Inclusive fitness equipment for people with a visual impairment

rica

TPT
Thomas Pocklington Trust
for people with sight loss
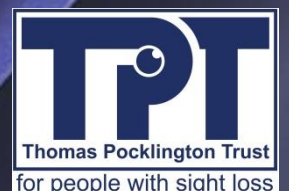
Contents

Executive Summary

The project was commissioned by Thomas Pocklington Trust and conducted by Rica (Research Institute for Consumer Affairs).

Our research objective was to investigate the development and provision of electronic fitness equipment for visually impaired users, with a specific focus on the accessibility of screen based consoles, and the needs and experiences of users. Equipment investigated included treadmills, cross trainers, exercise bikes and rowing machines.

To achieve this there were three elements to our research:

1. **Market research** – desk research and four visits to fitness equipment showrooms and exhibitions.
2. **User experience research** – three usability workshops and focus groups with 20 blind and partially sighted users, and a further 20 telephone interviews.
3. **Industry liaison**: Four industry interviews with experts from the fitness sector.

<ins>Findings</ins>

Participants found LED consoles, which feature tactile buttons and a fixed display, moderately more accessible than LCD touchscreen consoles. Overall, the average pass rate of LED consoles was 67% compared to 56% for touchscreen consoles. Participants found consoles more accessible if they featured tactile buttons, audio output, colour contrast and block colours. Participants unanimously agreed that there was a need for voice-over on all console types.

Use of cardiovascular fitness equipment had a substantial impact upon users' lives, including improvements in everyday fitness and mental health. However, participants found accessing fitness equipment and wider facilities challenging. This was due to the built environment and the customer service users received. Overall, the equipment, facilities and services for visually impaired users were largely inconsistent.

Industry liaison indicated that the barriers to the development of accessible fitness equipment were cost, industry culture, a lack of awareness of visually impaired users' experiences, and a reliance on Inclusive Fitness Initiative (IFI) standards from English Federation of Disability Sport (EFDS), which some manufacturers and gym operators have become disengaged with (see page 12).

<ins>Recommendations</ins>
1. Introduce audio output and voice-over technology for electronic fitness equipment.
2. Develop a best-practice guide for manufacturers outlining the design features most appropriate for visually impaired users.

3. Update the IFI scheme, reinforcing the case for inclusive design.
4. Product design teams to make better use of guidelines and best practice from other industries, independent organisations and governmental bodies.
5. Improve staff training and communication procedures across the fitness sector, using the NHS accessible information standards as a guide.
6. Implement a voluntary buddy scheme at all public sector leisure centres to assist visually impaired users and other disabled users.

Acknowledgement

Rica would like to express its appreciation to the Castle Centre, Ability Bow and Pancras Square Leisure for allowing us to use their facilities for the purpose of our research. We would also like to thank Metro Blind Sport and Thomas Pocklington Trust for their support and assistance throughout the project.

Rica

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

Rica has its own consumer panel – the RicaWatch panel – of over 750 people and is a disability-led organisation. 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.

Find out more about Rica's work: www.rica.org.uk

1. Introduction

RNIB research[1] has shown that 64% of visually impaired people would like to be more physically active and 57% felt that their sight loss was a barrier to being physically active. Around two million people in the UK are living with sight loss that significantly impacts upon their lives[2], with the number of people potentially denied the ability to maintain or improve their health being substantial.

The research aimed to encourage industry (manufacturers of equipment and gym operators) to develop and produce electronic fitness equipment which is inclusively designed and therefore easier to use for people with a visual impairment and consumers in general.

In particular this research investigated the accessibility and ease of use of fitness equipment consoles found on treadmills, exercise bikes, cross trainers and rowing machines.

There were three elements to the research:

1. **Market research** to identify: equipment and controls currently available; technology trends; the leading public sector gym providers; and what equipment, facilities and services are offered for visually impaired customers.
2. **User experience research** to understand:
   - needs and experiences of blind and partially sighted people
   - views about the design of control panels
   - impact on lives, health and fitness
   - views of visually impaired people when using separate accessible audio and tactile equipment interfaces
3. **Industry liaison** to uncover the barriers to developing more accessible fitness equipment and also to foster collaboration in future work.

[1] My voice 2015: Capturing the voices of the 'hard to reach', RNIB.
[2] A future everyone can see: Research strategy 2012-2017, Fight for Sight.

2. Method

2.1 Market research

Our market research included desk research and visits to fitness equipment showrooms and exhibitions.

Initial desk research assessed the current state of the fitness sector and the provisions made for visually impaired users. This included fitness equipment product information, inclusive gym facilities and accessibility frameworks. Information was gathered through online searches, email enquiries and literature reviews.

Further direct and indirect market research with industry provided a richer understanding of the market forces behind the supply and uptake of gym equipment. This was collected through industry interviews and through four showroom and exhibition visits, which aimed to identify product features which were accessible and any other fitness equipment that was easier to use.

2.2 User experience research

Our research was split into two elements:

1. Three usability workshops with 20 blind and partially sighted people investigating the usability issues of cardiovascular equipment control interfaces in three different fitness centres.
2. Three focus groups[3] and 20 telephone interviews[4] with blind and partially sighted people exploring their experiences of using gyms and fitness equipment.

2.2.1 Usability workshops

Workshops were carried out in London during July 2017. Two took place at local authority leisure centres, with one other taking place at a specialist disability gym.

Participants were split into pairs, each group testing three different types of cardiovascular fitness equipment[5].

To begin the usability testing, Rica researchers demonstrated how to use the fitness equipment, highlighting the main product features. Participants were then asked to complete five basic tasks in order to assess the products' inclusivity and usability.

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[3] These occurred as the second part of the usability workshops.

[4] The participants of these interviews were either active or interested in being active users of gyms and fitness centres.

[5] Fitness equipment tested - treadmill, exercise bike, cross trainer and rowing machine.

Participants attempted to complete the following tasks:

1. step on to the machine and locate the user interface
2. start the machine
3. increase the speed or resistance
4. decrease the speed or resistance
5. stop the machine

Participants were given one minute to complete each task, with each task being recorded as a pass or fail. If a participant was unable to complete a task within one minute this was recorded as a fail.

2.2.2 Focus groups

After our usability workshops participants took part in a focus group to discuss their experiences, to share their thoughts on product features, and to suggest how product inclusivity could be improved (see appendix C and D for consent form and focus group topic guide).

