

• Does it do more than just access the light and camera?
• Font adjustments?
• Contrast Adjustments?
Apps that Magnify: Examples

★ Magnifying Glass + Light (free or $1.99 for premium)
★ SuperVision + (with image stabilizer)
★ Bigger and Better (free)
★ Many others available
DEMO

• Supervision+
Apps that Read Out Loud

• Zoom Reader
• Voice Dream Reader
• Text Detective
• Prizmo Go
Apps for Daily Living

- LookTel Money Reader
- Eye Note (US $ only)
- IDEAL Currency Identifier (Android Only)
- US Currency Reader (iBill)
Apps for Daily Living

Color Identification Applications

• Color ID Free
• Kolorami

Product Identifiers/QR Readers

• Digit-Eyes
• Ideal Talking Tags
• TapTapSee
• iDentifi
Apps with Multiple Functions

- KNFB Reader Mobile App ($$$)
- Seeing AI (free)
- Aipoly Vision
- Envision AI
Our challenge Sensotec was founded in 1986 as a company active in the development of aids for blind children, their parents and teachers in mainstream education. We have since grown into a business with 35 employees, operating from 3 sites. Over the
Seeing AI Demo
Apps Relying on Sighted Users

• Aira: demo
• Be My Eyes
• Be Specular
News and Information Apps

- NFB Newsline
- BARD Mobile
Head-Mounted Displays/Augmented Reality
Poll Question 3

Do you have access to head-mounted displays in your clinic?

a. Yes
b. No
c. Not sure
Head Mounted Displays: History

• Started in 1994 with the LVES
• Joint effort between Johns Hopkins (Bob Massof, PhD) and NASA
• Limitations of the tech
  – Low resolution (only able to create 20/100 vision)
  – Weight/Size
  – Lag time/Computing power
  – Cost/Acceptance
# Head-Mounted Displays

Manufacture specifications of head-mounted video display low vision enhancement systems.

<table>
<thead>
<tr>
<th></th>
<th>Vistionix LVES</th>
<th>Jeryl</th>
<th>SeeBOOSTER</th>
<th>slight 3</th>
<th>NeEye</th>
<th>Cyber Eyez App</th>
<th>Iris Vision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (USD)</td>
<td>$5,000 (in 1994)</td>
<td>$1,620</td>
<td>$3,500</td>
<td>$8,995</td>
<td>$5,995</td>
<td>$1,997 (software only)</td>
<td>$2,500</td>
</tr>
<tr>
<td>Weight (grams)</td>
<td>992.2</td>
<td>256</td>
<td>25 (plus the weight of eyeglasses)</td>
<td>104</td>
<td>125</td>
<td>371.4</td>
<td>425.2</td>
</tr>
<tr>
<td>Binocularity</td>
<td>Binocular</td>
<td>Cyclopean&lt;sup&gt;+&lt;/sup&gt;</td>
<td>Monocular</td>
<td>Cyclopean&lt;sup&gt;+&lt;/sup&gt;</td>
<td>Cyclopean&lt;sup&gt;+&lt;/sup&gt;</td>
<td>Monocular</td>
<td>Cyclopean&lt;sup&gt;+&lt;/sup&gt;</td>
</tr>
<tr>
<td>Display resolution</td>
<td>~640 × 480</td>
<td>~640 × 480</td>
<td>~800 × 600</td>
<td>~1024 × 728</td>
<td>~1280 × 730</td>
<td>~960 × 480</td>
<td>~960 × 480</td>
</tr>
<tr>
<td></td>
<td>~5 armin pixel</td>
<td>~2.8 armin pixel</td>
<td>~2.25 armin pixel</td>
<td>~2.7 armin pixel</td>
<td>~1.6 armin pixel</td>
<td>~1.9 armin pixel</td>
<td>~1.9 armin pixel</td>
</tr>
<tr>
<td></td>
<td>~20/100 Snellen equivalent</td>
<td>~20/16 Snellen equivalent</td>
<td>~20/45 Snellen equivalent</td>
<td>~20/44 Snellen equivalent</td>
<td>~20/28 Snellen equivalent</td>
<td>~20/37.5 Snellen equivalent</td>
<td>~20/65 Snellen equivalent</td>
</tr>
<tr>
<td>Magnification</td>
<td>1.5–12X</td>
<td>1–14X</td>
<td>1.4–7X</td>
<td>1–24X</td>
<td>0.6–12X (with additional optical lens)</td>
<td>1–15X</td>
<td>1–4X</td>
</tr>
<tr>
<td>Field of view (Horizontal × Vertical)</td>
<td>50 × 40 degrees</td>
<td>30 × 17 degrees</td>
<td>30 × 22.5 degrees</td>
<td>37.5 × 28 degrees</td>
<td>30 × 17 degrees</td>
<td>20 degrees</td>
<td>70 × 50 degrees</td>
</tr>
</tbody>
</table>

*Viewing the same image with both eyes, no disparity.

Pictures are the authors' photographs unless otherwise referenced below:
- Visionix LVES: [https://en.unc.edu/vsu/web/product](https://en.unc.edu/vsu/web/product)
- SeeBoost: SeeBoost product brochure
Head-Mounted Displays

- Optical vs digital zoom?
- Battery life?
- Weight?
- Updates?
- Rx/Focusability?

- Full screen vs partial mag?
- Mobility
- Edge enhancement/contrast enhancement?
- Cost?
Current Issues in Augmented Reality

- LV devices can get regulatory (i.e. FDA) approval without clinical data
- Marketing can be deceptive “Vision will be restored”
- Human interest stories “Blind patient sees again!”
- Awareness of “standard” low vision devices is limited
- Cost
- Emergence of similar features on smart phones but not nearly as refined
Head-Mounted Displays

• E-Sight
• Jordy 3
• IrisVision

https://www.youtube.com/watch?v=hqoML4p-8kw
OrCam

OrCam
- Camera that can be mounted on most glasses
- OCR
- Facial recognition (can store up to 100 faces)
- Product recognition (can store up to 150 products)
- Currency identifier
Smart Assistants

- Amazon Echo ($150)
  - Echo Dot ($50)
- Google Home ($99)
- Apple HomePod ($300)

- All require Wifi
- Can make calls if enabled
- Can connect to lights/thermostat/etc in a connected home
- Encryption/privacy?
The Future
Artificial Vision: Argus II

- Electrical stimulation of the retina to induce visual perception
- Camera on glasses captures an image → video is sent to computer/processing unit → information is transmitted wireless to an antenna in the retinal implant → electrical information stimulates functional retinal cells
- Humanitarian Use Device
Argus
Argus
Questions?