Research Report: The Usability of Mobility Scooter Controls

September 2013

Lucy Pullicino and Jasper Holmes

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The Usability of Mobility Scooter Controls

Executive Summary

Background and Context

Mobility scooters can provide disabled and older people with a great deal of independence. Whether they wish to pop to the local shops, or enjoy day trips with friends and family, they provide a way to get out-and-about without being held back by pain or physical limitations.

However, scooters are a 'mechanically propelled vehicle'[1] and although there's no official record, there are anecdotal accounts of accidents involving pedestrians and scooter users. In 2009, the Department for Transport (DfT), raised concerns about the 'use and regulation' of mobility scooters, and in 2010 a consultation followed proposing changes to the laws in response to an increase in the number of scooter users in the UK.

In response to this and other industry reports concerning the safety of mobility scooters, Rica, an independent charity providing research for older and disabled consumers, suggested that user error may be a contributing factor to accidents involving scooters.

Following its previous research on Mobility Scooters on Public Transport[2] and its experience in user-centred design, Rica felt that the focus of further research in this area should be placed on the design and usability of mobility scooter controls; how easy they are for people to understand and use, given that the majority of users are older and disabled.

Rica suggested that mobility scooter controls may be an issue for the following reasons:

- **The mental model users have as drivers or cyclists:** The design and functions of mobility scooter controls are very different from those of a car, motor bike or bicycle, which may cause confusion for people new to mobility scooters.
- **Inconsistency of design and function across class and make of mobility scooter:** The design, layout and labelling of controls vary across scooter class, make and model, which may cause confusion and mistakes to be made e.g. if a person has more than one type of scooter, borrows a scooter or buys a new scooter.
- **Lack of training:** Users do not often have enough practice or training (if, any) to use the controls, before they take them out on pavements and roads.
- **People buying scooters with controls that are inappropriate for them:** A user's upper body strength, grip, movement, dexterity and co-ordination may be limited or impaired due to disability, illness or old age. If the controls are not suitable for their needs, the user may misuse the controls, due to pain, discomfort or lack of confidence.

Rica received grant funding from the Motability Tenth Anniversary Trust to carry out user research into the usability of mobility scooter controls and investigate these assertions further.

This report details the findings and insights from the user research. It suggests that there are a number of improvements that could be made to enhance the usability of mobility scooter controls, across the board.

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[1] 1988 Road Traffic Act: http://www.legislation.gov.uk/ukpga/1988/52/contents
[2] Rica report on Scooters on Public Transport http://www.rica.org.uk/content/scooters-and-powered-wheelchairs

As a result of this research, Rica has also provided online guidance for disabled and elderly consumers as part of the guide Choosing a mobility scooter[3].

Key Findings

A number of improvements could be made to the design, layout and function of mobility scooter controls which would enhance their usability, including:

- Use of meaningful colours
- Providing audio and visual feedback
- An increase in the volume of warning sounds
- Providing different, distinctive sounds for different warnings
- Clear labelling and symbols
- Large controls
- The position and proximity of controls to fingers and thumbs
- Reaching the accelerator levers and handbrake while steering

It was also found that:

- mobility scooter novices had difficulty controlling their speed and stopping due to their mental model of riding a bike and
- scooter users don't necessarily try before they buy.

Recommendations

The research shows that a number of improvements should be made that would make a significant impact on the usability of mobility scooter controls, and as a result could potentially increase the safety of scooter drivers and pedestrians. Rica makes the following recommendations:

1. **Best practice design standards and guidelines:** Although the British Standard (BS EN 12184) specifies the requirements and testing of electric wheelchairs, scooters and their chargers, it hasn't been officially updated since 2009. Manufacturers should have an up-to-date industry code of best practice that specifies a minimum standard of design to ensure a consistent approach to the colour, shape, size, position and layout of mobility scooter controls. Rica suggests that this set of design standards and guidelines include guidelines on the following:

- **Use of meaningful colours:** All controls must have a colour that makes them distinct from the others and, where relevant, use colours that give them additional meaning to make the control more recognisable, such as red for the hazard lights. Colour should also be used to group controls that are twinned or related e.g. indicators.

- **Provide audio and visual feedback:** When a control has been selected it must provide feedback in the form of a light and a sound e.g. when an indicator is switched on it should make a noise and flash a light on the main control panel.

- **Ensure audio warnings are distinctive:** The sound of a horn warning should be loud and distinctive enough for a pedestrian, and scooter driver, to hear and recognise it from other types of warnings such as reversing, indicators and hazards.

- **Use clear labelling and symbols:** All controls should have a clear, easy-to-see text label and/or symbol to aid their identification. The labels and symbols used should come from a standard set used across all mobility scooters to ensure that they are easily learnt and recognised.

- **Large controls:** It's important that all controls are designed to a minimum size to ensure that people with poor dexterity can hold, grip and manipulate them, and people with visual impairments can see them, easily.

- **Position and proximity of core controls:** Important, frequently used controls such as the indicators, hazard lights, horn and speed controls should all be within close proximity to a mobility scooter's steering so that they can be easily reached by a user's fingers or hands while they drive along. A user must not have to reach or take their hands off the main steering to reach these main controls.

