Institution: University of Hertfordshire

Unit of Assessment: Panel B (11): Computer Science and Informatics

Title of case study: Digital and Accessible Information: Accessibility for All

1. Summary of the impact (indicative maximum 100 words)

Human–computer usability research within the university's Sensory Disabilities Research Unit (1993–2002) led to the construction of accessibility guidelines that are widely used, with an estimated reach to a maximum of 30 million people in the EU. PAS 78: Guide to Good Practice in Commissioning Accessible Websites and BSI BS8788 Web Accessibility Code of Practice met 2010 web accessibility law in the UK and subsequent EU legislation. Similarly, BS EN 15823:2010: Braille on Packaging for Medicinal Products met UK, EU and International Standards for Braille on medicine packaging. Further research resulted in award-winning guides for blind users of Windows software that improves accessibility to work.

2. Underpinning research (indicative maximum 500 words)

The Sensory Disabilities Research Unit (SDRU) was set up at the university in 1993, with Professor Helen Petrie (now Professor of Computer Science at the University of York) as Research Director until 2001. Its high reputation resulted in the National Centre for Tactile Diagrams (NCTD) moving its base into the unit from 1999 to 2002; Professor Petrie directed both until 2001, with Dr Sarah Morley Wilkins (research assistant, then PhD student, and latterly NCTD assistant director, 1993–2001) taking over as director 2001–2. Between 1993 and 2002 Professor Diana Kornbrot (Research Advisor, 1993–present), five PhD students, a research fellow, a technical officer and several research assistants contributed to a series of accessibility/disability-related research projects.

An EU-funded programme of research started in 1993 with the GUIB10, which investigated access to general computer-based systems for older and disabled people. The ACCESS11 project on web accessibility included the first, and still one of the only, evaluations of the usability of the international guidelines for Web Content Accessibility. MOBIC12 (Mobility for Blind and elderly persons Interacting with Computers) and PAM-AID14 (Personal Adaptive Mobility Aid for the Frail and Elderly Visually Impaired) both examined mobility aids; other Europe-wide projects investigated common enhancement by touch or speech of common devices: SATURN13 for smart cards and terminal usability requirements and needs, and VISTEL15 (Visual Impaired Screen-based Telephony) for telephony.

Understanding the needs and capabilities of potential technology users is a key component of any development process – a particularly difficult task when the users have disabilities or belong to a different generation from the developers. Our research employed behavioural investigations of how both visually impaired and sighted people used technology to accomplish their goals. People's actions when using technology 'in anger' was the main source of information for the development of evidence-based guidelines. This performance information was supplemented by self-reporting and focus group discussions.

The pioneering research with visually impaired people and its subsequent findings therefore made a substantial contribution to understanding the specific requirements for technology users with disabilities, particularly visual disabilities, and older users of computer systems and the Internet. Development using an iterative user-centred design lifecycle was another key component of a successful design process. Our research articulated this design lifecycle with older and disabled users, and provided a wealth of examples of how to apply user-centred design methodologies with these user groups. The methods were first applied to general web uses and extended to the specific needs of museum visitors, followed by effective Braille and tactile labelling of commercial products.

Several UK projects employing our methodology investigated other aspects of technology use, including auditory, tactile and Braille aids, thus providing a comprehensive picture of the needs and abilities of visually impaired technology users. These included an evaluation of COMPAS, a groundbreaking website developed by the British Museum.

Providing a comprehensive non-visual guide to complex software was a further target of our user-centred research. Originating in Morley Wilkinson's doctoral work, this research culminated in the first non-visual guide to Windows software. The guide has been updated for every new version of Windows, and is now in its seventh edition.

3. References to the research (indicative maximum of six references)

Peer-Reviewed Publications

All publications are based on Professor Petrie's or Dr Morley Wilkins' work, some in collaboration with Professor Kornbrot, at the University of Hertfordshire. The top three publications are indicated by ******.

