



# Tech - what's new?

A pilot study with three disabled people exploring three connected products

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## Executive Summary

Rica was commissioned by the 4814 Trust to investigate whether connected products can help older and disabled people live more independently. Participants were given three of the latest connected products on the market: **the Apple Watch, the Amazon Echo and some Hive home automation products** (Hive active plug, Hive motion sensor and Hive active light bulb). Connected products are products linked wirelessly to a smartphone, allowing the user to control the operation of that product via their smartphone touch screen or using voice recognition technology.

The aim of this research was to uncover some of the issues which support, or do not support, disabled people when they use this technology.

Three participants who felt comfortable using technology were selected through the RicaWatch panel. This included two older and visually impaired participants and one participant with Multiple Sclerosis (MS). These people were given each of these products for a ten-day period to see how they could be of use to them. One of our researchers spent some time with them to help set up the products' features and explain how they might be used.

Five themes were uncovered from our findings, highlighting the main issues with using connected devices (not in order of importance):

1. **Privacy:** Can connected products reveal secrets about those around you which you would not have known otherwise?
2. **Accessibility (product and person):**
  - Are there features of these products which are not accessible?
  - Do these products make disabled users' environments more accessible?
3. **Self-efficacy/achievement:** Do connected products give disabled users a sense of achievement?
4. **Perceived usefulness:** If people find these products useful to them, will they engage more with them?
5. **Trust:** Can users trust the information given by these products? What is the impact on disabled people of mistrusting information from these devices?

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## Acknowledgement

Rica is grateful for the support of the 4814 trust, which funded this project. Rica especially wishes to thank its RicaWatch consumer panel members who tried out these connected products at home and attended our focus group.

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## Rica

Research Institute for Consumer Affairs (Rica) specialises in consumer research with older and disabled consumers. Founded through the Consumer's Association, publishers of Which?, Rica became independent in 1991.

Rica has its own [Consumer Panel – the RicaWatch panel](#) – of over 700 people and is a disability-led organization. Ten of the charity's twelve Trustees have a disability. Rica carries out [commissioned research work](#) with industry, other charities, service providers and policy makers to improve products and services. With grant funding Rica also publishes free [consumer reports](#) based on independent research.

See more at Rica's website: [www.rica.org.uk](http://www.rica.org.uk)

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## 1.1 Introduction

The role and scope of smart appliances in the home (washer, dryer, refrigerator, dishwasher, fridge, freezer, air conditioner, vacuum cleaner and so on) is on the increase with the market being estimated to have a year on year compound growth of slightly over 15%<sup>1</sup>. By the year 2020 the global value of this market is projected to be over 37 billion USD. This growth is reflected in the broader Internet of Things (IoT) market, where it is predicted that by the year 2020 there will be just under 30 billion connected end-point devices, from cars through to toasters.

Connected devices, when coupled with smartphones, hold enormous potential for older and disabled people by enabling them to engage more with everyday objects. Such devices can provide them with useful tools to assist them in their daily lives and facilitate independent living. For example, home automation products (such as lights or activity monitors) can help those who are blind or partially-sighted easily control their appliances by simply touching a button on the screen of their smartphones. Similarly, voice activated technology can enable those with mobility or dexterity impairments to control household appliances that otherwise would be difficult to reach, such as lights, thermostats or cookers. Smart home technology can also serve as a memory aid for people with cognitive impairments or as an activity monitor for caregivers or family members. Connected devices not only inform users of the status of their appliances but also provide them with a means of remotely controlling them. Such devices therefore offer much potential to make inaccessible appliances accessible to older and disabled people.

The aim of this research was twofold: firstly, to better understand how connected products might be appropriated by disabled people and secondly, to engage disabled people in a conversation about their wants and needs for this technology.

To do this we undertook a short explorative pilot study over three months during the summer of 2017. We selected three connected products: Apple Watch, Amazon Echo and Hive home automation kit (lights, motion sensor and plug) and gave them to three carefully-selected disabled people, known for their positive attitude towards technology, to take home and investigate.

In this report we document the pilot study process, what was uncovered during the home trials, and engagement material that came from this work.