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[3] The online consumer guide to Choosing the Right Mobility Scooter Controls can be found at
http://www.rica.org.uk/content/choosing-mobility-scooter

- **Base the design of mobility scooter controls on those of a car or motorbike controls:** The design and function of mobility scooter controls should be closer to those in a car or on a motor bike. This would make them more familiar to new scooter users and easier to learn and remember.
- **Legislation, regulation and standardization:** Introduce new legislation as well as update and improve current forms of legislation to help regulate the mobility scooter market place and the use of mobility scooters to cover issues including speed limits, the pricing of scooters, vendor licensing, accredited training and tests, medical certification, the policing of unsafe driving, and third party insurance.

A number of different organisations have a role in helping to make these improvements happen. These include:

- DfT
- Manufacturers
- British Transport Police
- Shopmobility
- Mobility centres and other assessment centres
- Mobility scooter suppliers and retailers
- Motability

About the Research

The research was divided in three strands; desk research, a focus group and usability testing.

Desk research

This involved a review of previous research and informal phone interviews with Rica's contacts from across the mobility sector including scooter manufacturers, suppliers and assessment centres.

Focus Group

The information gathered during the desk research and interviews was used to understand the context of the research, as well as shape the focus group and scooter usability trials. It also contributed towards the development of our final recommendations.

10 professionals from the mobility industry were invited to attend a facilitated focus group discussion. The participants included mobility assessors, trainers, accredited suppliers, as well as government and law enforcement representatives.
The focus group was asked to discuss:

- What the sector is doing well
- What the sector isn't doing well
- Recommended improvements and changes

They were also asked to briefly view and give general feedback on a sample of 10 class 2 and 3 mobility scooters, seven of which were later selected for the usability testing trials.

Usability Trials

A sample of seven mobility scooters were selected by Rica to be usability tested with 16 participants: seven scooter users and nine non-scooter users, all between the ages of 60 and 75 years old. All of the scooter users were affected by physical disabilities. Both groups of participants were affected by mild to moderate age-related disabilities e.g. poor sight and hearing.

The usability testing tasks were created to represent realistic driving tasks that required the participants to use all of the controls on each scooter.

- Identification of controls
- Acceleration
- Stopping
- Manoeuvring around obstacles
- Parking
- Reversing

The participants were also asked to 'think aloud' during each task and rate the ease of their experience.
After the sample of scooters had been tested, each participant was asked to summarise their experiences with the different scooter controls and discuss any preferences.

Research Findings and Insights

The primary research was divided into two stages:

- Focus Group: A formal, facilitated discussion with 10 professionals who work within the mobility sector.
- Usability testing: Formal, scripted, lab-based sessions with scooter users and non-scooter users who were between the ages of 60 and 75 years old. All scooter users had moderate to severe physical disabilities.

Usability Testing Findings

Table 1: Summary of frequent participant feedback and observations from Rica's researchers during testing

The following table of findings summarises common feedback from both the scooter users, and non-scooter users during the usability testing trials.

Controls	Key findings (Non-users)
Invacare Orion; class 3	
Invacare Orion; class 3 **Invacare Orion; speed controls**	**On/Off** • Couldn't find on/off • Liked having an 'on' light • Didn't like having to reach down to find and turn key **Battery** • Dislike position; had to angle head, which isn't easy with a bad neck or back **Handbrake** • Having a hand brake was considered reassuring • The handbrake was awkward to reach for smaller users. Users commented that they'd rather have it on or near the handlebars, like bike. **Tiller adjuster** • The tiller adjuster was easily mistaken for a handbrake because of its position above handlebars; it's much like the layout of a bike. **Speed dial and buttons** • Identified additional tortoise knob as something to do with reducing speed but very unclear as to its true purpose • Wanted feedback speed control buttons when pressed e.g. light going on • Had difficult seeing speed symbols on dial due to their size. • There was confusion around extra control buttons next to speed dial. Symbols were misunderstood as hazards. • Appreciated nice big speed dial **Acceleration levers** • Levers were considered flimsy compared to other more chunky versions. • Felt that it didn't stop quickly • The length of the levers was liked • The finger indents were liked • Liked that they had to pull the lever back before it fully engaged

Indicators, hazards, horn, lights

- Had to stop and think to find indicators
- Frustrated that indicators don't self-cancel
- Noted that there was no visual feedback to show/remind them when they were on
- Felt it was unsafe removing hand from accelerator or handlebars to indicate right
- Sound of horn was considered very low; Not loud enough to alert pedestrians
- Felt unsafe removing hands from accelerator or handlebars to press horn
- Horn doesn't sound different to indicators, which could cause confusion
- Liked having both audio and visual feedback when hazards switch on

Other

- It was felt that a speedometer would have been valuable
- Considered easy to manoeuvre and turn

TGA Vita S; class 3

TGA Vita S; class 3

Examples of user not being able to reach controls while holding onto steering

Battery

- Some confusion understanding and reading battery level indicators.

Handbrake

- Difficult stopping using handbrake due to reach
- Considered too hard to pull by those with poor strength and dexterity.

