Institution: City, University of London

Unit of Assessment: Compute Science and Informatics

Title of case study: GenderMag: a systematic method to address gender barriers within technology design and development, resulting in more inclusive and usable technology.

Period when the underpinning research was undertaken: 2015 – present

Details of staff conducting the underpinning research from the submitting unit:

Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Dr Simone STUMPF	Reader	2009 – present
Dr Stephann MAKRI	Senior Lecturer	2013 – present

Period when the claimed impact occurred: 2015 - present

Is this case study continued from a case study submitted in 2014? N

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

Research in Human-Computer Interaction (HCI) conducted by Dr Simone Stumpf and Dr Stephan Makri in collaboration with Oregon State University (USA) resulted in development of GenderMag, a systematic method to find and fix gender barriers in technology, leading to significant impact on existing technology, making it more inclusive and usable for everyone. Using the GM method, industry practitioners, such as Microsoft, can identify and address root causes of gender barriers and accomplish gender inclusive technology, benefiting organisations and end-users, for example (text removed for publication) website users. Through partnerships with organisations worldwide, public events and educational outreach, GenderMag has contributed to shaping industry standards, for example by contributing to the "Microsoft Inclusive Design Toolkit", a resource that sets standards for designers and developers of digital products, and to changing the mindset about gender inclusion in technology. 23 HE institutions worldwide incorporated GenderMag into undergraduate and graduate programmes.

2. Underpinning research (indicative maximum 500 words)

There are vast gender imbalances in a range of different circumstances and domains, which affect education, business and participation in society [3.5]. Gender differences have also been found in technology design, and it has been shown that much of this technology is not designed to support diversity (Borkin et al., 2013; Fernandez et al., 2013; Hassell, 2015; Tan et al., 2003), even when it is claimed that technology is gender-neutral, i.e. 'no gender is intentionally assigned to their [product's] users' (Williams, 2014). Furthermore, research by Burnett et al. (2005) demonstrated that commercial software tools are optimized based on male developer's preferences, whilst software development teams remain predominantly male (80%) (National Centre for Women in Information Technology (NCWIT), 2020 https://www.ncwit.org/resources/ncwit-scorecard-status-women-computing-2020-update),[1] leading to gender bias in product development (Williams, 2014). All this results in technology that is not inclusive and less usable by everyone. In addition, the effects of such gender-bias technology can impede business success (Williams, 2014).

[1] Software development team composition has not changed for the past ten years, since 2010. See National Center for Women in Information Technology. NCWIT scorecard: A report on the status of women in information technology 2010; http://www.ncwit.org/sites/default/files/resources/scorecard2010_printversion_web.pdf

In 2015, City academics, Dr Simone Stumpf and Dr Stephan Makri, began to collaborate with Professor Margaret Burnett and her colleagues from Oregon State University (USA) and researchers from Clemson University (USA), the Mathworks (USA), and a researcher from Denmark to develop the Gender Inclusiveness Magnifier (GenderMag) method. Prior to this research, there has been no previous work considering how to support designers and developers to systematically find gender barriers in their technology products and services, to then address them and make improvements, and to include all users irrespective of gender. The research team developed a new HCI method comprised of a set of personas based on multi-disciplinary research findings, coupled with a task walkthrough technique, which they validated through a set of empirical studies [3.1]. Personas have long been used in HCI design, and so are familiar to designers and developers. They encapsulate descriptions and traits of archetypal users and thus ensure that these user groups are put in the centre of designing the technology. The researchers developed a set of 3 personas (Abi, Pat and Tim) which embed 5 facets relevant to technology use which have been shown to vary by gender: information processing style, learning style for new technology, computer self-efficacy, attitude to risk and motivations. The Abi and Tim personas represent extreme opposites on the facet dimensions, for example, Abi has an extreme comprehensive information processing style while Tim has a selective information processing style; Abi is risk-averse while Tim has a high tolerance for risk. The Pat persona represents those people with facet dimensions in between those extremes. These personas are instrumental in bringing validated research to technology designers and developers, rather than relying on their stereotypes, to ensure that the technology is inclusive of all 3 personas.

A cognitive walkthrough is a well-established usability inspection technique, however, the research team adapted and extended this technique to deeply embed the personas. To conduct a GenderMag walkthrough, the researchers implemented a series of forms which designers and developers can use to step through a task, asking a series of questions which point to potential gender-inclusion issues. This new process method is available for download in a toolkit format, with printable material including instructions for use and customisation, printable personas, and printable walkthrough forms [3.2].