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<sup>1</sup> Bloede, K., Mischor G., Senan, A., Koontz, R. "The Internet of Things". Woodside Capital Partners. 2015.

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## 2.1 Method

### 2.1 Overview

The appropriation of new information technology by users is closely connected to the affordances<sup>2</sup> or the possible uses of the technology. If a technology assists users to find usefulness then it's more likely to succeed. This is clearly the case with connected products where the usefulness of combinations of connected products can be seen as advantageous once discovered, but they are not always apparent.

For example, when someone first configures an Amazon Echo to wirelessly connect to an internet enabled light bulb and use it to remotely switch the light on with a voice command, it literally is a 'light bulb' moment. It shows the new user what is possible and also other future options that, at first, may not be easily apparent. However, once discovered and carried out successfully, the result can offer significant help for people with mobility or visual disabilities.

The purpose of this research was therefore to explore how internet-enabled connected products that are currently on the market might be used by older and disabled people. We wanted to find out what these products could do, how they might be configured, and what impact, if any, they would have.

Participants were given the Apple Watch for a ten day period, after which they were given the Amazon Echo **and** some Hive home automation products for a further ten day period to see how they could be of use to them. The three products were:

- **The Apple Watch:** A smartwatch that incorporates fitness tracking and other health-related behaviours while integrating iOS and other services that feature on an iPhone. The Apple Watch is entirely dependent on a wirelessly connected iPhone to perform functions such as calling and texting.

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<sup>2</sup> Donald Norman, *The Design of Everyday Things*, ISBN 0-465-06710-7. Originally published under the title *The Psychology of Everyday Things*, often abbreviated to *POET*.

- **The Amazon Echo:** A voice activated home assistant that is equipped with a microphone and speakers that is able to answer questions (such as about the weather) and respond to requests (like setting alarms, playing the radio, news updates). The Amazon Echo operates through the Alexa app which works on any smartphone or tablet and connects the speaker to Wi-Fi. It can also be used to activate smart home devices such as Hive products.
- **Hive active light; Hive motion sensor, Hive active plug:** Smart home devices that operate on an interconnected system that links to a central hub (Hive hub) connected to the internet. Users can remotely control or monitor Hive products through a Hive app on their smartphone, tablet or laptop. Products given to participants included a Hive active light bulb; a motion sensor that detects movement whenever someone enters or leaves a room; and an active plug that allows users to remotely control any electrical device plugged into it.

## 2.2 Participants

Three participants who own an iPhone and feel comfortable using technology were selected through the RicaWatch panel:

- **Mike:** An active 67-year-old ex-Paralympian who has been blind since early childhood. Mike was interested in the health-related features of the Apple Watch such as the activity and heart rate monitor. He also hoped that the Amazon Echo would provide him with more flexibility when obtaining information online.
- **Christine:** A 72-year-old partially sighted former history teacher. Christine was interested in finding out if the Amazon Echo could facilitate her daily routine and whether it could provide useful reminders (shopping lists, appointments, chores). She was also interested in the GPS feature of the Apple Watch.
- **Denise:** A 38-year-old woman with Multiple Sclerosis (MS). Given that she has dexterity difficulties, Denise was particularly interested in how the Amazon Echo and Hive could enable her to carry out tasks such as turning on lights 'hands free' and in voice activation. She was also interested in using the Apple Watch for travelling on the London Underground and as a way of making a payment (Apple Pay).

One of our researchers spent some time with each of the participants setting up some of the devices and explaining how they might be used.

## 2.3 Data collection

Having given consent, participants were given pre-questionnaires to complete before receiving each connected product. They were asked questions about their current use of technology, what they hoped these devices might do for them, and if they felt that there were any barriers when using such devices.

During the ten-day period, we collected product use logs and observed some of the participants' data from the Amazon Echo Alexa and Hive apps.

Following the ten-day period, participants then completed post-questionnaires on how comfortable they felt using each connected product; what apps or features they mostly used; what features they found most useful; and how each product helped them throughout the day.

## 2.4 Group discussion/interview

After having used these connected products, participants took part in a recorded group discussion to share their experiences and thoughts on the products' features and to suggest how the products might be improved.