Speed button

- Confusion over the meaning of the H/L speed button. Labelling not understood on button and on screen display.
- Once understood, liked close proximity of H/L button to right accelerator

Acceleration levers

- Interpreted red lever as 'danger' due to red colour, before trying it out
- Felt levers were very little
- Felt it awkward to pull lever while turning a sharp corner
- Felt jerky to control; either too slow, or too quick
- Considered slow to stop; making it hard to judge stopping distance
- Disliked sensitivity; "it just whips away"

Digital display

- Had to shade screen to read it in darker lighting
- Technically intimidating by additional screen controls
- Like knowing speed; it gave confidence

Indicators, hazards, horn, lights

- Disliked having to remove hands from steering and/or acceleration to reach opposite indicator

- Felt that indicator should be closer to accelerator levers; considered easier to change digital display than indicate.
- Liked visual and audio (lights and sound) feedback for hazards
- Like large, clear indicator symbols
- Felt horn was too quiet
- Same sound for reverse and horn confusing
- happy with left but not right – had to take hand off lever

Other
- Frequently compared to a car due to range of controls and digital display
- Considered very easy to drive; can steer with one hand, while using lever with other.
- Felt that some controls were unnecessary; too many
- The look was popular and considered 'posh'
- Felt they'd have to read the manual and practice before driving in public place
- Liked material; helped grip

Pride Colt 9; class 2

Pride Colt 9; class 2

On/Off
- Slight confusion over on switch, not being an actual key.

Battery
- Loved visibility of colour lights on battery gauge, although unsure how to read it e.g. what colour represented low

Speed dial
- Speed dial turns way beyond hare and tortoise symbol causing confusion; expected it to go even faster or slower if turned further.
- Some users needed glasses to see hare and tortoise symbols

Acceleration levers
- Mixed reviews on comfort and ease of paddles, according to hand size and dexterity.
- Found it surprisingly quick to stop.
- Fast but jerky to drive e.g. difficult to control speed when manoeuvring around obstacles and parking.
- Felt it reacted quickly and was nippy.
- Quick to stop.
- Liked position of acceleration levers
- Mixed reviews on paddles – some liked them others prefer to use a switch to reverse

Other
- All controls identified correctly, first time.
- No beep when reversing.
- Steering considered very easy.
- Liked simplicity of controls and their proximity to hands.
- Mirror considered a benefit.
- Good turning circle.

Kymco For U; class 2	
Kymco For U; class 2 **Battery gauge and labels for accelerators**	**On/Off** • Easy to see when on/off; aids memory and prevents accidents. **Indicators, hazards, horn and lights** • Unsure about the purpose of the blue button due to it being blue and on the side of the control console. **Acceleration levers** • Considered easy to manoeuvre and control speed. • Symbols for accelerator misunderstood as paddles turning scooter left/right indicators. • Paddles thought to be nice because they are shaped to be used by thumb. • Levers stick out can get caught **Battery** • Battery gauge difficult to see especially with neck problems: some mistook it for a speedometer.
Pride Go-Go Elite Traveller; class 2	
Pride Go-Go Elite Traveller; class 2	**On/Off** • Liked fat key; easy to grip **Battery** • Some mistook battery gauge for speedometer • Battery gauge considered difficult to read; reflected light and needle not very visible for those with poor vision **Speed dial** • Felt it was difficult to estimate the driving speed; especially with no speedometer **Acceleration levers** • Felt it responded quicker than expected; nippy • Considered slow to stop • Liked being able to rest hands and swap hands controlling acceleration levers • Liked thumb shape paddles **Indicators, hazards, horn and lights** • Felt the noise of the horn was too feeble • Like that they didn't have to let go to press horn **Other** • Liked simplicity; felt that couldn't go wrong • Good turning circle and manoeuvrability

Electric Mobility Rascal; class 2	
Electric Mobility Rascal; class 2	**Speed dial and switch** • A lot of confusion around the meaning and purpose of the H/L switch; questioned that it was for speed because there was a speed dial. • Dislike removing hands from steering to flick the H/L switch; prefer operating with the dial alone **Battery** • Experiences glare on the battery gauge; affecting visibility • Liked 'F' for full; give reassurance and confirms interpretation of scale **Acceleration levers** • Some had to stretch to use levers; particularly those with poor dexterity and/or smaller hands • Likes responsiveness and manoeuvrability • Noted a considerable delay when trying to stop quickly **Indicators, hazards, horn and lights** • Disliked indicators due to having to take a hand off the steering to use the switch • Felt that indicator required strength in fingers to use switch • Felt indicator was in the wrong place; should be controllable from both sides of the console and positioned closer to the steering, particularly as used more than the headlights • Disliked sound of the horn; too weak **Other** • Disliked the lack of a mirror for reversing • Felt the controls were small and fiddly • Felt that all labels were difficult to read
TGA Breeze S3; class 3	
TGA Breeze S3; class 3 TGA Breeze S3; Right hand controls	**Handbrake** • Mistook handbrakes for forward/back accelerators **Speed switch** • Disliked 'full/half speed' button; felt there was not in-between as with a speed dial • Position of the acceleration levers and the strength required to pull them was a big problem for participants with arthritis but some managed to push it instead. (See photo on right) **Digital display** • The speed display of half and full (displayed as: 1/2 and 1) was mistaken for the level of battery charge, due to proximity to the battery symbol on the screen. • Some participants had difficulty seeing the screen in light • The 'set-up' and 'mode' buttons to set the digital display caused confusion and could not be correctly identified by all participants. They were considered as unnecessary extras by many.

TGA Breeze S3; Left hand controls

An example of someone having difficulty using the handbrake

An example of a good grip

Forward/reverse switch
- The forward/reverse switch had mixed reviews. It caused confusion and was disliked at first but then some participants grew to prefer it because they felt it was less ambiguous than using the levers to drive forward and back.