2.2.3 Telephone interviews

Telephone interviews were carried out with visually impaired participants, who were users or potential users of cardiovascular fitness equipment. Each interview lasted for twenty minutes.

Interviews investigated the needs and experiences of participants, including the way regular exercise impacted upon their life, as well as their thoughts on fitness equipment – both current product features and future product features (see appendix B for telephone interview topic guide).

2.2.4 Participants

We recruited from Rica's UK-wide consumer panel, RicaWatch, members of Metro Blind Sport, and industry networks.

All participants who took part in the telephone interviews, usability workshops and showroom visits had a visual impairment. Their levels of vision varied from no light perception to some partial vision. All participants were categorised by the British Blind Sport classification[6].

Participants also differed in frequency of gym visits and their level of physical activity. A breakdown of the participants' age, gender, level of sight, frequency of physical activity and use of fitness centres is given in appendix A.

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[6] Classifies blind individuals based upon their depth perception and field of vision to ensure fair competition in sport.

2.3 Industry Liaison

Four industry interviews were conducted with experts from across the fitness sector in August and September 2017. Interviews lasted approximately 30 minutes and aimed to identify the barriers that industry faces in providing inclusive fitness equipment, future industry trends, and how these may affect visually impaired users.

3. Results and findings

3.1 Market research

3.1.1 Fitness Equipment Consoles

Product manufacturers generally offer two types of console: LED displays and LCD touchscreen displays.

LED displays could be described as 'classic' consoles, with simplicity being the key component. LED displays offer a number of basic outputs and exercise measurements, such as heart rate, calories, distance, and time. LED displays often feature strong contrasting colours, with slightly raised buttons and symbols.

LCD touchscreen displays are a relatively new product introduced in the last 10 years. The first LCD touchscreen was produced in 2003; however, since that time, touchscreens have become more prevalent within the fitness industry. All major fitness equipment manufacturers offer touchscreen displays and they are now becoming more common within leisure centres and commercial gyms.

Touchscreen consoles offer the same exercise measurements as a standard LED console. However, the main aim of the touchscreen display is to create a 'captivating' work out experience, with internet connectivity allowing users to access entertainment apps, fitness apps and social media platforms during their work out.

3.1.2 Fitness Equipment and Console Information

Manufacturers produce consoles which can be attached to different cardiovascular fitness machines. Table 1 lists the different types of cardiovascular fitness equipment offered by the main product manufacturers within the UK. Although this list is not exhaustive, it does provide an overall indication of the current products within the market.

Table 1: List of console technology offered by equipment supplier

Manufacturers	Fitness Equipment	Console Info
Technogym	- Treadmill - Exercise bike - Rowing machine - Cross trainer Console features include Wi-Fi connectivity, TV tuner, and custom interface configurations to suit the individual.	- Three console options - 15.6"-19" touchscreen display - LED display with tactile features - Supported by Android technology
Life Fitness	- Treadmill - Exercise bike - Rowing machine - Cross trainer Console features include Wi-Fi connectivity, supported fitness apps and interactive courses.	- Up to six console options - 16"-19" touchscreen display - 7" LCD console with functional buttons
Matrix	- Treadmill - Exercise bike - Rowing machine - Cross trainer Console features include Wi-Fi connectivity and support custom interface configurations to suit the individual.	- Up to seven console options - 16" touchscreen display - LED display with tactile command buttons and colour contrast - Options for simplified display mode for rehabilitation and active-aging settings -
SportsArt	- Treadmill - Exercise bike - Cross trainer Console features include Wi-Fi connectivity and TV tuner, and support custom interface configurations to suit the individual.	- 15" touchscreen display - Tri-colour LED – with quick start keys

3.1.3 Technology Trends

Current technology trends within the fitness equipment market are moving towards an interactive data-driven fitness experience. The main manufacturers within the market offer machines which are Wi-Fi connected and allow the user to connect to their phone or wearable fitness accessories. Users are able to view their fitness data and track their workout progress by using apps and online websites. This follows a wider trend of personalisation in the fitness market. The increasing prevalence of touchscreens within the fitness sector is also part of an increased focus on engagement.

As yet, there is no discernible trend within the fitness sector toward audio output. Concept2, a rowing machine manufacturer, has introduced ErgChatter, a free software tool which provides audio output while the user is rowing. The software can be downloaded on to the user's PC and then connected to the rowing machine, providing regular audio updates on work-out progress. However, in terms of audio output, there is very little else on offer in the fitness sector.

There are examples from other industries which offer an insight into how inclusive design and technology could be implemented for fitness equipment. The best example of this can be found in the financial services sector, with the introduction of audio output for ATM cash machines.

In the UK a number of high street banks have installed ATMs which permit the user to access audio output features by inserting their headphones into the headphone jack. This allows users with a visual impairment to manage their money independently in a way that wasn't possible before.

Research organisations and governmental bodies also offer guidance and best practice on the types of features which would improve accessibility for self-service kiosks and other public digital interfaces similar to fitness equipment consoles. The Centre for Excellence in Universal Design[7] advocates for several product features including:

- voice output
- development of a separate audio menu
- tactile indicators on buttons, such as a dot placed on the 5 key to give users a reference point
- buttons raised or recessed by at least 2mm as a minimum
- raised edges for input slots such as a headphone jack

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[7]National Disability Authority – Centre for Excellence in Universal Design: Guidelines for public access terminals accessibility.

Moreover, as screen based consoles are becoming more prevalent in our everyday lives, governmental bodies in Australia and the USA have become concerned about the exclusionary nature of this technology. Both national governments have implemented amendments to existing legislation which attempts to ensure self-service kiosks and other public digital interfaces are accessible for all users[8]. The EU is also investigating ways to make this type of technology more accessible through APSIS4all[9], a project aimed at overcoming technological accessibility barriers for older and disabled people.

3.1.4   UK Public Sector Gym Providers

Four main management companies are responsible for manging local authority fitness centres. The largest is Greenwich Leisure Limited (GLL), which manages over 250 public fitness facilities for around 30 local councils and sporting organisations, operating under a brand called 'Better'.

The second largest management company, Sports and Leisure Management, operates under the Everyone Active brand and is responsible for the management of 140 sporting and cultural activity centres around the UK, in partnership with 40 local authorities.