The group discussion was led by an interviewer who touched on specific areas of interest. Participants were asked the following questions:

1. What features of the devices did you feel were the most useful?
2. Were there any features that made it easier for you to do things during the day?
3. Did you trust the responses you got from the devices?

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## 3.1 Results

### 3.1 Overview

Five emerging themes that highlight the main issues with using connected devices were identified from the study findings. To reflect each of these themes, we focused on several examples of how the participants used the devices.

The following results are presented by theme: privacy, accessibility, self-efficacy/achievement, perceived usefulness and trust. These results are the findings generated from post-questionnaires and the group discussion/interview. Although the themes are different, it is important to note that they are not mutually exclusive.

### 3.2 Privacy

One of the themes that emerged from the group discussion concerned privacy. Can connected products reveal information about you, or those around you, which otherwise you would not have known?

#### Example

The Hive motion sensor detects motion in your home and will alert your smartphone if anyone or anything is moving about unexpectedly. Two of our visually impaired participants reported using the Hive motion sensor to discover that their guide dogs had been up to no good...

For example, Mike had been finding hairs on his living room chair and discovered that his dog Izzy had been going up on it during the day.

***“I put the sensor on the speaker in front of the chair and then managed to track all the motion that she [Izzy the guide dog] was then doing” – Mike***

Similarly, after suspecting that her guide dog May had put on weight, Christine used the Hive motion sensor to discover that she had been sneaking into the kitchen late at night to eat from the bin.

Figure 1 Privacy



This suggests that one of the potential benefits of using connected devices at home is improved security for older and disabled people. A deaf person may not hear a break-in or a visually impaired person may not see it, but a motion sensor might compensate for that by alerting users through their smartphones in the event of a break-in or suspicious movement. Additionally, motion sensors might benefit relatives or caregivers by allowing them to monitor older and disabled people's daily routine. For example, a sensor might alert a caregiver when a person gets out of bed, or a sensor placed inside a fridge might record when and how many times the door was opened and closed.

### 3.3 Accessibility

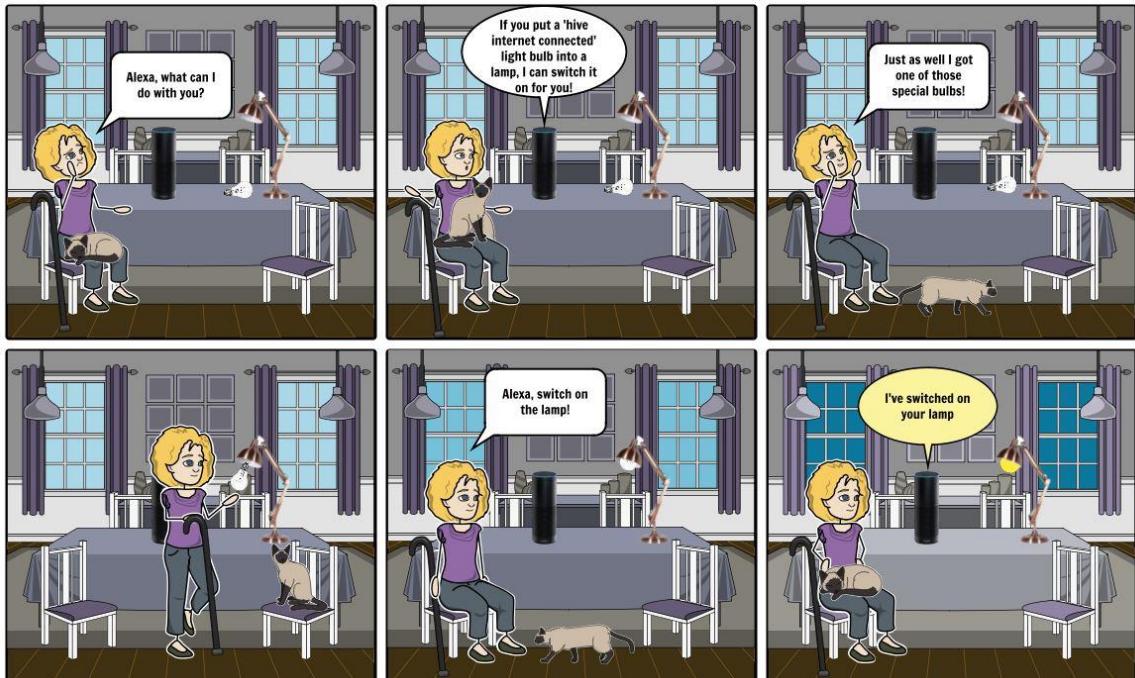
From the group discussion, there was evidence to suggest that connected technology can make older and disabled people's environments more accessible to them. One of the main benefits of using the Amazon Echo paired with Hive products was that it allowed participants to remotely control appliances that otherwise might be inaccessible to them, such as lights and plug points.

