Assistive Media for Health and Wellbeing in Ageing
UK and Brazil Network

Abstract

The proposed project is a collaborative research activity and network between the University of Surrey, University of Sao Paulo and Federal University of Sao Carlos. It tries to fill a gap in the research and development of mobile device applications for older users, including tools for assisted living, monitoring, e-health care and wellbeing. In particular, it addresses this area from an 'assistive media' perspective, combining insights from multiple research strands across these three universities, exploring the use of digital media *content* for remote monitoring, communication and advice in the ageing population. This will comprise a collaborative interdisciplinary research network funded by FAPESP and University of Surrey jointly. The USP and UFSCar team complements research at Surrey in terms of expertise in Computer Science, Gerontology, and wellbeing. The Surrey team expertise is healthcare, digital storytelling and interaction design.

Project Team

Brazil / Principal Investigator (PR): **Maria da Graça Campos Pimentel (MP), Full Professor**, ICMC, University of São Paulo (USP). Expert in Ubiquitous and Interactive Multimedia Systems, is the PI of a FAPESP Regular Research Award aimed at proposing the Experience Sampling and Programed Intervention Method (ESPIM). This method will be used in this project to further development of assistive media for health and wellbeing in individual treatment plans. Recent publications, related to the subject of this project, report the development an extensible infrastructure to support ESPIM (ZAINE et. al, 2016), and report results from offering ICTs older adults a smartphone literacy course in the context of the University of the USP Third Age Programme (PIMENTEL et al, 2016). http://www.icmc.usp.br/~mgp

United Kingdom / Principal Investigator (PR): **David Frohlich (DF), Full Professor,** Digital World Research Centre (DWRC), University of Surrey. Expert in tangible interfaces for computing, new media design and user-centered innovation. His recent publications, related to the subject of this project, involve the development of the methodology that will be used *Focusgroup+* (FROHLICH; LIM; AHMED, 2014), technologies in the context of ageing in place and home (LIM; FROHLICH; AHMED, 2012) published in one of the leading journals of the field; and user-centred design (SPENCE; FROHLICH; ANDREWS, 2015).

http://www.surrey.ac.uk/schoolofarts/people/complete_staff_list/david_frohlich/

Co-Principal Investigator (PP): **Dr Theopisti (Theti) Chrysanthaki (TC)**, Lecturer B, Faculty of Health and Medical Sciences, University of Surrey. Expert in e-health, telehealth/telecare, integrated care, long-term conditions, quality of life and ageing. Theti is an expert in implementation and evaluation studies of policy and technology innovations in healthcare. She was involved in the evaluation of the biggest randomised controlled trial of remote care/assistive technology (telehealth/telecare) undertook worldwide, the Whole System Demonstrator Programme (WSD). She investigates remote care technologies for ageing populations (CHRYSANTAKI et al. 2013; HENDY, CHRYSANTHAKI and BARLOW 2012). She is currently working on projects that examine the use of technology as a sustainable approach to improving quality of care and outcomes for people living with dementia and their carers. In Surrey, she is the PI of a project that explores the design and acceptability of using a digital story-based communication system for care home settings (TiME Matters Project) and she is the Lead of the qualitative evaluation strand of an RCT study that investigates the effectiveness of Internet of Things-based telehealthcare to support people with dementia and their carers to live independently at home (TIHM Project).

Co-Principal Investigator (PP): **Dr. Renata Pontin de Mattos Fortes (RF)**, Faculty at the Computer Science Department, ICMC, University of Sao Paulo. Expert in Accessibility and Usability, Human-Computer Interaction and Older User-centered innovation. Her research interests includes user-centered design techniques for enhancing accessibility for older adults using mobile devices and Web (LARA et al. 2015; WATANABW et al, 2015). www.icmc.usp.br/~renata/