The research team also validated this new method through a series of empirical studies, which showed that this method can be easily employed by designers and developers, with no background in gender research, to identify potential gender-inclusion issues, and that those issues that they found are in fact **real** issues that affect technology.

In conducting their work, Drs Stumpf and Makri also realised that there is scant work in teaching designers and developers about gender inclusion. Therefore, they have developed teaching materials in support of GenderMag [3.3], which can be used by others to educate future HCI, UX and software professionals about gender issues in software design and how to find these. In these teaching materials, they conceptualise gender as a socially constructed notion, the harmful effects that gender stereotypes can have, and how gender impacts technology design and use. They motivate why gender needs to be considered in technology design and discuss a number of approaches to design more inclusively. The researchers have provided worked examples for applying GenderMag in a classroom setting.

Their work has since extended beyond gender to consider other user groups, such as people with cognitive or visual impairments, or low literacy or socio-economic status. The research team have devised InclusiveMag – an Inclusiveness Magnifier – built inductively by generalising principles and processes used in creating Gender Mag [3.4]. They have shown how the GenderMag method could be systematically extended to produce new sets of personas, and how to embed these in expert evaluations.

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

3.1 Margaret Burnett, Simone Stumpf, Jamie Macbeth, Stephann Makri, Laura Beckwith, Irwin Kwan, Anicia Peters, William Jernigan. GenderMag: A Method for Evaluating Software's Gender Inclusiveness. 2016. Interacting with Computers, 28 (6). [Google Scholar citations: 92. IwC 911 PDF Downloads]. DOI: https://doi.org/10.1093/iwc/iwv046

3.2 Margaret Burnett, Simone Stumpf, Laura Beckwith, Anicia Peters. The GenderMag Kit: How to Use the GenderMag Method to Find Inclusiveness Issues through a Gender Lens. 2020. Latest version publicly available from http://gendermag.org Accessed 20.12.20.

3.3 Simone Stumpf. Gender Issues in Inclusive Design. 2017. Lecture notes publicly available from https://sites.google.com/site/gendermagteach/ Accessed 20.12.20.

3.4 Mendez, C., Letaw, L., Burnett, M., Stumpf, S., Sarma, A. and Hilderbrand, C. From GenderMag to InclusiveMag: An Inclusive Design Meta-Method. 2019 IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC), pp. 97-106. DOI: 10.1109/vlhcc.2019.8818889

3.5 Simone Stumpf, Anicia Peters, Shaowen Bardzell, Margaret Burnett, Daniela Busse, Jessica Cauchard, and Elizabeth Churchill. Gender-Inclusive HCI Research and Design: A Conceptual Review. *Foundations and Trends® in Human-Computer Interaction* 13, 1 (2020), 1–69. DOI: https://doi.org/10.1561/1100000056

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

GenderMag allows ordinary practitioners, with no background in gender research, to identify which aspects of their software have gender-inclusiveness issues, in order to resolve them. The GenderMag methods are research-based, empirically shown to work, and freely available to the public. Their implementation has been leading to improved products and process in commercial and public organisations. GenderMag method helps to shape industry standards and has been shaping attitudes and rising awareness of gender inclusion issues via series of training workshops and via inclusion of GenderMag in 23 HE programmes worldwide.

Improved products and processes in commercial and public organisations
Since 2015, the GenderMag (GM) methods have been implemented into the design and development processes by Microsoft (US) [5.2], [5.3], (text removed for publication) (UK) [5.4], Greenstone Digital Library (NZ) [5.6], HazAdapt (US) [E5], and at least 4 other organisations [5.1] to improve gender-inclusiveness of products and services used by millions of end-users worldwide.

Twelve teams at Microsoft have implemented the GM methods and using GM successfully improved the inclusiveness of Microsoft software [5.2]. Issues identified using GM mirrored findings involving real users. Kat Holmes, a former Principal Director of Inclusive Design at Microsoft, emphasises the unique value of the method [5.3]: “A product leader was concerned that there were far fewer women using their product than they expected. [GenderMag] helped the Microsoft research team reframe the problem and ensure that the product did not favor a particular learning style. They restructured their research to recruit people by learning style and interviewed people from multiple genders, including transgender participants.”

(text removed for publication)

HazAdapt (Oregon, US), whose customers include Oregon State University Emergency Management and local emergency authorities in Oregon (US), integrated GM into the development of the emergency platform that compliments calling the emergency line number to communicate with authorities. Ginny Katz, CEO, explains that “in the initial design process of our HazAdapt app, we placed a great deal of focus on the first few minutes and hours of an

emergency (…) GenderMag was an essential tool for us to get this critical user story right" [5.5].

