Our mistakes are invisible: What designers can learn from the experiences of visually impaired users about approaching smart technology.

Blind users have a great interest in smart technology. It can offer more personal autonomy and convenience, and can be an appealing alternative to costly assistive technology. Smartphone apps for navigation and image-to-text reading provide users with information about their environment, and smart products in the home replace devices that were difficult or impossible to operate.

However, many smart devices themselves are difficult or impossible to operate for blind users. It seems like disabled users are often forgotten in the development of these products, unless they are the sole target group. Although specialized tools to aid visually disabled users are useful and desirable, broader accessibility in smart technology is essential for their digital inclusion and social participation.

There are many guidelines and initiatives to increase digital accessibility for visually disabled users, but these mostly concern making software and web design compatible with assistive technology and accessibility software. Resources such as The Inclusive Design Toolkit provide a structure for designers to expand and evaluate the accessibility of their work.

Both of these emphasize accessibility for a wide range of users, including those with disabilities, rather than placing an exclusive focus on visually disabled people. A common argument for this approach is that by more accessibility increases the usability for all users.

Although these guidelines are available to designers, the problem still persists: a lot of smart technology is inaccessible to blind users. This research project aims to provide insight into the specific elements that make these designs inaccessible to blind users, and how the current approaches of designers facilitate these elements. This is used to create guidelines for practices that promote the development of inclusive design for blind users.

Methods

This project consists of a literature study concerning accessible design, interviews with blind users of smart technology, and an evaluation of the proposed guidelines with smart home technology concepts from student projects.

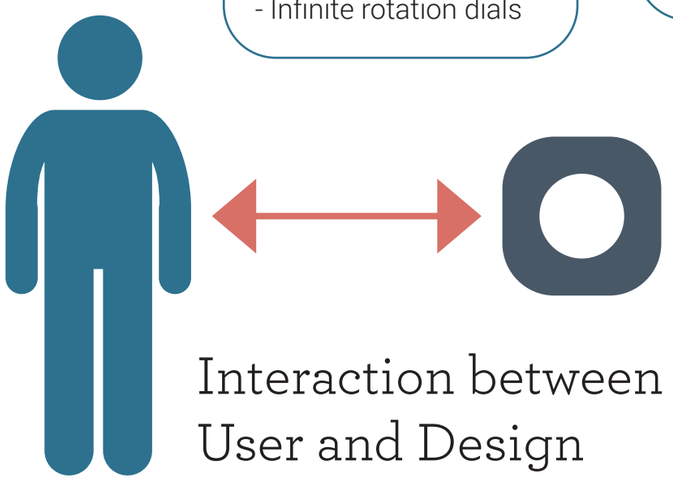
What specific accessibility problems do blind users experience?

Only visual feedback

- Silent
- No haptics
- Touchscreens and touch sensors
- Infinite rotation dials

Lack of orientation features

- Smooth design
- No physical buttons or no button textures



Interaction between User and Design

No accessibility settings to enable...

- Sounds for notifications and error messages
- Touchscreen content read out loud
- Alternative interaction options such as vocal commands and shortcuts.
- Haptic feedback

Limited feedback

- Not all information is observed
- Memorization and practice needed
- Guesswork

Complex interactions

- Multiple actions needed
- Changing values ascribed to buttons etc.

Solutions

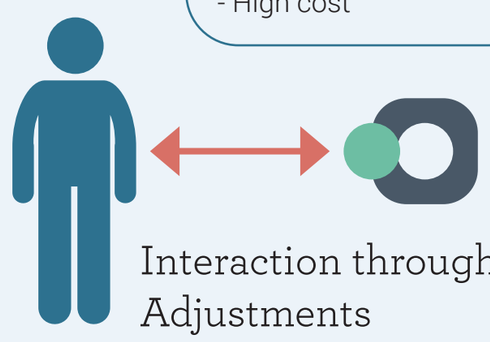
Adjustments can be made to the design itself to increase usability, such as tactile markers or sound chips.

Practical limitations

- No adjustments can be made
- High cost

Adjustments are insufficient

- Only orientation features or feedback features
- See: Limited feedback



Interaction through Adjustments

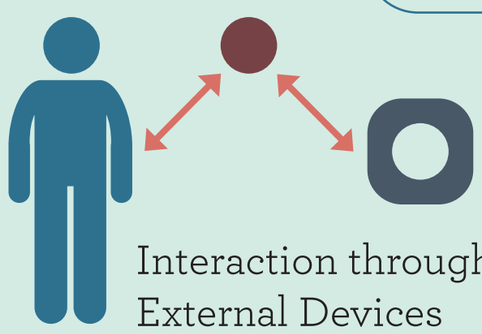
No alternative controls possible

- Design cannot be controlled externally
- Design cannot interface with usable devices

External devices can be used in place of direct interaction with the design. Smartphone apps, smart home assistants, and remote controls are alternative methods to operate the design.

Inaccessible controls

- Smartphone app is (partly) inaccessible for screen reading
- Remote control (partly) lacks useful orientation and feedback information
- Limited external controls



Interaction through External Devices

The influence of designers

We don't take the usability of disabled people into account

Our "standard" user is not disabled, therefore accessibility is often a low priority. We don't seek out accessibility guidelines and toolkits because they are not relevant to our goals, and the tools and methods we use don't demand accessibility.
However: Accessible design principles generally make design more user-friendly.

We want code finished fast

Minimum viable products, design sprints, and hackatons encourage fastly constructed code that cuts corners and skips accessibility testing. Common flaws are unlabeled or wrongly labeled objects, that pose no problem in a visual interface but do for screenreading software.
This type of code is difficult to work with on a long-term basis. This also means later changes to increase accessibility are difficult.

We focus on one perfect interaction method

Striving to first create one perfect method of interaction for a smart product seems practical, but is also limiting. Allowing multiple interaction alternatives and compatibility with many devices enables a wider possibility for integration in the smart home. Taking the possibilities of multiple interaction methods into account early on in the process can also ensure freedom of choice between different interaction methods for the user, which can help improve the user experience.

Where to go from here? (preliminary)

In an ideal situation designers would suddenly start using accessible design toolkits, work according to accessibility guidelines, and test with disabled users. In practice this is not a realistic expectation.

The next step is to create an evaluation of accessible practices and guidelines from the experiences of both designers and blind users of smart technology. This consists of a few "golden rules" and assessment criteria regarding communication methods, design principles, and hands-on testing.

If we consider the unique perspective of blind users as an evaluation of core principles of usability. The communication between user and design needs to be examined: What and how is information exchanged, and is this inuitive and understandable? If not, how can we make them clear?

"Golden rules" for accessibility would include the avoidance of complex interactions, the inclusion of alternative methods of interaction, and physical orientation features. These "golden rules" will be created through further design accessibility assessments.

DIGSIM
Designing for Growing Systems in the Home

Name student: Merel Vermeeren
Coach: Lenneke Kuijer
Type of project: M1.2 Design Research