Co-Principal Investigator (PP): **Dr. Paula Costa Castro (PC)**, **Assistant Professor**, Faculty at the Gerontology Department, Federal University of Sao Carlos – UFSCar. Expert in Gerontechnology, Healthy Aging, Quality of Life / Wellbeing and University of the Third Age. PC is currently the PI of a FAPESP fellowship abroad

(2016/10982-3) with the Surrey team on the Assistive Media for Health and Wellbeing project. She leads the Assistive Technology for Independence and Aging in Place Group (TAMIE), with the USP team. Recent work related to this project include the development of new guidelines for design with older people (CASTRO et al., 2014) (CASTRO et al., 2015), in addition to older user's preferences and concepts for applications on smartphone (FORTES; MARTINS; CASTRO, 2015). http://www.bv.fapesp.br/pt/pesquisador/673844/paula-costa-castro/

Graduate students and postdocs: Olibário José Machado Neto (OM), Bruna Rodrigues da Cunha (BC), Caio Viel (CV), Liliam Leal (LL), Maria José Machado Costa (MC), Humberto Lídio Antonelli (HL), Sandra Rodrigues (SR), Dr. Izabela Zaine (IZ), Dr. Kamila Rodrigues (KR), Surrey future postdocs.

Background

The proposed project is a collaborative research activity between the University of Surrey and University of Sao Paulo/ Federal University of Sao Carlos that aims to identify guidelines, requirements and interests for custom digital assistive media with ageing users and healthcare professionals, relatives and institutions.

While demographic transition changed societies, and created challenges that can be addressed by the Gerontechnology development (CHA, 2014), the epidemiologic transition is causing high incidence and prevalence of disability in old age and the current social core institutions should be re-designed, to attend the growing aged population (ROWE; KAHN, 2015). On the other hand, independent healthy older individuals need to integrate society by maintaining or expanding occupational and social roles to improve the dyad functional ability-wellbeing and, in this case, digital inclusion could be a key factor (WHO, 2015).

Studies have shown digital media adoption benefits for the individual during the digital life course and for the social institutions. Considering traditional institutions (care and nursing homes, hospitals, social assistance centres, residential, pensions systems) as also non-traditional ones (University of the Third Age (U3A), shared houses, villages, e-health and telehealth care providers), the results indicate risk protection and/or improvement of numerous aspects and domains: costs, quality of service, mortality, satisfaction, ageing in place; among others. Positive outcomes such as mental health improved function, cognition, better humour, quality of life improvement, wellbeing, independence and aid to social interaction and activities of daily living have been observed in groups of older users of information and communication technologies.

Although all cited benefits of digital applications in the ageing field, we must be critical of overly optimistic predictions about the value of new technologies, and more realistic about the challenges of making technology accessible, attractive and useful to people, and having it fit within everyday behaviours and broader healthcare systems. At the same time, the empirical attention to the use of technology explodes numerous myths about the reticence of older people to engage with it. Many older people are frequent users of email and social networking systems, avid gamers, on-line shoppers and web surfers; open to exotic developments such as social robots and concerned about the inheritance of digital possessions when they die (PRENDERGAST; GARATINNI, 2015).

However, studies conducted by the proponents of this project (CASTRO et al., 2014) (FORTES; MARTINS; CASTRO, 2015) (LIM; FROHLICH; AHMED, 2012) identified several typical problems of interaction by older adults, who still need to be addressed. Moreover, the literature has shown that many problems and factors still have high impact against digital media technology adoption for older persons considering social participation, ageing in place and health care related activities (LEVY et al., 2013) (PEEK et al., 2014) (VEER et al., 2015) (CHRYSANTHAKI et al, 2013).

The proposal is to create a network to investigate concepts that can serve as the basis for future development of transcultural assistive technology and products for e-health in ageing related health conditions and also aid the wellbeing in ageing from a life course perspective.