Other smaller public-sector gym providers include Fusion Lifestyle and Parkwood Leisure. Fusion Lifestyle manages around 100 sports and leisure facilities on behalf of 21 local authorities. Parkwood Leisure operates under a number of different brands and separate entities such as Leisure Centre.com and Legacy Leisure. It manages around 81 sports and leisure facilities for 27 local councils.

3.1.5   Equipment, Facilitates and Services

Provision for visually impaired users varies greatly between facilities irrespective of which operator is responsible for its management. The services, facilities and equipment available are largely dependent on location. This reflects the inconsistent nature of services and facilities for disabled gym users. Most leisure centre operators offer an online search tool which indicates the services and facilities available to disabled users at each centre.

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[8] Disability Discrimination Act, 1992 and Americans with Disabilities Act, 1990.
[9] European Committee for Standardization: Identification card systems – Man-machine interface – Part 4 – Coding of user requirements for people with special needs.

The fitness sector has sought to address this inconsistency through the Inclusive Fitness Initiative (IFI). The IFI scheme is managed by the English Federation of Disability Sport (EFDS) and was initially funded by the National Lottery and later, in part, by the Department of Health, although this funding has now stopped. The IFI scheme looks to focus on four key areas: equipment, staff training, marketing and sports development.

In terms of equipment, IFI provides an endorsement scheme for fitness equipment that has been designed with inclusivity in mind. These products comply with the IFI design standards and there are currently over 100 accredited products available. All public sector management companies offer IFI-approved fitness equipment.

The IFI scheme also assists leisure centres to become more accessible. Their IFI Mark indicates how accessible a leisure centre is. Currently there are 56 gyms and leisure centres listed on the EFDS database. All four major gym operators manage facilities that are IFI accredited.

Gym operators also provide inclusive gym membership with concessionary pricing. Alternative forms of communication are also available; members can request documents and correspondence in Braille or large print. Other assistance can be provided, such as bowls of water for assistance dogs. Fusion Lifestyle 'disability ambassadors' at leisure centres can assist disabled users to access facilities and services.

3.2 User experience research – usability workshops

Figure 1: Participants using fitness equipment consoles
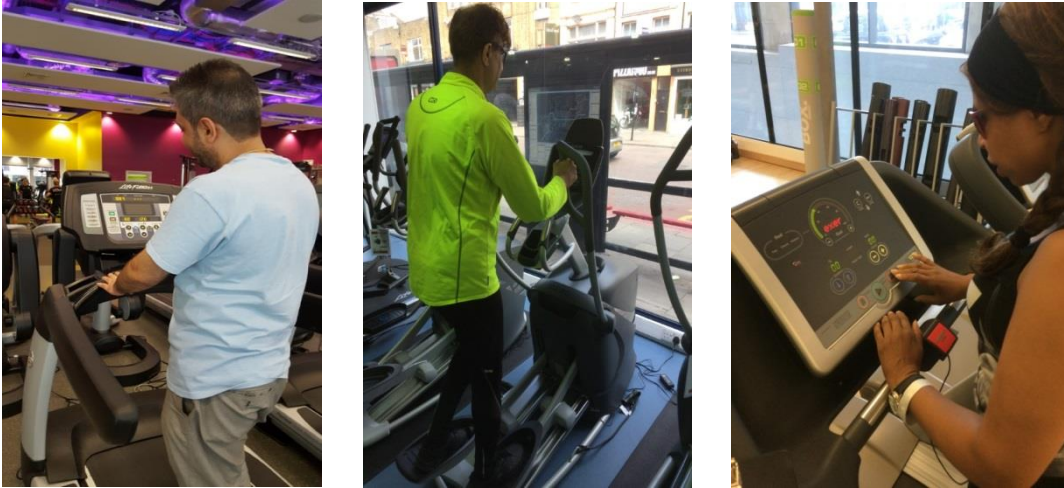
The products tested during our usability workshops were mainly produced by two manufacturers: Life Fitness and Technogym. The rowing machines were produced by Concept2. See table 2.

Table 2: Equipment tested

Number	Name	Equipment Supplier		
		Life Fitness	**Technogym**	**Concept2**
1	The Castle Centre	Treadmill Exercise bike Cross trainer		
2	Ability Bow		Treadmill Exercise bike	Rowing machine
3	Pancras Square		Treadmill Exercise bike Cross trainer	

Wherever possible, participants tested equipment which was IFI approved.

Tasks[10] asked of our participants:

1. step on to the machine and locate the user interface
2. start the machine
3. increase the speed or resistance
4. decrease the speed or resistance
5. stop the machine

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[10] Each task to be completed within one minute for a pass

3.2.1　Usability pass and fail results

A full breakdown of pass and fail results, according to console and type of fitness equipment used, can be seen in appendix E.

Participants were asked to complete five basic tasks which were seen as the very minimum a person would need to use the equipment independently. The overall average pass rate across all types of fitness equipment was 63%, with the highest pass rate achieved by any piece of fitness equipment being 77%. This was seen as disappointing, given that these tasks are sequential in nature and a failure in any one task would effectively stop the user from using the equipment.

LED consoles were found to be slightly more accessible, with an overall average pass rate of 67%, compared to the overall average pass rate for touchscreen consoles of 56%. Pass rates were also low across all types of fitness equipment including those with IFI accreditation.

Figure 2: Overall average pass rate　　**Figure 3:** Fitness equipment pass rate
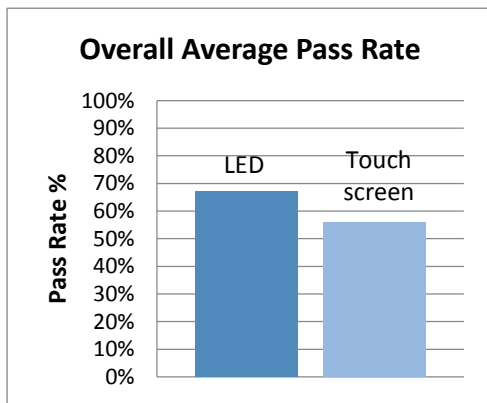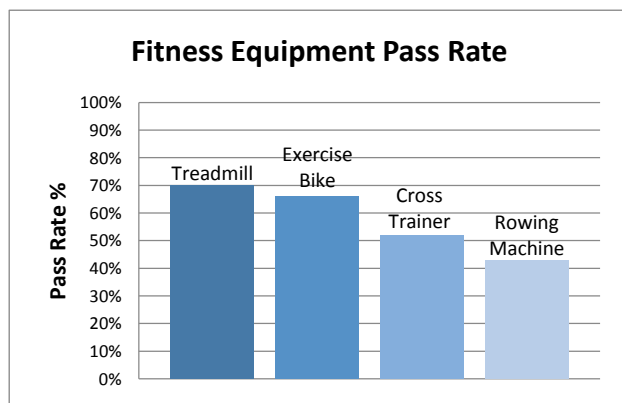
3.2.2 Product features – LED consoles

Figure 4: LED consoles

Technogym | Life Fitness | Technogym

Helpful Design Features

Overall, participants felt that LED consoles were more accessible than touchscreen consoles. There were a number of product features which enabled the participants to complete tasks and to use the fitness equipment with some independence.

