Institution: Sheffield Hallam University

Unit of Assessment: 34 Art and Design: History, Practice and Theory

Title of case study: Tactile Interpretation of Visual Symbols

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

The research has explored the value of making in developing knowledge and the role of haptic cues and their design application in improving usability of products. The research has informed the design of TacMap whose primary beneficiaries are blind and partially sighted users. Resulting impact of research has been 1) a **spin out company TacMap Ltd**. 2) **greater independence and dignity for blind and partially sighted people** who through the use of 'TacMap' can move more easily around interior and exterior spaces. 3) **more inclusive and compliant services for businesses in relationship to the Equality Act 2010 agenda**.

2. Underpinning research (indicative maximum 500 words)

Chamberlain was appointed by Sheffield Hallam University (SHU) as a Senior Lecturer in 1991, a Principal Lecturer in 2004, Professor of Design in 2007 and Head of the Arts and Design Research Centre in 2009. He has adopted a practice-led experimental approach to research that has increased understanding of the characteristics of shape and textures that are more and less easy to detect via the cutaneous senses. His research has engaged sensory impaired users (deaf/blind) and sensory challenging contexts (intensive care) that have highlighted the value of multi-sensory design. Chamberlain through his research outputs demonstrates the limitation of traditional user-centred research methods that focus on verbal and visual protocols and the value of tangible artefacts as a methodology for eliciting information and developing knowledge.The methodological approach was initially developed and applied (R1, G1) with deaf/blind users in educational, therapeutic and recreational contexts and informed the design (by Chamberlain) of the tactile-sounds system and Q chair (R2), both gaining Design Council UK Millennium Product awards in 2000. These products were subsequently manufactured and distributed world-wide by ROMPA Ltd. Further enquiry explored the role of visual and haptic cues in the discrimination of small medical connectors with the aim of reducing misconnections and potential fatalities (R3, R4). The research (G2), in collaboration with B-Braun Ltd., Psychologists at the University of Leeds and regional hospitals, was applied in the design of a patented (WO2004/097994A1) connection system and was cited by the Crafts Council UK in 'Making Value' as an exemplar of the value of craft "making" and its impact on industry.
http://www.craftscouncil.org.uk/files/file/7cec2fd1e3bdbe39/making_value_full_report.pdf

Supported by Higher Education Innovation Funding (G3) Chamberlain applied the developed methodology to explore how blind people conceptualise and navigate space. This led to the development of an iconic tactile language for use in tactile maps. Signs and symbols can generally be described as pictographs, literal pictorial representations of the real world, and ideographs that are abstracted ideas of that world. Chamberlain supervised Patricia Dieng (SHU 2008 - 2011 Research Assistant) to investigate whether pictographs, ideographs or abstract symbols used in tactile maps were more appropriate for blind people to conceptualise spatial and environmental concepts and relationships. The study (R5) involved a series of user-workshops with the Sheffield Royal Institute of the Blind where Chamberlain and Dieng created tactile translations from a set of 42 standard architectural symbols using microcapsule paper upon which black ink swells when passed through a heater. Printing is done with a standard inkjet printer. A series of tests with blind and partially sighted people identified difficulties in interpretation due to the reduced scale of the tactile translations and the fact that blind people do not have the experience of visual association of the pictographs. New symbols were created and tested through an iterative development. The result of these trials and refinements was a significant reduction in the use of pictographs and an increase in abstract symbols. The modified symbols were then employed on maps (using microcapsule paper) for site-specific locations and a series of user navigation trials undertaken with blind users.