Exchange activities and timeline

We propose a two-year programme of work across the three universities, as shown in the Work plan diagram of Figure 1. This will be based on mutual understandings established during Castro's one-year academic visit with Frohlich at Digital World Research Centre in Surrey, and additional visits by Pimentel and other USP staff to Surrey during this period. In particular, the funding will allow continued collaboration on the FAPESP fellowship project and *TiME Matters* pilot project at Surrey on a story-based communication system for care

homes, established in 2016 between Chrysanthaki, Frohlich and Castro, and a subsequent full bid to Alzheimer's Society with a UK-Brazilian dimension. It will also allow other related work at each university to be shared, combined through joint analysis and publication, and additional research bids to be generated. This will be done over 24 months from 1st Jan 2017, and based around two visits of UK staff to Brazil and two visits of Brazilian staff to the UK, as shown on the work plan below. On-going work in this area at each university will be presented and shared at each visit, in a workshop format, with a wider group of local staff attending by invitation. Follow-up papers and bids being written in between visits. The entire project will be preceded in December 2016 with an international panel of all the co-investigators at DSAI 2016 in Portugal (Software Technologies for Enhancing Accessibility and Fighting Info-Exclusion). It will also culminate in a similar panel at an international conference at the end of 2018, to report and discuss the findings of the network.