Raised tactile buttons were particularly helpful, allowing participants to navigate the user interface with key reference points, such as the start button which participants could locate easily on all consoles. Participants who tested the Technogym console (see above) found the raised lip along the bottom edge particularly useful as it dipped down to the start button. From this position participants could identify where other buttons were.

Participants preferred the speed and incline buttons to be placed with the increase and decrease symbols directly opposite each other, as can be seen on the Life Fitness console in Figure 4. Participants felt that having the increase and decrease symbols arranged in this way was more intuitive and allowed them to identify the buttons easily.

Audio feedback was also a helpful feature for all participants. The 'bleep' sound made when participants pressed a button allowed them to count the number of intervals they were increasing or decreasing by. This gave participants a reference point for managing the intensity of exercise.

> *"The buttons had quite a good bleep, so you could listen to the buttons, count the numbers and go up 3 or 4. The bleeps are important for the visually impaired. When I turn my one on at home, it starts on 0 so I immediately go to 12 and then go up or down from there." – Regular user, workshop two*

For participants with some partial vison, contrasting colours were an important feature. Both Life Fitness and Technogym consoles were considered to have good contrasting colours. Dark backgrounds with bright fonts were preferred by our partially sighted participants.

Unhelpful Design Features

A number of participants suggested that the buttons on the console were too close together. For our partially-sighted users the close proximity of the buttons was seen to be confusing. Participants felt that the use of poor colour highlighting for functional buttons, such as the start and stop button on Technogym consoles, was largely redundant as the colour wasn't distinctive enough. Participants suggested that all fitness equipment should use block colours.

> *"Buttons should be colour contrasting, with matched colour coding [11] – with block colours, rather than colour highlights. That would give you a chance to at least see something on the screen." – Regular user, workshop three*

Font size also hindered the usability of fitness equipment. Participants with some partial vision could see the large digits on the console. However, they didn't know what these digits referred to as the fonts were either too small or had poor contrasting colour. Not being able to identify the text limited the information participants could obtain from the console.

This is related to a broader issue with fitness equipment consoles which hinders usability. Nearly all participants felt that they were unable to access the same information as users with full vision. Participants' inability to access information and outputs that fitness machines provide was a source of great frustration.

3.2.3   Product features – touchscreen console

Figure 5: Touchscreen consoles

Life Fitness   Life Fitness   Technogym

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[11] A system of marking features with different colours as a means of identification.

Helpful Design Features

Participants found touchscreen consoles highly inaccessible; however there were some features which users found helpful.

Participants commented that the consoles generally had clear contrasting colour which made it easier to distinguish between shapes and fonts. They also preferred the large font size used for exercise measurement outputs. These included: workout time, calories burned and heart rate. Participants found these outputs easier to identify and read compared to LED consoles.

Unhelpful Design Features

The biggest issue for participants, irrespective of their level of vision, or their familiarity with using fitness equipment, was the lack of tactile reference points on the console to aid navigation. Participants with no light perception found the consoles almost impossible to use, and those with some partial vision struggled.

> *"Touchscreens are a disadvantage because if you can't really see you don't know where to put your hands. It's [fitness equipment] not talking so even if you have a little bit of sight you have to get really close to the screen or you need to rely on someone to do it and come back to assist you" – Regular user, workshop one*

Those with some usable vision could use the touchscreen to some effect but felt that the menus were complicated and acted as a further barrier. For example, the initial start button was difficult to locate on all consoles and the presence of language selection menus before the user could start the machine created more confusion.

Other participants also felt there was a lack of feedback features such as 'bleeps' or 'clicks' which let the user know a button had been pressed.

The choice of colours used in the menu interface could also be improved. Participants who tested the Technogym console found there was a large orange ID tile, with participants mistaking it for a pause or stop button.

3.2.4   Other non-console useful equipment features

There were two features worth highlighting which improved the usability of fitness equipment and were not part of the console interface.

A Technogym treadmill featured lever controls or 'fast track controls' which adjusted the speed and incline of the treadmill by moving up or down. Participants found this helpful as the levers were in a fixed position in front of them, allowing users to adjust the speed or incline mid-workout, rather than stopping to feel the console.

Having control buttons on handle bars was also helpful, allowing participants to control the machine without having to break the flow of their workout.

3.2.5 Future design features requested by participants

Audio output

All participants felt that an audio output was needed in order to make cardiovascular fitness equipment fully accessible for visually impaired users. In terms of audio outputs on touchscreen consoles, participants felt that a system which would match the experience they have with Apple products would be best:

> *"The good thing about voice-over is that as you pass your fingers over the screen it will actually tell you exactly where you are, you don't even have to press anything before you start hearing things. So you actually know where you are at each point in time." – Regular user, workshop three*

Screen magnification

Screen magnification was also a popular option for users with some partial vision. Again, when using touchscreen consoles participants wanted technology which would match previous experiences. One participant had previously used screen magnification on a touchscreen console:

> *"I have a little bit of vision that I can use in my left eye, at this gym I use the touchscreen machines and they used to have a treadmill which you could press a button on the left and it would go to a magnified screen with a black background and white text, so I could see calories and distance" – Regular user, workshop three*

Standardisation

The third feature participants favoured was a standardised console layout which would apply throughout the industry. This would allow participants to use different types of equipment and learn the basic outline of each console. It was suggested that this would also benefit general users who prefer simple interfaces, including those over 60.