Acceleration levers
- Poor turning circle not easy to manoeuvre
- Takes a while to stop
- Speed (½ and 1) switch caused confusion and wasn't liked; participants mentioned their preference to gradually control the speed with a dial
- Felt it was fast
- Felt they needed to keep looking at the screen when adjusting the speed to see if they had selected half or full speed; not easy while driving along.
- Felt it was generally easy to turn and manoeuvre

Indicators, hazards, horn and lights
- Disliked everything about the indicator; it made no sound when on and only displayed visually with lights above the digital display; they didn't self-cancel and the position of the indicators on the right hand side was considered awkward.
- Felt that indicators should be placed close to both hands
- Frustration shown at difficulty trying to cancel indicator; toggle design felt to be fiddly
- Liked the position and proximity of the horn; on both sides and next to the driver's thumb
- Felt the hazards lights were in a very awkward position, which wasn't immediately obvious; not prominent enough in an emergency, and required too much reach
- Felt the hazard lights button should be red
- Considered the noise of the hazards too indistinctive
- Felt that the sound of the horn wasn't loud enough to warn pedestrians

Other
- Participants tended to try to look behind instead of using mirrors because they found them too difficult to adjust
- Use of red on many of the buttons was considered confusing because red represents danger.
- Those with poor dexterity didn't like switches but it was also felt that switches are good because it's less difficult to make a mistake; they are more definite
- On first impressions, all felt this scooter seemed complicated, due to number of controls and its digital display

Qualitative insights

The following insights reflect both the key issues raised in the focus group discussion, as well as themes noted during the usability testing:

Scooter users compared to non-scooter users

Driving forward and reversing: Overall, scooter users were more confident using the acceleration levers, having had experience with their own scooters. This was evident from their successful completion of the parking and reversing

> *I don't like having to pulling back to move forwards; it's not logical.* (Non-user 68)

tasks, compared to the non-scooter users who had three (minor) crashes in total due to pulling or pushing the wrong acceleration lever. Non-scooter users found it particularly difficult to get used to pulling a lever to go forward; associating the action with braking to slow down on a bike.

Unsurprisingly, the non-scooter users rated the TGA Breeze S3 as the easiest-to-use mobility scooter, overall.

Slowing down and stopping: Speed control was more of a challenge for non-users, overall. They felt that having to remove their hands to stop, was counter unintuitive. Generally, they were surprised at the 'nippiness' of the smaller scooters and found that some had very sensitive acceleration levers; making it difficult to increase or decrease their speed, gradually.

> *It's very unlike a car. It's a bit foreign to remove my hands to stop. I would expect something you could hold all the time.* (Non-user 71)

This lack of speed control was repeatedly reflected in their overestimation of their driving speed (particularly on class 2 scooters); estimates ranged up to 10mph on a class 2 scooters. The scooter users were far more accurate at judging their speed, without the use of a speedometer.

Choosing a scooter: They also took a more practical approach to assessing the usability of the scooters' controls; basing judgements on their own experiences and requirements. For example, when asked whether any of the scooters they'd tried during the testing session were easier to use than their own, most preferred their own model.

> *Levers that stick out can catch on your clothing if you turn around you might pull the lever forward and shoot off – then you're stuck panicking; so you have to turn the key to stop. This has happened to me before! It's good if they're inside (the steering; they're protected.* (User 70)

> *I just saw and got it second hand from Ebay. I used it and got used to it.* (User 64)

This practical approach was also reflected by this group's equal rating of the TGA Breeze S3, the Invacare Orion and the Pride Colt 9 as the easiest-to-use mobility scooters, overall. However, only three of the seven scooter users had received any information or training from an accredited organisation before buying their own scooters. The majority had bought them online or second hand from a friend or neighbour.

Regardless of experience, feedback on preferences from scooter-users was found to be very similar to that of the non-users across a number of features, which could improve the usability of scooter controls for all users. These are set out below:

Use of meaningful colours

Colour was found to be an aid to seeing, recognising, understanding and reading certain controls e.g. buttons and battery gauges. However, colour was more effective when it was considered 'meaningful' such as red for danger, hazard or warning and green for go, positive or good.

> *It's easy to understand the dial because it has red amber and green lights.* (User 70)

Audio and visual feedback

> *Yes, I you know the scooter is on because the light's comes on. It's also good to have audio and visuals showing that the indicators are on.* (User 75)

Feedback, in the form of a sound or a visual indicator following the selection of a control was found to provide reassurance and increase confidence that a task had been successfully achieved e.g. an indicator flashing and beeping confirmed that it had been turned on. If feedback was both audio and visual this was reported as even more

noticeable and useful for those who were affected by either a hearing or vision impairment.

Warning sounds and volume

The volume and type of sound made by a horn to give warning was frequently found to be too low or not forceful enough; particularly not meeting expectations on the larger (class 3) scooters. This was considered

> Noise doesn't suggest a hazard. It sounds very like the reversing beep, which might confuse pedestrians. (Non-user 60).

particularly important for those with hearing impairments. It was also

> Odd horn - don't think I'd hear it - hearing aid. My mobile makes more noise. Pathetic. Expected more noise for something this size. (Non-user 68)

expected that all warnings e.g. hazard lights, indicators, reversing and horn, would make a different noise to help both pedestrians and mobility scooter drivers correctly identify the type of warning being given.

Labelling and symbols

Controls labelled with large, clear, recognisable symbols made them easier to identify, read and differentiate from other controls. New or additional symbols did cause confusion, which shows the importance of consistency of design across the standard mobility scooter controls.

> It's a speed dial. The hare and tortoise make it obvious and it also shows a thicker line for faster. (User 69)

Large controls

Larger controls were considered far easier to use for several reasons; they're easier to see, identify, grab, grip and manipulate, while driving along. Smaller switches took more strength and coordination, while smaller buttons were easily

> The key power switch is awkward and small but the speed control is a nice big dial. I can use it as you go. Levers are nice and long. Quite easy. (User 67)

missed and caused frustration for those with poorer vision. It was also found that larger controls were thought to be sturdier, longer lasting and better quality.