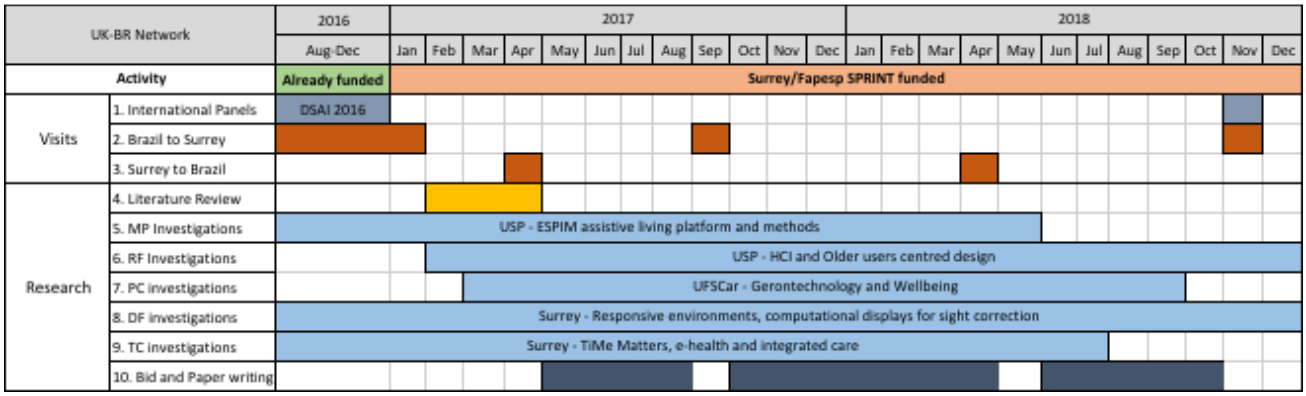

Figure 1. Work plan

Activity

1. **International panels.** DF, MP, PC and RF are going to present a panel at the DSAI 2016 (Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion) conference, called "Design with older adults: enhancing connectivity". A second panel will be proposed for another international conference at the end of the SPRINT project period, to promote and discuss the findings of the network.
2. **Brazil to Surrey visits.** The collaborators MP and OM have already visited Surrey for information exchange. Moreover, Prof PC is currently at Surrey for a one-year postdoc program, where she will stay until January 2017. Besides, an additional meeting will be held with the collaborators of USP, UFSCar and Surrey in December 2016 to discuss on going and future projects. In September 2017 collaborators MP, PC and RF will visit Surrey again to strengthen initial collaboration among the partners, keep track of on-going activities and share additional findings. A third mission of MP, PC and RF to Surrey will take place in November 2018 to follow-up on interim activities and prepare for a shared panel at an international conference in the area. We will consider targeting any suitable conferences in Brazil itself at this point.
3. **Surrey to Brazil visits.** The first visit of DF and TC to Brazil will be in April 2017. If the Surrey budget allows, we would also like to take along a Surrey post-doctoral researcher or PhD student working in the area, to this and the second visit to Brazil. A first workshop will be held to share research findings and two new approaches proposed by the Brazilian and British groups (ESPIM and *Focusgroup*+ respectively). The second mission of DF and TC to Brazil will take place in April 2018, to keep track of on-going activities and share additional findings. Again, this will be done in a workshop setting, with additional staff and students invited by the local Brazilian host.
4. **Literature review.** The researchers will create an annotated bibliography repository and a shared library. This will be an opportunity for the collaborators to share their knowledge about the state-of-the art literature. Although this activity may remain in progress throughout the whole project, it will be more intense in the first months of 2017. The reviews might lead to adjustments of the projects to contemplate recent research findings.
5. **MP investigations.** With OM, BC, CV, LL, MC, IZ and KR, work will allow integrating requirements gathered from DF, PC and TC's current investigations into the ESPIM model and its software platform. Results should allow supporting specialists to define individualized treatment plans to older adults as well as to support communication among professionals, older adults and their family.

6. **RF investigations.** With HL and SR, work will be carried out toward integrating user-centered design techniques developed at USP with those proposed by the Surrey and UFSCar researchers. Requirements and evaluations will take place in the context of UFSCar, Surrey and USP's U3A programmes.
7. **PC investigations.** Parallel investigations will be conducted by the TAMIE group, at UFSCar and U3A, to provide guidelines for applications on haptic devices, by individuals of different ages, including older than 60 years, to support the development of tools for e-health care application and assistive technology.
8. **DF investigations.** Work on responsive environments is currently underway at Digital World, to examine the effect of audio and visual stimuli on health and wellbeing in hospital environments. This is expected to lead to prototyping of a responsive environment utilising printed and embedded technology in floor, wall and ceiling coverings. Other work in this area is also in progress, including the development of computational displays for sight correction.
9. **TC investigations.** Work on using technology based solutions to enhance communication between carers (formal and informal) and residents of care homes is underway at School of Health Sciences and Digital World Research Centre in Surrey. We aim to develop a prototype of a customised technology solution based on user feedback (formal and informal carers, residents with dementia) and design an evaluation strand to study its impact on residents' and carers' wellbeing.
10. **Bid and paper writing.** A major set of deliverables from the network will be a number of internationally co-authored papers on assistive media and individualised treatment plans. These will be written between visits, and may involve cross-cultural comparisons between UK and Brazilian data sets and experiences. In addition, we aim to submit several joint research bids to both UK and Brazilian research councils.

Performance indicators

The indicators of this project are the workshops performed in the exchange visits, reports with requirement specifications resulting from the collaboration in the context of the TIHM, Focusgroup+ and ESPIM projects, final panel with the joint submission to an international conference, and the bid to the *Alzheimer Association* Call and FAPESP.

Foreseen Additional Actions

This network supports a strategic global partnership between the University of Surrey and University of Sao Paulo, which extends into other areas of technology design and healthcare research. We therefore expect to explore wider connections between existing relevant groups within this partnership. The work also extends a cross-faculty research initiative at the University of Surrey in e-health, and a related research theme at Digital World Research Centre on assistive media for health and wellbeing. In addition, another important result is establishing collaboration for future exchange of students (PhD/Ms internships for instance) and researchers in both institutions. Finally, the work of the network will involve technology development. This may generate new IP and patent applications, resulting in subsequent knowledge transfer to industry.

References

PRENDERGAST, David; GARATTINI, Chiara (Ed.). **Aging and the digital life course**. Berghahn Books, 2015.

PEEK, Sebastiaan TM et al. Factors influencing acceptance of technology for aging in place: a systematic review. **International journal of medical informatics**, v. 83, n. 4, p. 235-248, 2014.