#### Example

Denise has MS and found using the Amazon Echo paired with the Hive active light and active plug allowed her to easily control appliances which normally would be difficult to reach or might put her at risk of falling.

***"I have a lot of dexterity and mobility difficulties... I could use voice activation [with the Amazon Echo] for turning lights on and off and for switches... the voice activation, hands free nature of the Amazon Echo was really useful" – Denise***

Figure 2 Accessibility (person)



For Mike and Christine, who are both visually impaired, the voice activation feature of the Amazon Echo made it a lot easier for them to access information and carry out tasks such as setting timers , changing radio stations or requesting news updates.

***"You're not trying to find your phone, trying to get out your computer...it could be sitting there on your work surface... and you talk to it and it adds things to different lists ... I find it very good, it saves time and it's stress busting!" – Christine***

Although there was evidence that connected products can make older and disabled people's environments more accessible to them, our visually impaired participants found features of the Apple Watch not accessibility-friendly.

*"I found the combination of my impairments made the watch a real access no no ... So from a visually impaired perspective the Apple Watch wasn't great for me, Mike or you Christine" – Geoff [Interviewer]*

For example, our visually impaired participants reported that the features of the Apple Watch were not as accessible as those on their iPhones, arguing that the screen size was too small and that the haptic feature was not as effective or consistent on the watch.

*"The Apple Watch met my expectations but not accessibly" – Mike*

### 3.4 Self-efficacy<sup>3</sup>

An important motivating factor for users of connected products is whether the product's features support users' self-efficacy or sense of self-competence. Previous research has shown that the more a product strengthens users' sense of achievement or self-efficacy, the more motivated they will feel to use it. This was evident in our findings.

#### Example

Denise and Christine both reported that the Apple Watch made it easier for them to accomplish tasks such as answering calls.

*"When I am out and about... and the phone rings, I usually have to stop, go to the side of the pavement, lean my crutches against the wall, go through my bag ... so I found the Apple Watch really useful because it was to hand" – Denise*

There was also evidence to suggest that the health related features of the Apple Watch might strengthen users' self-efficacy. For example, Mike, who regularly goes to the gym, found that the activity and heart rate monitor of the Apple Watch provided motivational support when exercising.

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<sup>3</sup> Psychologist [Albert Bandura](#) has defined self-efficacy as one's belief in one's ability to succeed in specific situations or accomplish a task

Figure 3 Self-efficacy



### 3.5 Perceived usefulness

One of the strongest predictors of technology acceptance and adoption is perceived usefulness. Research<sup>4</sup> has shown that the more useful a user perceives a connected product to be, the more likely it is that they will continue to use it. Our findings were consistent with this.

Opinions on the perceived usefulness of the Apple Watch were mixed, which explains why some participants did not use or engage as much with it.

#### Example

*"Apart from the calorie counter ... my phone can virtually do the same ... and it's easier because it's so tiny the watch ... easy to make mistakes"* – Christine

Both Mike and Christine reported that they had abandoned the Apple Watch during the ten-day trial period as they did not perceive it to be useful to them. This could be attributed to the fact that from a visually-impaired perspective, the watch was not accessibility-friendly (small screen size; lack of consistency with haptic feature).

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<sup>4</sup> [The Impact of Technological Trust and Self-Determined Motivation on Intentions to use Wearable Fitness Technology](#). Michael A. Rupp, Jessica R. Michaelis, Daniel S. McConnell, Janan A. Smither. Proceedings of the Human Factors and Ergonomics Society 2016 Annual Meeting.