Greenstone Digital Library (GDL) is a suite of open-source, multi-lingual software for building and distributing digital library collections, produced by the University of Waikato, and developed and distributed in cooperation with UNESCO. GDL is currently used in over 70 different countries worldwide, with downloads of 4,500 times a month. An evaluation of the GDL interface using GenderMag uncovered three major gender barriers that could hinder GDL uptake [5.6].

As of 20 December 2020, the GM toolkit has been downloaded 1185 times by 353 unique organisations [5.7].

Shaping industry standards
GenderMag research has made a significant contribution to the development of the "Microsoft Inclusive Design Toolkit", a resource that sets standards for designers and developers of digital products [5.8]. Further, the GM method has been included in recommendations for "tools for making human-computer interaction research gender aware and gender inclusive" in a report from the EU Gender Equality in Engineering through Communication and Commitment (GEECCO) project [5.9].

In addition, GenderMag can be used to get the award of the iGIANT Seal of Approval (https://www.igiant.org/sea) to demonstrate that a company has integrated gender inclusivity into their operations. Virginia Katz, CEO at HazAdapt, explains "in September 2019, GenderMag also helped us to get awarded the iGIANT Seal of Approval. (…) Our goal is to continually lead in the field of emergency communication technology as the first and highest rated inclusive option as we are now. Being certified inclusive is an attractive aspect that helps public safety and emergency management entities showcase their initiatives to become more inclusive and engaging with their diverse public." [5.5]

Shaping attitudes and rising awareness of gender inclusion issues
Through a series of workshops, Dr Stumpf and Professor Burnett have reached out to software professionals worldwide. A GenderMag webinar delivered by Dr Stumpf in May 2020 was attended by professionals from 20 UK-based companies and 2 companies in the US. The post-event feedback showed that attendees' awareness of gender inclusion issues has improved. This session led to establishing a partnership with the (text removed for publication) [5.4].

Incorporation of GM into higher education teaching programs has wider impact on raising awareness among future STEM professionals. GenderMag has been taught in 23 HE programmes worldwide, including Cornell University, USA; Harvard University, USA and University of Edinburgh, UK (https://sites.google.com/site/gendermagteach/home/where-is-gendermag-taught). GM has become a desirable specialism for user researchers. Competence in GM was included in the person specification for a post of Senior User Researcher at Bloomberg, New York, US [5.10].

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

5.1 Margaret Burnett, Anicia Peters, Charles Hill, and Noha Elarief. *2016. Finding Gender-Inclusiveness Software Issues with GenderMag: A Field Investigation*. Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems. Association for Computing Machinery, New York, NY, USA, 2586–2598. DOI: https://doi.org/10.1145/2858036.2858274

5.2 Mihaela Vorvoreanu, Lingyi Zhang, Yun-Han Huang, Claudia Hilderbrand, Zoe Steine-Hanson, Margaret Burnett. 2019.*From Gender Biases to Gender-Inclusive Design: An Empirical Investigation*, In ACM Conference on Human Factors in Computing Systems Proceedings (CHI 2019), May 4-9, 2019, Glasgow, Scotland, UK. ACM, New York, NY, USA.

5.3 Kat Holmes, (2020) *Mismatch: How Inclusion Shapes Design* (Simplicity: Design, Technology, Business, Life). The MIT Press.

5.4 (text removed for publication)

5.5 Letter of Support, CEO at HazAdapt.

5.6 Sally Jo Cunningham, Annika Hinze, and David M. Nichols. 2016. *Supporting Gender-Neutral Digital Library Creation: A Case Study Using the GenderMag Toolkit*. In Digital Libraries: Knowledge, Information, and Data in an Open Access Society (Lecture Notes in Computer Science), 45–50.

5.7 GenderMag google form stats.

5.8 Microsoft Inclusive Design Kit (2018) available online at https://www.microsoft.com/design/assets/inclusive/InclusiveDesign_DesigningForGuidance.pdf Accessed 20.12.20.

5.9 Sabrina Burtscher (2019) Literature Review: *Gender Research in Human Computer Interaction*, a report from the European Union project GEECCO: Gender Equality in Engineering through Communication and Commitment, available at http://www.geecco-project.eu/fileadmin/t/geecco/Literatur/neu/literature_review_KORR_07012020.pdf Accessed 20.12.20.

5.10 Bloomberg Job Advertising, Listing knowledge of GenderMag as part of the requirements.