Smartphone connection

Participants' views on using separate accessible interfaces were mixed. The idea of using smartphones and their accessible settings to improve accessibility was viewed positively. However, some felt that there was a risk of damage or theft if they were to use their phone in the gym. Other separate accessible interfaces such as tactile overlays and screen readers were thought to be cumbersome and difficult in a gym setting.

3.3 User experience research – focus groups and telephone interviews

Our three focus groups and 20 telephone interviews explored the thoughts and experiences of visually impaired users who were regular users, or potential users, of cardiovascular fitness equipment.

3.3.1 Health and wellbeing impact

Participants were highly aware of the benefits that cardiovascular fitness equipment could bring to their lives. Both regular users and non-users identified positive health impacts, such as weight loss, weight maintenance, and improved heart condition. Regular users also noted an improvement in their day-to-day body movements, such as climbing the stairs.

Exercising in the relatively safe environment of a fitness centre was a common theme amongst all participants. It was felt that cardiovascular equipment allowed them to be more energetic without exposing themselves to potential harm outdoors. This sense of safety is also linked to perhaps the most common benefit of using cardiovascular fitness equipment, and of regular exercise more generally, which was the improvement in participants' mental health.

Participants felt that regular use of cardiovascular fitness equipment contributed to an improvement in their mood and energy levels. Using fitness equipment and completing a work-out was often spoken about in terms of independence and gaining a certain sense of achievement:

> *"It makes you feel more capable and independent; it improves your balance which is important for us. Getting into a different environment is the most positive thing, because you have independence. And it's good for the brain as well – it makes you feel more mentally active." – Regular user, telephone interview*

Many participants felt that the psychological benefits were as beneficial, if not more so, than the physical benefits of attending the gym.

3.3.2 Built Environment

Although participants had a keen appreciation of the benefits of physical exercise using cardiovascular fitness equipment, being able to access and use these products could be problematic. These difficulties begin with the built environment.

Walls, floors and signage

The interior colours of leisure centres can often present a challenge. Participants found that leisure centres which had been through refurbishment had become less accessible due to the colours and lighting used. There was recognition that it can be difficult for leisure centres to make adaptations that will suit everybody, as there is such a wide range of eye conditions. However, participants did feel that there were certain adaptations that could make a difference to all visually impaired users. For example, contrasting colour between the walls, floor and exercise equipment would help users with some partial vison to navigate around the space:

> *"'If you have dark walls, dark floor and dark equipment I can't see anything. At least if you have a light floor you know you have some idea of where you are" – Regular user, workshop two*

Lighting

Lighting was also an issue. As with colour contrast, participants felt that it was hard for leisure centres to implement lighting that would be suitable for everybody. However, many participants found spot lighting difficult as it created areas within the gym which were better lit than others and this made it harder for users to move around the gym.

Layout

The layout of fitness equipment was another hurdle for users. Fitness equipment in leisure centres tends to be arranged in a compact way, leaving little room between machines. The close proximity brings potential trip hazards and can present a significant risk to the health and safety of users. Many of our participants also relied upon their ability to learn the layout of the leisure centre from memory to use it independently. However, any rearrangement presented a further barrier as users are unable to move around the gym with certainty.

3.3.3   Customer Service and Communication

The ability of visually impaired users to access and use fitness equipment is also dependent on the customer service they receive. Customer service was measured by participants in terms of the treatment and level of assistance they received from staff. Overall, participants' experience varied widely, with some finding it excellent and others being highly critical.

Assistance in and around the gym was the main issue of contention. Due to the difficulties with the built environment, participants often needed assistance between machines and with the programming of fitness equipment. In most cases leisure centres were unable to provide this assistance. This was due to a number of factors, including a lack of staff members; staff not knowing how to meet the needs of visually impaired users; and what some participants viewed as a general unwillingness to help.

Participants did acknowledge that there were members of staff who did have the best of intentions and tried to find a way to assist them in the gym. Some participants experienced successful assistance, while other participants' requests for assistance were refused outright, with members of staff citing cost and staff time.

The inability of staff to assist visually impaired users was interpreted as a lack of understanding about their needs. Due to high staff turnover in the fitness sector participants felt that staff weren't properly trained and this could lead to difficulty and confusion when trying to access fitness facilities:

> *"I've only just recently started going to a new gym and it's been ok most of the time but yesterday between three of them [members of staff] they couldn't even understand that I just wanted to go to the changing room, get changed and go the pool, so it took to the fourth person before I could get assistance." – Regular user, workshop three*

4. Industry Liaison

Industry interviews focused on two key topics:

1. current barriers that prevent the development of fitness equipment which is easier for visually impaired people to use
2. future industry trends within the sector and their potential impact upon disabled users

4.1 Barriers

4.1.1 Cost

The barrier cited most often by industry experts was cost - both in terms of the initial cost of adapting machines already in production, and in terms of the long-term investment needed at the beginning of the design process to ensure equipment is inclusive.

Once the manufacturer has made a commitment to the production process, including the materials, fabrics and plastics, any further adaptations can be costly and difficult to make, discouraging manufacturers from changing their design. As all product manufacturers are commercial enterprises, industry experts suggested that there needed to be a clear and justifiable market opportunity in order to invest the necessary resources to make fitness equipment accessible:

> *"To be honest, we haven't had a great deal of feedback or requests from our customer base, although we are a global manufacturer and work across all sectors, from local authorities, corporate, private clubs, and education we haven't had any feedback from any group requesting a change to our mainstream machines." – Country Manager, SportsArt*

However, industry experts felt that the barrier of high costs was one which could be overcome, as operators and manufacturers are becoming more aware of the potential new market that older and disabled people represent.

4.1.2   Industry culture

Experts felt that until companies were able to implement inclusive design principles within their research and development teams and consider inclusivity at the beginning of the design process, there will always be issues with accessibility as the cost of adaptations is so prohibitive. Some experts also commented on the culture of short term deadlines within the industry. The urgency placed upon the design process creates a perception that there isn't enough time for inclusive design, as it is seen as slowing down the development of a product:

> *"I mean I have been involved with other companies where the powers that be don't care. Their attitude is that the product has to be ready next month or in 6 months' time." – Business Development, HUR*

Others also suggested that the wider culture within the fitness industry was rooted in the idea of a youthful sporting image, making it difficult for the industry to encompass the ideas and values of inclusivity and accessibility.