1. Petrie, H., Morley, S. and Weber, G. T. (1995). Tactile-based direct manipulation in GUIs for blind users. Paper presented at the Companion on Human Factors in Computing Systems (CHI '95 Conference), 428–429. doi: 10.1145/223355.223769 ACM ISBN 0-89791-755-3

2. Colwell, C., Petrie, H., Kornbrot, D., Hardwick, A. and Furner, S. (1998). Haptic virtual reality for blind computer users*. Proceedings of the Third International ACM Conference on Assistive Technologies*, 92–99. doi: 10.1145/274497.274515 ISBN 1-58113-020-1 ******

3. Morley, S., Petrie, H., O'Neill, A.-M. and McNally, P. (1999). Auditory navigation in hyperspace: Design and evaluation of a non-visual hypermedia system for blind users, *Behaviour and Information Technology*, 18(1), 18–26. doi: 10.1080/014492999119219 ******

4. Ramsay, A. I. G., & Petrie, H. (2000). The tactile depiction of visual conventions: The advantage of explicit cues. *British Journal of Visual Impairment*, 18(1), 7–14.
doi: 10.1177/026461960001800103

5. Colwell, C. and Petrie, H. (2001). Evaluation of guidelines for designing accessible Web content. *Computers and the Physically Handicapped* (70), 11–13. doi: 10.1145/501078.501082

6. Kornbrot, D. E., Penn, P., Petrie, H., Furner, S. and Hardwick, A. (2007). Roughness perception in haptic virtual reality for sighted and blind people, *Perception & Psychophysics*, 69(4), 502–512. doi: 10.3758/BF03193907 ******

Funding, 1993–1998

EU Commission (Telematics Applications Programme)

Six separate grants totalling **£580,192** for work on the GUIB, ACCESS, MOBIC, PAM-AID, SATURN and VISTEL projects. Collaborators included the RNIB, NCR, MA Systems and Control Ltd (UK); Stuttgart University; Trinity College Dublin; Phillips Consumer Electronics (Netherlands); CNR-IROE, Telecon Italia (Italy); and other institutions and organisations in Belgium, Finland, France, Greece, Norway and Sweden.

HEFCE

Three major awards totalling **£165,700** to support UK higher education students, including the Tactile Diagram Centre; and Higher Education Reach-Out to Business and the Community.

Other Grants

The SRDU was awarded eleven smaller non-higher education grants, totalling **£158,500**, from UK

organisations including: the British Museum; the Library and Information Commission; British Aerosol Manufacturers Association; IT and Disability Alliance/National Disability Council; and Microsoft Corporation (New Discoveries Award).

4. Details of the impact (indicative maximum 750 words)

The number of people with disabilities in the UK is estimated as 10.8 million, and the RNIB estimates that over 2 million people in UK have sight loss. The beneficiaries of Professor Petrie's and her colleagues' research are individuals with disability, predominantly but not exclusively visual impairment. The impact of this work falls into one of three categories: protective legislation and guidelines; producers of goods and services creating better and more accessible products; and products put into immediate use, such as the widely used *Windows . . . Explained* guides. The impact reaches beyond Britain, as UK and EU guidelines influence guidelines worldwide, and some of the resources described below have been translated into many languages.

1. Web Accessibility Standards

The 1998 SDRU research on both the nature of accessibility and the methodologies to be used in investigating accessibility later resulted in Helen Petrie (by then at City University) being asked to undertake the first Formal Investigation for the Disability Rights Commission into web accessibility. The resulting highly influential report, *The Web: Access and Inclusion for Disabled People* (2004), in turn led to the Equality and Human Rights Commission with the British Standards Institute developing PAS 78: Guide to Good Practice in Commissioning Accessible Websites (2006) and subsequently the BS 8878:2010 Web Accessibility Code of Practice (2010). Both of these documents continue to be widely used to ensure that websites and services are accessible to disabled people – in this context, 'disabled' includes hearing-impaired, mobility-restricted and dyslexic, as well as visually impaired. These standards are EU- as well as UK-implemented.

2. Provision of Resources to Support HEIs, Businesses and Organisations

Initial University of Hertfordshire work conducted with the former Anglia Polytechnic University on tactile mapping symbols produced the most robust research evidence yet available on their use. This, together with work on tactile graphics standards, resulted in the following impacts: an invitation to Sarah Morley Wilkins to act as consultant and contributor to the Braille Authority of North America and the Canadian Braille Authority in 2010 on the development of major guidelines; her acting as lead UK consultant on EU implementation of an International Standard for Braille on medicine packaging; and a European standard being published in the UK by BSI as BS EN 15823:2010 Packaging. Braille on Packaging for Medicinal Products (2010). It is now in the process of being implemented as an International Standard, with Dr Morley advising as the UK expert.