Position and proximity of controls to fingers and hands

Frustration was caused when the indicators, horn or speed controls were not positioned close enough for the scooter driver to use them with their thumbs or fingers while holding onto the steering. These were considered to be the most important controls, which would be used most often. It was reported as inconvenient, uncomfortable and unsafe when the scooter driver struggled to reach the controls while driving, or had to stop to use them.

> It's daft having indicators up there. It's easier to change digital display! Why aren't controls closer to the levers and my finger and thumbs. (Non-user 64)

> Controls are centralised and all in line; making them easy to see what they are. I can also use them when gripping the steering. I don't need to let go to touch the horn or speed dial. (User 70)

Reaching accelerator and handbrake while steering

Overall, reach of controls was a recurring issue because of its effect on a person's comfort, confidence and ability to drive a scooter safely. It's critical that a scooter driver can hold on and

> I appreciate the hand brake but it took time to reach it. It might be uncomfortable after a while. (User 60)

steer, while accessing and using the accelerator levers, or handbrake (if present). However, it's clear that there's no one standard design or layout of the accelerator levers, steering and handbrake controls that will suit or benefit all scooter users, equally.

Additional insights

Although not directly relevant to the usability evaluation of mobility scooter controls, the following insights taken from the focus groups were considered valuable to include in this report due to their general relationship to scooter safety.

What isn't the mobility sector doing well?

- Anyone can become a mobility scooter dealer – there are no licensing laws.
- There is a lack of after sales service from manufacturers and dealers.
- A person does not need to take a driving test to drive a scooter on the pavement or road.
- There is no obligation to get an eyesight test or any form of medical sign-off before driving a scooter.
- There's no legislation dictating that scooter-users must have third party insurance.
- The stability of scooters with three wheels is poor.
- There's no legislation or obligation for scooter users to wear florescent jackets or use reflectors
- Unsafe driving is not policed or reported by the police
- All scooters must have lights, particularly for use on winter afternoons
- Scooters tend to speed up when going downhill
- There's no obligation to take a training course before driving a mobility scooter and there's no one, national accredited mobility scooter training course
- Pricing is not standardised or regulated, which means that people can get tempted by cheaper prices rather than choose a scooter based on their needs. Alternatively, customers can also get overcharged.
- There's no official Highway Code for mobility scooter drivers. There are only sections within the Highway Code which refer to scooters, and a number of unofficial guides which may not be known to scooter users unless they happen to visit an accredited organisation for an assessment or advice.

Future Research

This research highlighted a number of areas where further research would be of value to consumers, manufacturers, suppliers, support services as well as to governance development. Rica suggests the following areas for future investigation:

- **Stopping distances** – Rica researchers observed that mobility scooters sometimes took a long time to slow down and stop. This is a safety issue that needs to be considered by consumers when choosing a scooter. Rica suggests further research into this, to investigate whether there are differences between scooters (and between scooters and wheelchairs), and whether stopping distances are affected by factors such as driver weight, terrain (slope, surface etc) and speed.

- **Storage** – The issue of how people store their mobility scooters was raised as a matter of on-going concern by various professionals within the mobility sector. During the focus group, several examples were given of where a person had purchased a mobility scooter that was too large to store in their own home, they didn't have a shed and as a result the scooter would end up blocking a communal hallway, a fire exit, or exposed to all weathers in their garden. It was also reported that some people were charging their scooters via an extension lead into the garden. Poor storage of mobility scooters effects safety, security and maintenance. Rica proposes that mobility scooter consumers need advice and guidance on this matter when they are in the process of purchasing a scooter. They also need to know where they can buy suitable storage solutions and the costs.

- **Dismantling boot scooters** – Mobility scooters that fold or dismantle so that they fit into the boot of a car, are very popular. However, due to the effects of age and/or disability such as Arthritis or a stroke, many scooter-users may find that it's actually very difficult to dismantle their scooter due to the strength and dexterity required. This was an issue raised by professionals from the mobility sector, and Rica researchers observed the physical limitations that many scooter-users had, during this research project. Rica suggests further research into the ease of dismantling popular models of boot-scooters to provide a comprehensive guide to the easier to use makes, as well as tips and techniques to use when dismantling a scooter.

- **Safety and maintenance** – This was highlighted as a concern among the non-scooter users. They were keen to know who to contact in the event of a breakdown, flat tyre or accident, if they did decide to purchase a scooter. This was also an issue raised by the focus group, who felt that there was not enough information or support for scooter users, and that the after-sales service from scooter suppliers was often non-existent. Rica suggests carrying out research into the maintenance options that scooter-users have and providing consumers with a guide on organisations to contact (who to call) in the event of an accident, or maintenance issue.

Acknowledgements

Acknowledgements

Appendix 1: Methodology

The sample of participants was selected so that a comparison could be made between those with experience of driving a mobility scooter and those without experience. All participants were recruited from Rica's Consumer Panel of disabled and older people, which is maintained by Intertek.