4.1.3   Lack of awareness

A further barrier to the provision of inclusive fitness equipment is the lack of awareness that design teams have about the experiences of visually impaired users. Although large manufacturers have substantial testing procedures in place to ensure the quality and reliability of their products, there is no standard testing with disabled users:

> *" To be honest, we haven't had a great deal of feedback or requests from our customer base, although we are a global manufacture and work across all sectors, from local authorities, corporate, private clubs, and education we haven't had any feedback from any group requesting a change to our mainstream machines." –Country Manager, SportsArt*

There is some informal testing and feedback with small groups of disabled users. For instance, if a manufacturer tests a prototype product in one of its client's facilities and that facility has disabled users, then they may collect some feedback. However, this doesn't happen with every product.

Some manufacturers have engaged with disability charities to gain a better understanding of the needs of specific groups. This can be seen with conversations between the RNIB and Johnsons Health Tech, and in the wider fitness industry with Pure Gym and the RNIB to improve access to their facilities. There has also been some work by UK Active through their Active Lab initiative to encourage the creation of digital products which will improve the experiences of disabled users.

4.1.4   IFI Standards

Manufacturers largely rely on IFI standards provided by the EFDS to offer guidance on what product features are appropriate for disabled users, including visually impaired users. Across the sector the IFI scheme is viewed as a positive and worthwhile endeavour and has genuine support from most parts of the fitness industry.

However, some of the industry experts we interviewed said that they felt the IFI's purpose has been diminished, which, in turn, has stunted the introduction of inclusive fitness equipment for visually impaired users and disabled users more generally. Experts suggested that the IFI initiative was initially a very straightforward process. Over time, though, manufacturers felt that the process became overcomplicated and burdensome. As the IFI standards changed and grew more demanding, some manufacturers felt that their products were becoming too specialised and thought they would lose mainstream appeal. Other parts of the fitness industry also believed that the IFI scheme had generally lost some of its credibility:

> *"I was talking to an operator, they were talking about their refurbishment, and I said you won't be IFI compliant if you make those changes to which the reply was 'who cares?' because they already had the badge on the front door, nobody was ever going to go back and check." – Business Development, HUR*

This loss of credibility is partly due to the lack of funding available for the scheme and also due to the scheme being skewed toward what some felt was the political purposes of larger manufacturers and gym operators.

Manufacturers' reliance on IFI standards to provide guidance was also an issue when the standards didn't keep pace with technology or didn't provide guidance on certain features. For instance, there are currently no IFI standards for touchscreen consoles, making it difficult for design teams to know what features would be most useful for visually impaired users or what type of audio output would be required for other types of console.

4.2 Future Industry Trends

Future industry trends over the next 10 years were considered likely to be driven by innovations in technology. With consoles moving back to a simpler design as smart phones and tablets increasingly function as consoles:

> *"Built consoles will be simpler and the tablet will give you more advanced programmes and personalisation. You'll be able to customize the display. I think that's 3-5 years away." – Product Design, Johnson Health Tech*

The move toward smartphones and tablet integration will lead to a greater emphasis being placed upon entertainment and engagement in the gym. This will be a driving factor in the industry's development as general gym users continue to lead lives which are more integrated with technology. It was also predicted that gym users' fitness routines will become increasingly varied as the variety of exercise equipment and programmes continues to grow. The integration of smartphones and tablets will mean that users will be able to move across different types of fitness experiences using one device.

Experts also predicted the continued growth in strength and resistance training as public health advice moves away from focusing on cardiovascular health and focuses on muscle strength in older age:

> *"The public message for so many years about aerobic exercise etc [this] really formed the basis for modern gyms and what equipment they have, [but] that's now shifting toward strength." – Business Development, HUR*

When asked about audio output as a potential product feature in the future, industry experts were largely positive and thought that it was feasible. However, there was some ambiguity as different types of audio output would be required for different types of consoles:

> *"I think one of the things when we first spoke to the RNIB is the talk to text which works for people when they're online. I think that is something that is a possibility. I think that's probably the easiest one." – Product Design, Johnsons Health Tech*

Other challenges to the implementation of audio output include: the technical difficulty of live touchscreens (as opposed to a fixed screen), the number of languages consoles are programmed with, and the potential noise which could be created in a gym setting.

Generally, industry experts felt that this increase in technology both in terms of hardware and software was problematic for manufacturers as technology is constantly changing. This made manufacturers feel that they had to play catch-up with larger technology companies.

4.2.1   Impact upon disabled users

Industry experts had mixed views on the impact future trends may have on visually impaired users. Some believed that the increased use of smartphones and tablets would improve accessibility as users would be able to use accessible settings on their devices. It was also suggested that increasing technology in the fitness sector will make information and facilities more accessible, and encourage greater participation.

Others believed that changes in technology wouldn't be an issue as there would always be a choice between two consoles, as LED screens are still a popular choice for many gym operators. The view was that LED consoles were accessible for visually impaired users. Although entertainment and technology will continue to be a key factor, the staff and atmosphere within the gym were argued to be just as important, and could be the biggest difference between a positive and negative impact.

It was also argued that, to ensure new products and technology had a positive impact, product manufacturers needed clear guidelines of what features are required for visually impaired users. Technology companies and other equipment manufacturers also needed to develop more collaborative relationships to ensure that users aren't left waiting for the latest accessible technology. Industry experts were keen to emphasise that many of these changes would take time.

> *"It will probably take 5-10 years as a sector to change, but there is a growing desire and ambition for the sector to fully capitalise on the opportunity. It's less to do with the technical difficulty but the will, and what you're finding now is there is a growing appetite from major operators, both public and private to fully embrace this agenda." – Public Affairs, UK Active*

5. Conclusion

The research shows that LED consoles are moderately more accessible compared to touchscreen consoles. However, pass rates were low across all types of fitness equipment consoles, including equipment with IFI accreditation. Participants suggested that voice-over and audio output was needed in order to improve accessibility for visually impaired users.

Although cardiovascular fitness equipment had a positive impact upon users' health and fitness, participants found accessing fitness equipment and wider facilities difficult. This was due to the built environment and the customer service they received. Overall, the equipment, facilities and services for visually impaired users were largely inconsistent.

Barriers to the development of accessible fitness equipment identified by industry experts included cost, industry culture, a lack of awareness of visually impaired users' experiences, and an over-reliance on IFI standards. Future trends were predicted to be driven by innovations in technology, with simpler console design and smartphone integration having the potential to positively impact upon disabled users. However, others believed that that the attitude of staff and the atmosphere within the gym would have the most impact.