Morley Wilkins also led the creation of the UK Association for Accessible Formats (UKAAF), a unified charitable company formed in 2009 and responsible for accessible format standards. Heavily informed by the SRDU's research, the association exists for the benefit of everyone with print-disabilities. It has around 150 institutional and individual members.

3. Guidance for Non-Visual Information Systems

SDRU research has helped thousands of blind and visually impaired computer users to make effective use of their PCs at home, in education and at work. It has done so via a series of five internationally successful books for users and trainers, authored by Morley Wilkins and published 1995–2009: *Windows 95 Explained*, and subsequently *Windows . . . Explained* guides for Windows 98, XP, 7 and Vista; and *Window Concepts: An Introductory Guide for Blind and Visually Disabled Users* (1995). These have been translated into Dutch, French, German, Hungarian, Japanese and Russian. The RNIB website displays a comment from Rob Sinclair, Director of Accessibility at Microsoft, that Morley Wilkins' *Windows 7 and Vista* guide is: 'An invaluable resource for PC users who are blind or visually impaired and a source of greater insight for readers looking at the screen.' This sentiment is echoed by 'DN', of the British Computer Association of the Blind: 'With the major changes to the interface Microsoft has introduced into Windows 7 the need for such a well-

described guide is even more important for visually impaired computer users.'

Morley Wilkins also delivered train-the-trainer Window Concepts courses for many prestigious organisations in the UK and USA, and for overseas blindness agencies setting up courses in their own countries, among them Switzerland, Ireland, and Eastern European nations. Consequently, she has become a world leader in the training of blind computer users.

In 2010, Sarah Morley Wilkins won the National Federation of the Blind Grimshaw Award (2010) for her work on accessibility in a wide range of settings, having earlier been awarded the SAP/Stevie Wonder Vision Pioneer of the Year Award (1998) and the National Information Forum Getting the Message Across Award (1998).

5. Sources to corroborate the impact (indicative maximum of 10 references)

Reports and Supporting Publications

1. Web Accessibility Standards

BS 8878: 2010 Web Accessibility Code of Practice. (Arising from *The Web: Access and Inclusion for Disabled People* (2004)

PAS 78: Guide to Good Practice in Commissioning Accessible Websites (2006).)

– *Copies of both are available on request*

2. Provision of Resources to Support HEIs, Businesses and Organisations

BS EN 15823:2010 Packaging. Braille on Packaging for Medicinal Products. <http://shop.bsigroup.com/ProductDetail/?pid=000000000030180500>

Braille Authority website: lists Dr Morley Wilkins' role in US and Canadian guideline formation, <www.brailleauthority.org/tg/web-manual/index.html>

PharmaBraille website: November 2012 announcement of Dr Morley Wilkins' lead role in developing International Standard for Braille on medicinal packaging, <http://www.pharmabraille.com/pharmaceutical-braille-news/international_standard_for_braille_on_medicine_packaging>

3. Guidance for Non-Visual Information Systems

Sarah Morley Wilkins and Steve Griffiths, *Windows 7 and Vista Explained: A Guide for Blind and Partially Sighted Users*. Peterborough: RNIB, 2009 (and later editions).

<https://www.rnib.org.uk/professionals/services/booksprofessionals/windows7/Pages/windows_7_vista.aspx>

Reader comments about *Windows 7 and Vista Explained*, including the quotes by Rob Sinclair and 'DN' in section 4, can be found on the RNIB website:

<https://www.rnib.org.uk/professionals/services/booksprofessionals/windows7/Pages/windows_7_vista.aspx>

and also on the 'Feedback from Readers' page on Sarah Morley Wilkins' website, along with a selection of other comments on her books: <www.winguide.co.uk/feedback/>

Corroboration from External Partners

Three individuals have agreed to corroborate aspects of the impact outlined in this case study concerning British and International Standards, and Braille packaging (names and contact details supplied separately).