Research participants were recruited according to the following criteria:

General sample

- 50/50 males and females
- 60-75 years olds
- 8 x mobility scooter users
- 8 x non-disabled, non-scooter users

Scooter users (nine individuals)

- Must own a scooter for at least two months
- Use their scooter regularly (at least once a week)
- Disability is not from childhood or life long
- May have vision, motor, cognitive and/or other physiological conditions/impairments
- Must not be blind or have a severe vision impairments
- May require glasses to be able to read and/or drive, unable to read and/or focus on smaller text sizes without magnification

Non-scooter users (seven individuals)

- Do not own and have never owned a scooter
- Have no physical experience of scooters
- Interested in scooters as a mobility option for the future
- May be considering a scooter for themselves or an older relative, friend or neighbour
- May have vision, motor, cognitive and/or other physiological conditions/impairments due to age

Table 1: Mobility scooter trial participants

Male and female, scooter users and non-scooter users who were between the ages of 60 to 75 years old.

Participant	Gender	Age	Scooter experience
P1	F	71	Non-user
P2	F	70	Non-user
P3	F	75	User
P4	F	70	User
P5	F	62	Non-user
P6	F	70	Non-user
P7	F	60	Non-user
P8	M	71	Non-user
P9	F	60	User
P10	F	64	User
P11	M	68	Non-user
P12	F	64	User
P13	M	67	User
P14	M	69	User
P15	F	64	Non-user
P16	M	64	Non-user

The focus group participants were recruited by Rica's senior researcher during the desk research phase of this research project. They were selected according to their own willingness to contribute, as well as there role and experience of the issues that mobility scooter users have when choosing and driving a scooter.

Table 2: Focus group participants
Male and female professionals who work in or for the mobility sector.

Participant	Organisation	Role
P1	William Merritt Centre	Occupational therapist, team leader at WMC and Member of Assist UK, and Forum of Mobility Centres.
P2	London Mobility	Motability dealer
P3	London Mobility	Motability dealer
P4	Motability Operations	Account manager, Powered wheelchair and scooter schemes
P5	Hertfordshire Action on Disability	Manager
P6	Hertfordshire Action on Disability	Driving assessor
P7	PACT Safe Scooter scheme	Project manager
P8	PACT Safe Scooter scheme Norfolk Constabulary	Traffic management officer
P9	Department of Transport	Head of Disability and Equalities at Department for Transport
P10	Ealing shop mobility	Shop Mobility manager and trustee for the National Federation of Shopmobility

Focus Group

One, two-hour focus group was held with 10 experts who work with disabled people, and within the mobility scooter sector. During the focus group, participants discussed the safety and usability issues of mobility scooters, as well as their own experiences working with disabled and older people who want or have scooters. They were also asked to discuss:

- What is the mobility sector doing well?
- What isn't the mobility sector doing well?
- What improvements need to be made to the usability and safety of mobility scooters?

Finally, they were asked to briefly look at a sample of 10 class 2 and 3 mobility scooters and feedback their thoughts.

Usability Trials

Seven, of the original sample of 10, mobility scooters were selected for the usability testing trials.

Eight, two and a half hour usability testing sessions were carried out with a total of 16 participants; 2 participants per session were testing scooters simultaneously with two researchers. All participants were asked to perform the same set of tasks, which were based on were designed to investigate the ease of use of a range of mobility scooter controls while performing the following common, basic tasks:

- Identification of the function and purpose of all driving controls
- Turning scooter on
- Speed control/ acceleration
- Steering
- Stopping quickly
- Parking
- Reversing
- Checking the battery charge
- Using the indicators, hazards and horn.

During each task, participants were asked to 'think aloud', and after each task was completed they were asked to feedback on the overall experience of the scooter and rate its ease-of-use. At the end of the two and a half hour session, participants were asked to feedback on their overall experience of all seven mobility scooters.

The research venue
The focus group and all testing took place at Intertek's labs in Milton Keynes.

Appendix 2: Selecting the mobility scooters

There are over 120 different mobility scooters available in the UK. To be able to select a sample that would accurately represented the range of driving controls across these different types of scooters, Rica referred to industry experts for advice and guidance.

Motability Operations informed the selection by providing sales statistics showing the most popular size, as well as make and model of scooter.

Table 1: Percentage breakdown of applications on the Motability scheme (2012)

Size	% sold
Large Scooter	58%
Medium Scooter	15%
Small Scooter	11%
Standard Powered Wheelchair	14%
Custom Build Powered Wheelchair	2%

Table 2: Highest volume mobility scooters sold on the Motability scheme from Q3 (2013)

Manufacturer	Range	Product	Product Category	Category price cap
Kymco	Kymco	Mini LS	Small	£750
TGA	TGA	Breeze S4-heavy duty battery	Large	£3,000
Roma Medical	Roma	Cadiz	Large	£3,000
Kymco	Kymco	Maxi XLS	Large	£3,000
Van Os Medical	Excel	Galaxy 4 with Battery Upgrade	Large	£3,000
AVC	Quingo	Vitess	Large	£3,000
Pride	Pride	Colt PLUS	Medium	£1,500
Pride	Pride	Colt Sport	Large	£3,000
Electric Mobility	Rascal	329LE	Large	£3,000
Invacare	Invacare	Comet	Large	£3,000
Kymco	Kymco	Midi XLS	Large	£3,000
Pride	Pride	Colt Deluxe	Medium	£1,500

Rica then selected the scooters that represented the most popular sizes, both ends of the price range, as well as different makes. The highlighted rows show the scooters originally selected for the testing sample. London Mobility also fed into this process, informed the final selection and lent Rica all of the scooters used for the testing.

NB: Motability scheme volumes and are not necessarily reflective of the scooter market as a whole.