Recommendations
1. Introduce audio output and voice-over technology for electronic fitness equipment.
2. Develop a best practice guide for manufacturers outlining the design features most appropriate for visually impaired users.
3. Update the IFI scheme, reinforcing the case for inclusive design.
4. Product design teams to make better use of guidelines and best practice from other industries, independent organisations and governmental bodies.
5. Improve staff training and communication procedures across the fitness sector, using the NHS accessible information standards as a guide.
6. Implement a voluntary buddy scheme at all public sector leisure centres to assist visually impaired users and other disabled users.

6. Appendices

Appendix A: Participant Recruitment

Telephone Interviews

Across our telephone interviews the average age was 47, with 60% of participants being male; see Figure 6.

Figure 6: Age range – telephone interviews

Age Range - telepone interviews
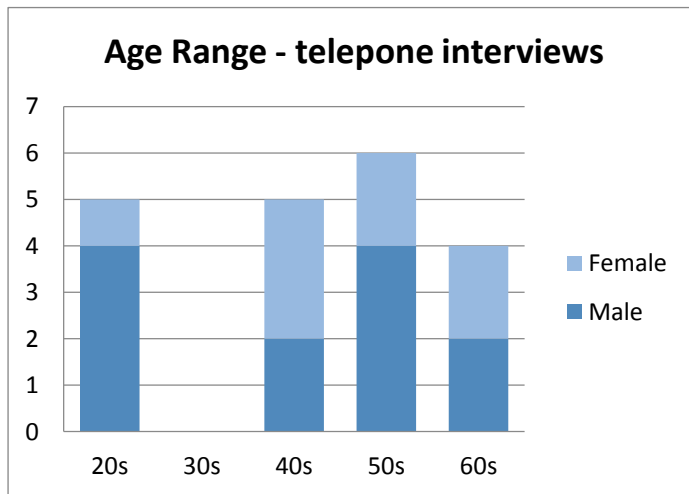
A total of 13 participants had some degree of vision, with seven other participants having no light perception.

Table 3: Level of vision

British Blind Sport category	Participants
B1	7
B2	9
B3	4

Table 4: Regularity of physical activity

Regularity of physical activity	Participants
Every other day	10
Once a week	6
Once a month	4

Table 5: Use of cardio fitness equipment

Frequency of use	Participants
Regular user	14
Non user	6

Usability Workshops

The average age of participants who took part in our usability workshops was 52, with 65% of our participants being male; see Figure 7.

Figure 7: Age range – usability workshops
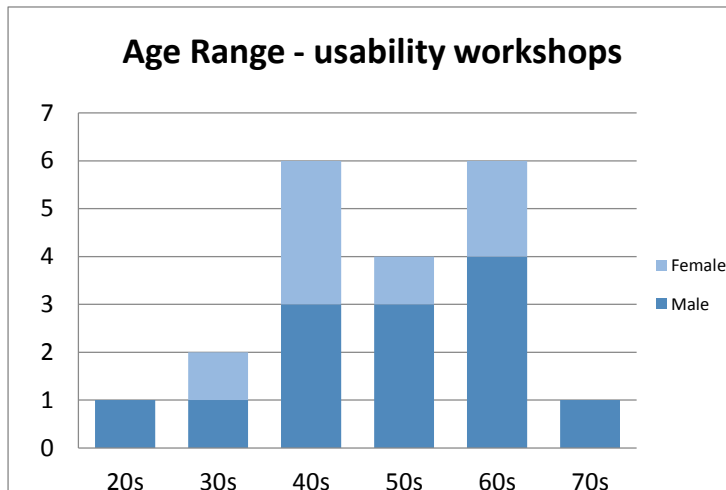
A total of twelve participants had some degree of vision, with eight participants having no light perception.

Table 6: Level of vision

British Blind Sport category	Participants
B1	8
B2	8
B3	4

Table 7: Physical activity

Frequency of physical activity	Participants
Every other day	8
Once a week	8
Once a month	4

Table 8: Use of cardio fitness equipment

Frequency of use	Participants
Regular user	15
Non user	5

Table 9: British Blind Sport categories

B1	From no light perception in either eye up to light perception, but inability to recognise shapes at any distance or in any direction.
B2	Low level of usable partial vision, can distinguish some colour and shapes. With visual acuity of 2/60 or field of five degrees or less.
B3	A reasonable level of partial sight. The highest category used at international and Paralympic sport. With 6/60 visual acuity or field of more than 5 degrees but less than 20 degrees.
B4	A good level of partial sight - 25% of normal eye sight or less would be suitable for this category. Visual acuity above 6/60.

Appendix E: Usability Results Tables

Workshop One

Table 10: Life Fitness IFI accredited **treadmill** – LED console

User Sight	Age	Gender	User frequency	Task 1 Get on	Task 2 Start	Task 3 Increase	Task 4 Decrease	Task 5 Stop
B3	47	Male	Regular User	Pass	Pass	Pass	Pass	Pass
B1	73	Male	Non User	Pass	Fail	Fail	Fail	Fail
B2	26	Male	Regular User	Pass	Pass	Pass	Fail	Fail
B1	65	Male	Regular User	Pass	Fail	Fail	Fail	Pass
B2	33	Female	Regular User	Pass	Pass	Pass	Pass	Pass
B2	40	Male	Non User	Pass	Pass	Pass	Pass	Pass
B1	50	Male	Regular User	Pass	Fail	Fail	Fail	Pass

Over all the tasks: Pass rate = 66% (B1 Pass rate = 33%, B2 Pass rate = 87%)

Table 11: Life Fitness **exercise bike** – touchscreen console

User Sight	Age	Gender	User frequency	Task 1 Get on	Task 2 Start	Task 3 Increase	Task 4 Decrease	Task 5 Stop
B3	47	Male	Regular User	Pass	Pass	Pass	Pass	Pass
B1	73	Male	Non User	Pass	Fail	Fail	Fail	Fail
B2	26	Male	Regular User	Pass	Fail	Fail	Fail	Pass
B1	65	Male	Regular User	Pass	Fail	Fail	Fail	Fail
B2	33	Female	Regular User	Pass	Pass	Pass	Pass	Pass
B1	40	Male	Non User	Pass	Fail	Fail	Fail	Fail
B2	50	Male	Regular User	Pass	Pass	Pass	Pass	Fail