ANDERSON, W. L.; WIENER, J. M. The Impact of Assistive Technologies on Formal and Informal Home Care. **The Gerontologist**. v. 55, n. 3, pp. 422-433, 2015.

BUJNOWSKA-FEDAK, M. M.; PIROGOWICZ, I. Support for e-Health Services among Elderly Primary Care Patients. **Telemedicine and e-Health**. v. 20, n. 8, pp. 696-704, 2014.

CASTRO, P.C.; FORTES, R.P.M.; PASSOS, Y.G.; ANTONELLI, H.L.; OISHI, J. Towards Guidelines for Older Adults Interactions with Touchscreen-based Mobile Devices. **The Gerontologist**. v. 54, n 2, p. 452, 2014.

CASTRO, P.C; MARTINS, G.A.; ALMEIDA, J.E.M.; MAYUMI, M.; FORTES, R.P.M. New Indicators and Usability Guidelines for Designing Interfaces for Touchscreens-based Devices to Older Adults. **The Gerontologist** 55 (2), 345. Suplement.

CHA, C. H. Global population ageing and mission of gerontechnological research and development. **Gerontechnology**, v. 13, n. 2, p. 65, 2014.

HENDRIKS, J., SMITH, S., CHRYSANTHAKI, T., BLACK, N. (2016). Reliability and validity of a self-administration version of DEMQOL-Proxy. *International Journal of Geriatric Psychiatry.*

HENDY, J. CHRYSANTHAKI, T. & BARLOW J. (2014). Managers‟ identification with and adoption of telehealthcare. Invited paper for special issue on “Beyond Techno-Utopia: Critical Approaches to Digital Health Technologies. **Societies,** *4* (3), 428-445.

CHRYSANTHAKI**,** T., HENDY, J. & BARLOW, J. (2013). Stimulating whole system redesign: lessons from an organisational analysis of the Whole System Demonstrator Programme, **Journal of Health Services Research and Policy**, 18(1 suppl):47-55.

HENDY, J., CHRYSANTHAKI, T. & BARLOW, J. (2012). An organizational analysis of the implementation of telecare and telehealth: The Whole Systems Demonstrator, **BMC Health Service Research***,* 12: 403.

SANDERS, C., ROGERS, A., BOWEN, R.,BOWER, P., HIRANI, S., CARTWRIGHT, M. FITZPATRICK, R. KNAPP, M.

BARLOW,J., HENDY, J., CHRYSANTHAKI, T., BARDSLEY, M. & NEWMAN, S. (2012). Exploring reasons for non-participation and withdrawal from a randomised controlled trial of telehealth and telecare in England: a qualitative study, **BMC Health Service Research***,* 12:220.

BARLOW, J; HENDY, J & CHRYSANTHAKI T. (2012). ‘Scaling-up remote care in the United Kingdom. Lessons from a decade of policy intervention.’ Anthony Glascock, David Kutzik (eds.) *Why it's not Plug and Play: Tests, Lessons and Implications about the Future of Telehomecare*, IOS Press.

HENDY, J., BARLOW, J. & CHRYSANTHAKI, T. (2011). Implementing remote care in the UK: an update of progress. **Eurohealth**, Vol. 17, No 2-3, pg. 21-23.

Newman, S.P. Bardsley, M., Barlow, J. Beecham, J. Beynon, M., Billings, J., Bowen, A., Bower, P., Cartwright, M, Chrysanthaki, T., Dixon J., Doll, H., Fernandez, J. L., Fitzpatrick, R., Henderson, C., Hendy, J., Hirani, S.P., Knapp, M. MacNeill, V., Rixon, L. Rogers, A., Sanders, C., Silva, L.A., Steventon, A. (2015). The Whole System Demonstrator Programme Report, available at: https://www.city.ac.uk/__data/assets/pdf_file/0004/243067/WSD_report_Final_27th_20Aug.PDF.