NB: AVC / Quingo are no longer on the scheme.

Mobility Scooter sample

Mobility Scooters	Name/model/class
	Invacare Orion (class 3)
	TGA Vita S (Class 3)
	Pride Colt 9 (class2)
	Kymcoi For U (class 2)
	Pride Go-Go Elite Traveller (class 2)
	Electric Mobility Rascal (class 2)
	TGA Breeze S3 (class 3) and TGA Breeze S3 Right and left controls

10a

10b

Appendix 3: Test questionnaires

Test questionnaire

Note: On all scale questions, 1=very difficult and 7=very easy

Welcome to today's usability testing session and thank you very much for agreeing to participate in our research. My name is Lucy, and this is my colleague Cassie. We work for Rica, a charity that tests the usability of products for older and disabled people.

Today we will be asking you to take a look at some mobility scooters and have a go at driving them. [Person A] will work with me and [Person B] will work with Cassie. We'll take you to look at each of the scooters. We'll start out by asking you to look at the controls and tell us what you think of them. We'll then ask you to drive the scooters and try a few different tasks.

As you go along, we'd like you to give us your feedback on how easy the controls are - just tell us whatever good and bad points come into your head. The important thing is that this isn't a test of your driving skills, we're just interested in how good the scooters are. We want you to do whatever comes naturally.

If you don't feel safe or comfortable with driving any of the scooters, just say so and we'll skip over the driving task for that one. Once you've tried out all the scooters, we'll ask you a few more summary questions.

This session will take between two, and two and a half hours. If you need a break at any point, let me or Cassie know. You're also free to stop the session at any time.

Do you have any questions?

Class 2 scooter

First of all, take a seat on the scooter and have a look at the controls.

Can you talk me through each of the controls individually? Please tell me what you think they are and what you would expect them to do.

[Responses recorded on a diagram of the control panel]

How easy or difficult do you think this scooter would be to use? Show me on this scale.

1   2   3   4   5   6   7

Task 1 (turn on)

The first thing I'd like you to do is turn the scooter on.

Performance

      Completed without help

      Completed with help

      Errors made?

Notes

Next, we'd like you to try driving this scooter. We'll explain all the controls fully first. We'd like you to do a number of tasks to do with starting, stopping and controlling the scooter. It should take around 10 minutes. You can ask to stop if you're not happy with any of the tasks. Do you feel comfortable doing the driving task with this scooter?

If no, P doesn't have to do the driving task. If yes, use of the scooter must be fully explained so P can do the task safely.

Was that what you expected?

Overall, how difficult or easy did you find the task?

1	2	3	4	5	6	7

Why?

Task 2 (speed)

Now I'd like you to try controlling the speed of the scooter. Start at the slowest speed possible, and then as you go along turn it up to the fastest speed possible, or as fast as you're happy to go.

Performance

> Completed without help
>
> Completed with help
>
> Errors made?
>
> Notes

Was that what you expected?

Overall, how difficult or easy did you find the task?

1	2	3	4	5	6	7

Why?

How fast do you think you were going, at your fastest?

Task 3 (steering)

Now I'd like you to try controlling the speed of the scooter. Start at the slowest speed possible, and then as you go along turn it up to the fastest speed possible, or as fast as you're happy to go.

Performance

> Completed without help
>
> Completed with help
>
> Errors made?

Notes

Number of cones touched/knocked down

1

2

3

Was that what you expected?

Overall, how difficult or easy did you find the task?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Why?

Task 4 (stopping)

The next task is about stopping quickly. I'd like you to keep going in a straight line, and then stop when I give the signal. I can blow this whistle or wave this flag, which would you prefer?

Performance

Completed without help

Completed with help

Errors made?

Notes

Was that what you expected?

Overall, how difficult or easy did you find the task?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Why?

Task 5 (parking)

The next task is about parking. I'd like you to drive the scooter forwards into that space marked out on the floor, and then stop it.

Performance

Completed without help

Completed with help

Errors made?

Notes

Was that what you expected?

Overall, how difficult or easy did you find the task?

1   2   3   4   5   6   7

Why?

Task 6 (reversing)

Now I'd like you to reverse out of the space in a straight line.

Performance

      Completed without help

      Completed with help

      Errors made?

      Notes

Was that what you expected?

Overall, how difficult or easy did you find the task?

1   2   3   4   5   6   7

Why?

Task 7 (battery)

Can you tell me how much power is left in the battery?

Performance

      Completed without help

      Completed with help

      Errors made?

      Notes

Was that what you expected?

Overall, how difficult or easy did you find the task?

1   2   3   4   5   6   7

Why?

Class 3 scooter

First of all, take a seat on the scooter and have a look at the controls.

Can you talk me through each of the controls individually? Please tell me what you think they are and what you would expect them to do.

[Responses recorded on a diagram of the control panel]

How easy or difficult do you think this scooter would be to use? Show me on this scale.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

(1= very difficult, 7= very easy)

Task 1 (turn on)

The first thing I'd like you to do is turn the scooter on.

Performance

       Completed without help

       Completed with help

       Errors made?

       Notes

Next, we'd like you to try driving this scooter. We'll explain all the controls fully first. We'd like you to do a number of tasks to do with starting, stopping and controlling the scooter. It should take around 10 minutes. You can ask to stop if you're not happy with any of the tasks. Do you feel comfortable doing the driving task with this scooter?

If no, P doesn't have to do the driving task. If yes, use of the scooter must be fully explained so P can do the task safely.

Was that what you expected?