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

Key Outputs

R1 Chamberlain P, Roddis J (2003) Making sense: A Case Study of a Collaborative Design-Led New Product Development for the Sensorily Impaired. The Design Journal, Volume 6, issue 1, Ashgate Publications Ltd. England. ISBN 0-7546-0910
doi: 10.2752/146069203790219353

R2 Tac-Tile sounds system and Q chair, Design Council 'Millennium product Awards' 2000
http://www.designcouncil.org.uk/about-us/our-history/millennium-products/
Portfolio can be supplied by SHU on request

R3 Chamberlain P, Gardner P, Lawton R (2007) Shape of Things to Come. Design Research Now, Essays and Selected Projects. pp. 99-119. Board of International Research in Design. Edited by Ralf Michel. Birkhauser ISBN 978-3-7643-8471-5
doi: 10.1007/978-3-7643-8472-2_7

R4 Lawton R, Gardner P, Green B, Davey C, Chamberlain P, Phillips P, Hughes G (2009) An engineered solution to the maladministration of spinal injection. Quality and Safety in Health Care. 18:492-495 BMJ journal published by group.bmj.com.
doi:10.1136/qshc.2007.025767

R5 Chamberlain P, Dieng P, (2013) How Does it Feel? Tactile Interpretations of Visual Symbols. Signs & Symbols for Workplace and Public Use. Chapter 10, pp. 147-162, Nova Publications
ISBN 978-1-62618-471-8

Patent Application
Patent application number: WO 2004097994, Identification systems for compatible components and apparatus for use with such systems, Inventors Chamberlain P, Walters P, 25 April 2003
Available at: http://www.epo.org/searching/free/espacenet.html.
Document can be supplied by SHU on request

Funding
G1 Chamberlain P.I., Britland Research Centre: To Advance the Knowledge and Application of Sensory Aids and Supporting Protocols, Rompa Ltd., January 2004 - December 2005, £91,331
G2 Chamberlain P.I., The Shape of Things to Come, Health Technology Devices: National Institute of Health Research, April 2004 - March 2006, £50,907 (NIHR); £30,000 (B-Braun); £20,380 (in-kind contribution B-Braun Medical Ltd. and B-Link UK Ltd.) Final report awarded the exceptional grade of 9/10
G3 Chamberlain, P.I. **TacMap, Navigation System for the blind.** Higher Education Investment Fund £25,000 2010

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

The research has generated three types of impact.

1) Spin out company.
Following the research and user trials Patricia Dieng established TacMap Ltd (S1) under licence from the University. TacMap in 2010 was located in 'The Hatchery', an incubation unit within the University. It helps new business developments by offering 12 month's support including one to one advice, workshops and access to networks, as well as use of facilities and resources. In 2010 TacMap was shortlisted for the RCUK business competition (S6)
In 2013 Dieng moved into more permanent offices in the Cultural Industries Quarter of Sheffield operating as TacMap Ltd. (http://www.tacmap.co.uk/), providing a design service utilising findings from the research and also creating tactile maps for a range of businesses and public services. Dieng liaises with Mobility officers and vision support services and continues to work closely with

end users. TacMap has been exhibited at the following events: Sight City Frankfurt, 2010; Autonimic Fair, Paris 2010; 'Sight Village' Birmingham 2013.
http://www.qac.ac.uk/exhibitors/sight-village-birmingham/1/tacmap-ltd/956.htm

2) Greater independence and dignity for blind and partially sighted.
The engagement of users throughout this research programme has helped optimise the design of the TacMap and brought direct and tangible benefits to blind and partially sighted people. The use of the 'TacMap' can improve the way blind people plan their journeys, travel and move around exterior and interior spaces. According to a senior manager at the Sheffield Royal Society of the Blind: *"SRSB has worked with TacMap™ for a number of years, providing feedback from visually impaired people which has aided its development. TacMap™ is a tool which can be used alongside white canes or guide dogs and has the advantage of enabling visually impaired people to discover their surroundings. People I know who have used TacMap™ think it is an innovative and simple tool which gives them confidence and independence in their everyday life. The system has been praised by users for giving a better sense of the environment than using voice direction. "* (S2)
End users have responded positively after using the maps. For example: *"This is wonderful, this illustrates so many things. The plans are really useful, and it is great to be able to go in a room such as the toilets and to know where the basins, the WC and the hand dryers are ".*
"I have walked by something a hundred times and I'll never know it's there, like the main reception and the lift here at the Millennium Galleries". (see http://www.tacmap.co.uk/)
"The benefit of TacMap is the replicability, consistency and simplicity of the symbols. Many non-braille users are less used to receiving tactile information and consequently this can sometimes present a challenge. The considered graphics and symbols on TacMap are easy to understand through tactile interpretation as well as being meaningful to people with vision and helps provide a communicative link". (S3)