BARLOW, J., CURRY, R., CHRYSANTHAKI, T., HENDY, J., & TAHER, N. (2012). Remote care plc: Developing the capacity of the remote care industry to supply Britain’s future needs submitted to the DH and available at: http://www.haciric.org/.

DELELLO, J. A.; MCWHORTER, R. R. Reducing the Digital Divide Connecting Older Adults to iPad Technology. **J Appl Gerontol.** In press (publicado on line), acesso em: Junho de 2015. DOI: 10.1177/0733464815589985

FORTES, R.P.M.; MARTINS, G.A.; CASTRO P.C. A review of senescent’s motivation in the use of tactile devices. **Procedia Computer Science**. v. 67, pp.376–387, 2015. In the International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Infoexclusion (DSAI 2015).

FROHLICH, D.; LIM, C. S. C.; AHMED, A. Keep, lose, change: Prompts for the re-design of product concepts in a focus group setting. **CoDesign**, v. 10, n. 2, p. 80-95, 2014.

FROHLICH, D.; LIM, C. S. C.; WOODS, S.; AHMED, A. What older people want: A catalogue of codesigned concepts. University of Surrey, 2012.

LARA, S.M.A., de FORTES, R.P., RUSSO, C.M. and FREIRE, A.P., 2015. A study on the acceptance of website interaction aids by older adults. **Universal Access in the Information Society**, pp.1-16.

LIM, C.S.C.; FROHLICH, D.M.; AHMED, A. The challenge of designing for diversity in older users. **Gerontechnology**. v. 11, n. 2, p. 297, 2012.

PIMENTEL, M. G.; CUNHA, B. C. R.; ANTONELLI, H. L; RODRIGUES, S. S.; RODRIGUES, K. R. H.; ZAINE, I.; MACHADO-NETO, O. J. Enhancing older adults connectivity by introducing mobile devices communication tools. **Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion** (in press). Vila Real, Portugal, 2016.

RASHIDI, P.; MIHAILIDIS, A. A survey on ambient-assisted living tools for older adults. **IEEE Journal of Biomedical and Health Informatics**, v. 17, n. 3, p. 579-590, 2013.

SPENCE, J.; FROHLICH, D.; ANDREWS, S. Performance and critical design. In: **Proceedings of the 2015 British HCI Conference**. ACM. p. 228-229, 2015.

VEER, A. J. E.; PEETERS, J. M.; BRABERS, A. E. M.; SCHELLEVIS, F.; RADEMAKERS J.; FRANCKE, A. L. Determinants of the intention to use e-Health by community dwelling older people. **BMC Health Services Research**. v. 15, n. 103, 2015.

WARPENIUS, E.; ALASAARELA, E.; SORVOJA, H.; KINNUNEN, M. A mobile user-interface for elderly care from the perspective of relatives. **Informatics for Health and Social Care**, v. 40, n. 2, p. 113-124, 2015.

WATANABE, W.M.; DIAS, A.L.; FORTES, R.P.D.M., 2015. Fona: Quantitative metric to measure focus navigation on rich Internet applications. **ACM Transactions on the Web** (TWEB), 9(4), p.20.

WINSTEAD, V.; ANDERSON, W.A.; YOST, E.A.; COTTON, S.R.; WARR, A.; BERKOWSKY, R.W. You can teach an old dog new tricks: a qualitative analysis of how residents of senior living communities may use the web to overcome spatial and social barriers. **J Appl Gerontol.** v. 32, n. 5, pp. 540-60, 2013.

WORLD HEALTH ORGANIZATION et al. **World report on ageing and health**. World Health Organization, 2015.

ZAINE, I.; RODRIGUES, B. C. R.; VIEL, C. C.; ORLANDO, A. F.; MACHADO-NETO, O. J.; MAGAGNATTO, Y.; PIMENTEL, M. G. ESPIM: a ubiquitous data collection and programmed intervention system using ESM and mobile devices. **Brazilian Symposium on Multimedia and the Web** (in press). Teresina, Brasil, 2016.