Overall, how difficult or easy did you find the task?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Why?

Task 2 (speed)

Now I'd like you to try controlling the speed of the scooter. Start at the slowest speed possible, and then as you go along turn it up to the fastest speed possible, or as fast as you're happy to go.

Performance

       Completed without help

       Completed with help

       Errors made?

       Notes

Was that what you expected?

Overall, how difficult or easy did you find the task?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Why?

How fast do you think you were going, at your fastest?

Task 3 (steering)

Now I'd like you to try controlling the speed of the scooter. Start at the slowest speed possible, and then as you go along turn it up to the fastest speed possible, or as fast as you're happy to go.

Performance

> Completed without help

> Completed with help

> Errors made?

> Notes

Number of cones touched/knocked down

> 1

> 2

> 3

Was that what you expected?

Overall, how difficult or easy did you find the task?

1	2	3	4	5	6	7

Why?

Task 4 (stopping)

The next task is about stopping quickly. I'd like you to keep going in a straight line, and then stop when I give the signal. I can blow this whistle or wave this flag, which would you prefer?

Performance

> Completed without help

> Completed with help

> Errors made?

> Notes

Was that what you expected?

Overall, how difficult or easy did you find the task?

1	2	3	4	5	6	7

Why?

Task 5 (parking)

The next task is about parking. I'd like you to drive the scooter forwards into that space marked out on the floor, and then stop it.

Performance

      Completed without help

      Completed with help

      Errors made?

      Notes

Was that what you expected?

Overall, how difficult or easy did you find the task?

1   2   3   4   5   6   7

Why?

Task 6 (reversing)

Now I'd like you to reverse out of the space in a straight line.

Performance

      Completed without help

      Completed with help

      Errors made?

      Notes

Was that what you expected?

Overall, how difficult or easy did you find the task?

1   2   3   4   5   6   7

Why?

Task 7 (indicators)

For the next task, please drive in a straight line again and turn on one of the indicators as you go along.

Performance

      Completed without help

      Completed with help

Errors made?

Notes

Was that what you expected?

Overall, how difficult or easy did you find the task?

1	2	3	4	5	6	7

Why?

Task 8 (horn)

Can you sound the horn?

Performance

Completed without help

Completed with help

Errors made?

Notes

Was that what you expected?

Overall, how difficult or easy did you find the task?

1	2	3	4	5	6	7

Why?

Task 9 (hazard lights)

Can you put the hazard lights on?

Performance

Completed without help

Completed with help

Errors made?

Notes

Was that what you expected?

Overall, how difficult or easy did you find the task?

1	2	3	4	5	6	7

Why?

Task 10 (battery)

Can you tell me how much power is left in the battery?

Performance

       Completed without help

       Completed with help

       Errors made?

       Notes

Was that what you expected?

Overall, how difficult or easy did you find the task?

1   2   3   4   5   6   7

Why?

[If has screen] Was it easy to see what was on the screen?

Post-test questionnaire

Note: for all scale questions, 1=strongly disagree and 5=strongly agree

That's all the tasks for this scooter. I have a few more questions before we move on to the next one.

For the first few, I'd like you to use this scale (show prompt card) to show me how much you agree or disagree with the following statements.

I felt very confident on this scooter

1   2   3   4   5

It was very easy to work out how to use this scooter

1   2   3   4   5

Thinking about the controls of the scooter, did using them cause you any physical discomfort?

Which, if any, of the controls were particularly easy to use?
Prompt: Why that one/those ones?

Which, if any, of the controls were particularly difficult to use?
Prompt: Why that one/those ones?

Take a look at this list. Can you show me which places you'd feel safe driving this scooter in?

Empty pavement

Crowded pavement

Inside a shop

On a road

In heavy traffic

Final evaluation questionnaire

Note: for all scale questions, 1=very dissatisfied and 7=very satisfied

Which of the scooters that you've seen today did you find easiest to use?

1. Invacare Orion (class 3)

2. TGA Vita S (class 3)

3. Pride Colt 9 (class 2)

4. Sterling Pearl (class 2)

5. Kymco For U (class 2)

6. Pride Go-Go Elite Traveller (class 2)

7. Invacare Lynx (class 2)

8. Electric Mobility Rascal (class 2)

9. Roma Medical (class 2)

10. TGA Breeze (class 3)

[EXPERIENCED USERS] Were any of the scooters you tried out easier to use than the scooter you currently own?
If no: Why not?
If yes: Which ones?

[EXPERIENCED USERS] Think back to when you bought your own scooter. (The most recent time, if you've bought more than one).

How satisfied were you with the information you were given beforehand?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Why?

[EXPERIENCED USERS] How satisfied were you with the after-sales service and information?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Why?

[NEW USERS] Would you consider getting one of these scooters in future, if your needs changed?
If no: Why not?
If yes: Which ones?

[NEW USERS] If you were buying a scooter, what information would you want to get before making a final decision?

[NEW USERS] What support or information would you expect to get after your purchase?

Think about times when you might drive a scooter on the pavement. Do you know the top speed you're allowed to go at?

Correct (4mph)

Incorrect

Don't know

Where did you find this out?

Would you try and find out before trying it? (If yes) Where?

Appendix 4: Terminology

For the purpose of this study, the term controls refers to those used to drive and control a mobility scooter:

- Steering tiller
- Handbrake
- Accelerator levers/paddles
- Horn
- Lights
- Indicators
- Speedometer
- Hazard lights
- Visual digital display
- Battery gauge
- Key, on/off switch