Over all the tasks: Pass rate = 54% (B1 Pass rate = 20%, B2 Pass rate = 73%)

Table 12: Life Fitness **cross trainer** – touchscreen console

User Sight	Age	Gender	User frequency	Task 1 Get on	Task 2 Start	Task 3 Increase	Task 4 Decrease	Task 5 Stop
B3	47	Male	Regular User	Pass	Pass	Pass	Pass	Fail
B1	73	Male	Non User	Pass	Fail	Fail	Fail	Fail
B2	26	Male	Regular User	Pass	Fail	Pass	Fail	Pass
B1	65	Male	Regular User	Pass	Fail	Fail	Fail	Fail
B2	33	Female	Regular User	Pass	Pass	Fail	Pass	Pass
B1	40	Male	Non User	Pass	Fail	Fail	Fail	Fail
B2	50	Male	Regular User	Pass	Pass	Pass	Fail	Pass

Over all the tasks: Pass rate = 54% (B1 Pass rate = 20%, B2 Pass rate = 73%)

Workshop Two

Table 13: Technogym IFI accredited **exercise bike** – LED console

User Sight	Age	Gender	User frequency	Task 1 Get on	Task 2 Start	Task 3 Increase	Task 4 Decrease	Task 5 Stop
B1	51	Female	Regular User	Pass	Fail	Fail	Pass	Pass
B3	44	Female	Regular User	Pass	Pass	Pass	Pass	Pass
B1	64	Female	Non User	Pass	Fail	Fail	Fail	Fail
B1	50	Male	Non User	Pass	Fail	Fail	Pass	Pass
B2	54	Male	Regular User	Pass	Pass	Pass	Pass	Pass
B2	49	Male	Non User	Pass	Pass	Fail	Fail	Pass

Over all the tasks: Pass rate = 73% (B1 Pass Rate = 53%, B2 Pass Rate = 80%)

Table 14: Concept2 **rowing machine** – LED console

User Sight	Age	Gender	User frequency	Task 1 Get on	Task 2 Start	Task 3 Increase	Task 4 Decrease	Task 5 Stop
B1	51	Female	Regular User	Fail	Fail	Fail	Fail	Pass
B3	44	Female	Regular User	Pass	Fail	Pass	Pass	Pass
B1	64	Female	Non User	Fail	Fail	Fail	Fail	Pass
B1	50	Male	Non User	Fail	Pass	Fail	Fail	Pass
B2	54	Male	Regular User	Pass	Fail	Fail	Fail	Pass
B2	49	Male	Non User	Pass	Fail	Fail	Fail	Pass

Over all the tasks: Pass rate = 40% (B1 Pass rate = 27%, B2 Pass rate = 40%)

Table 15: Technogym IFI accredited **treadmill** – LED console

User Sight	Age	Gender	User frequency	Task 1 Get on	Task 2 Start	Task 3 Increase	Task 4 Decrease	Task 5 Stop
B1	51	Female	Regular User	Pass	Pass	Pass	Fail	Pass
B3	44	Female	Regular User	Pass	Pass	Pass	Pass	Pass
B1	64	Female	Non User	Pass	Fail	Fail	Fail	Fail
B1	50	Male	Non User	Pass	Fail	Fail	Fail	Pass
B2	54	Male	Regular User	Pass	Pass	Pass	Pass	Pass
B2	49	Male	Non User	Pass	Pass	Fail	Pass	Fail

Over all the tasks: Pass rate = 67% (B1 Pass rate = 47%, B2 Pass rate = 80%)

Workshop Three

Table 16: Technogym **cross trainer** – touchscreen console

User Sight	Age	Gender	User frequency	Task 1 Get on	Task 2 Start	Task 3 Increase	Task 4 Decrease	Task 5 Stop
B2	67	Male	Regular User	Pass	Fail	Fail	Pass	Fail
B2	40	Female	Regular User	Pass	Fail	Pass	Pass	Fail
B3	67	Male	Regular User	Pass	Pass	Pass	Pass	Pass
B1	61	Female	Regular User	Fail	Fail	Pass	Pass	Fail
B3	47	Female	Regular User	Pass	Pass	Pass	Pass	Pass
B2	36	Male	Regular User	Pass	Fail	Pass	Pass	Fail
B1	66	Male	Regular User	Fail	Fail	Fail	Pass	Fail

Over all the tasks: Pass rate = 60% (B1 Pass rate = 30%, B2 Pass rate = 53%)

Table 17: Technogym IFI accredited **treadmill** – LED console

User Sight	Age	Gender	User frequency	Task 1 Get on	Task 2 Start	Task 3 Increase	Task 4 Decrease	Task 5 Stop
B2	67	Male	Regular User	Pass	Pass	Pass	Pass	Pass
B2	40	Female	Regular User	Pass	Pass	Pass	Pass	Pass
B3	67	Male	Regular User	Pass	Pass	Pass	Pass	Pass
B1	61	Female	Regular User	Fail	Pass	Pass	Fail	Fail
B3	47	Female	Regular User	Pass	Pass	Pass	Pass	Pass
B2	36	Male	Regular User	Pass	Pass	Fail	Fail	Pass
B1	66	Male	Regular User	Pass	Pass	Fail	Fail	Fail

Over all the tasks: Pass rate = 77% (B1 Pass rate = 40%, B2 Pass rate = 87%)

Table 18: Technogym IFI accredited **exercise bike** – LED console

User Sight	Age	Gender	User frequency	Task 1 Get on	Task 2 Start	Task 3 Increase	Task 4 Decrease	Task 5 Stop
B2	67	Male	Regular User	Pass	Pass	Pass	Pass	Pass
B2	40	Female	Regular User	Pass	Pass	Pass	Pass	Pass
B3	67	Male	Regular User	Pass	Pass	Pass	Pass	Pass
B1	61	Female	Regular User	Pass	Fail	Fail	Pass	Fail
B3	47	Female	Regular User	Pass	Pass	Pass	Pass	Pass
B2	36	Male	Regular User	Pass	Fail	Fail	Pass	Pass
B1	66	Male	Regular User	Pass	Fail	Fail	Pass	Fail

Over all the tasks: Pass rate = 77% (B1 Pass rate = 40%, B2 Pass rate = 87%)