***"I found the Apple Watch hard to negotiate with" – Christine***

Participants also emphasised the need for more instruction on how to use the Apple Watch. If participants had been more aware of the services or features on offer they might have perceived the product to be more useful.

***"One big issue was the amount of information it would have been useful to have ... none of us had enough information about how to use it, what it did" – Mike***

However, from a mobility-impaired perspective, the Apple Watch was useful in terms of checking texts or answering calls while on the go.

***"I find it really useful for checking texts and messages that have come through" – Denise***

On the other hand, all participants appeared to have been engaged in using the Amazon Echo. Participants agreed that the voice activation feature and 'hands-free' nature of the Amazon Echo were very useful from both a visual and mobility impaired perspective.

***"The flexibility of note taking, reminding me to change a library book, asking the time, the radio station, news... was very useful [Amazon Echo]" – Mike***

For Denise, the Amazon Echo was particularly useful when paired with the Hive active light as it allowed her to remotely turn lights on and off by simply using voice activation.

***"It was very useful as it meant that I didn't need to bend down to switch the light on [Amazon Echo and Hive active light]" – Denise***

However, for Mike and Christine, who are both visually impaired, the Hive active light did not serve any use as they have little or no light perception.

***"It [Hive active light] wasn't much good for me. I didn't need it ... it wasn't necessary" – Christine***

Overall, this suggests that perceived usefulness is crucial if the product is to provide any ongoing benefits to older and disabled users. In order for connected products to be adopted and engaged with, the technology has to meet the users' needs.

## 3.6 Trust

Another important factor to consider when using connected devices is trust. Can users trust the information given by these products? What is the impact on older and disabled people of mistrusting information from these devices?

Our findings indicated that the more participants trusted a connected device, the greater their user experience and satisfaction with the product. For connected products to be adopted and used, users need to be provided with transparent and accurate information that can be easily understood. Failure to provide transparent or accurate data can make older and disabled users less trusting of the device and may result in them abandoning the product. Trust was an important predictor of whether participants engaged with the products or not.

### Example

In terms of the Apple Watch, participants reported having several trust issues with some of its features. For instance, Christine argued that there was a lack of clarity and accuracy with the information provided by the GPS feature of the Apple Watch.

***“It [GPS] wasn’t clear for me … I wouldn’t trust it. For getting to a destination I wouldn’t touch it, I would be too worried it would fail me” – Christine***

Additionally, Denise questioned whether she could trust using Apple Pay on the Apple Watch.

***“I trusted it [Apple Watch] most of the time … but think there was an air of sense checking. There were times that I would think, how easily could this be hacked?” – Denise***

On the other hand, participants appeared to trust the information provided to them by the Amazon Echo. However, they did note that the Amazon Echo was not always able to respond to certain requests.

***“The Amazon Echo was very good … if it didn’t understand what you were asking it says ‘I don’t understand’ … it was very time saving for me and I trusted it … and I enjoyed it” – Christine***

Overall, these findings show that in order for older and disabled people to use a connected device they must be able to trust the information provided to them by the product and be reassured that any data or personal information collected by the product is safely stored.

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### 3.1 Comment

This explorative research uncovered some of the key issues that need to be addressed in order to maximise acceptance and uptake of connected products for older and disabled people. These issues are well documented in mainstream research but their application to older and disabled people uncovers several problems:

- How do you influence the design of connected products to uncover ‘perceived usefulness’ if older and disabled people are not actively involved in the direction of the design?
- Achieving a sense of self-efficacy using an inaccessible product is difficult, if not impossible.

Engaging older and disabled people in discussions about possible uses for combinations of connected technology is crucial in order to harness the potential of these technologies to their needs and wants. Without this engagement in developing meaningful ‘use cases’, improvements of both product and environmental accessibility will be reactive and slow.

These ‘use cases’, or useful combinations of connected technology, do not appear overnight but emerge over time with familiarity with these products. It is with this in mind that an extended trial of these products, by a range of disabled people, is needed. It is thought that living with these products for a period of six to nine months will encourage creative use of combinations of technologies.