TacMap provides a system that integrates with a range of existing transport and mobility services. **For example** TacMap is promoted by the Sensory Impairment Team at Sheffield City Council Travel guide for disabled and older people in Sheffield (https://www.sheffield.gov.uk/caresupport/adult/support-available/travel-pass/support.html) and also by Describe online (www.describe-online.com) which provides access solutions for blind/vision impaired people and which includes a text and audio guide to support TacMap through its website.

3) **More inclusive services for businesses**
TacMap has been commissioned and adopted by South Yorkshire Passenger Transport Executive (http://www.travelsouthyorkshire.com/interchangeguide/) as part of its accessible interchange guide (S7) and for use in The Queen Elizabeth Olympic Park by the London Legacy Corporation (http://www.londonlegacy.co.uk/the-park/accessibility-and-inclusive-design-2/) to support its equality and inclusion agenda. TacMap Ltd has also secured and delivered a contract for a local school where habilitation specialists (vision support) have conducted one to one meetings with pupils to assess the impact that TacMap has had on their orientation around the school. The pupils, blind and partially sighted, aged 11-17 commented:
"Symbols are very meaningful and easy to access when out and about' (pupil with no vision). *"The use of colour makes the buildings stand out, this would have helped me when I first started at Tapton"* (school) (pupil partially sighted).
The support teachers commented on how the map provided independence for the pupils and overcame the challenges of escorting boys and girls into the toilet. They also commented on how the map has given them greater spatial understanding of their environment: "*Pupils generally are driven by mini bus to the school building and the map prompted pupils to comment that they never knew there were two ways into the school and that there were green spaces surrounding the school"*. (S4).
The Equality Act 2010 is placing demands of the public sector and industry to make buildings and facilities accessible, usable and safe for disabled people, and TacMap aims to improve provision for the visually impaired. TacMap was presented to the UK Universities Safety and Health Association (USHA) to demonstrate how tactile symbols could support the HM Government

Personal Escape and Evacuation Programme (PEEP). Health & Safety officers described 'TacMap' as a '*well timed intervention in the quest to improve communication around the health and safety agenda'*. The needs of sighted individuals are usually well catered for regarding the provision of essential safety information, particularly fire and other emergency information (http://www.hse.gov.uk/). The standardised use of colours, shapes and symbols represents most of the safety communication to date. TacMap has attracted the attention of a network of safety and health professionals operating in the UK Higher Education Institutions (HEI's), one of whom has commented that *'TacMap opens an effective communication to an otherwise disadvantaged group and could result in lowered risks and wider participation. There are real opportunities to take the provision of safety and health information to completely new levels – making for example, the fine details of risk assessments more easily communicated to those who might otherwise be oblivious to those risks'*. (S5)
The research was disseminated at the 'Include' Conference at the Royal College of Art 2011 (http://www.hhc.rca.ac.uk/3845/all/1/proceedings.aspx)
Chamberlain was invited to deliver a workshop at the British Royal Cartographic Society Conference 2013.
(http://www.cartography.org.uk/default.asp?contentID=1072)

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

S1. Director TacMap ltd. http://www.tacmap.co.uk/
S2. Manager, Sheffield Royal Institute for the Blind
S3. Vision impaired consultant EYECAN. (Blind person)
S4. Habilitation Officer, Tapton School, Sheffield.
S5. Assistant Director of HR, Workplace Wellbeing. University of Birmingham
S6. TacMaP TM - The World at your fingertips, RCUK Business Plan Competition (2010), pp. 40 http://www.rcuk.ac.uk/documents/innovation/bpc/BPCFINAL.pdf
S7. South Yorkshire Passenger Transport Executive
http://www.travelsouthyorkshire.com/interchangeguide/