EPSRC
Engineering and Physical Sciences
Research Council

GETAMOVEON

1st GetAMoveOn Symposium – London

May 24th and 25th 2017

Leveraging technology to enable mobility and transform health

UCL

University of BRISTOL

UNIVERSITY OF Southampton

INTRODUCTION

Welcome to the 1st GetAMoveOn Symposium!

Funded by the EPSRC, the GetAMoveOn Network+ brings together experts in sensor networks, data analytics, interactive visualisation, human computer interaction, online citizen engagement, behaviour change, sports and exercise with the aim of transforming health through enabling mobility. We do this through our events, newsletter, and funding for member-led activities and research.

In our first year, the Network has grown in number from around 60 founding members to over 140, including members from 71 institutions across 13 countries - stretching the across the globe from the UK to Australia. In our first year we have organised a course on Inbodied Interaction which was held at the CHI 2017 conference in Denver, USA and a workshop on using technology to help older adults be physically active. We have also funded a set of 8 ‘thinkpieces’ with the aim of identifying topics and research agendas that could subsequently inspire future research projects and new collaborations. These ‘thinkpieces’ will be presented at today’s event, our 1st GetAMoveOn Symposium, together with research findings from 20 other groups of researchers. Our aim today is to bring together a range of experts to help to scope and define approaches, and stimulate debate, about the role of current and future technologies in enhancing levels of activity and movement in one of our three target groups: schools, workplaces, communities of older adults.

We hope you will have an enjoyable day and come away with new contacts, conversations, and inspirations.

Anna Cox, Ann Blandford, Clare Casson, Ian Craddock, m.c. shraefel, Lucy Yardley
GetAMoveOn Network+ Team

About the GetAMoveOn Network+

When we move more, we become smarter; as we become stronger, chronic pain decreases. Greater movement, especially in social contexts, improves collaboration. As we move, not only do we reduce stress: we improve our capacity to handle stressful situations and to see more options for creative new solutions. Movement enhances both strength and stamina, improves bone mineral density and balance, reducing incidence of falling and associated hip injuries (causes of death in the elderly). Movement complements other functions, from assisting with sleep and therefore memory and cognition, to helping with diet and associated hormones - improving insulin sensitivity and balancing cortisol. There are recent studies showing benefits of movement related to dementia. And yet, physical inactivity is the fourth leading cause of death worldwide; sedentarism has been called the “new smoking”. Meanwhile costs to UK GDP from sedentarism and associated disease are increasing - from sick days lost to work, to elders losing mobility and having to move into care homes.

We have designed ourselves into our sedentarism: sitting during our commute, at desks while we work, and at home on the sofa. There is a critical need to design ourselves back into the natural effects of health accrued simply by moving more. We need solutions that will help build both the evidence and the experience that movement can enhance and benefit people's lives.

New technologies are transforming our ability to capture lifestyle data on individuals in real time. Consumer technologies such as step counters and wifi scales are the tip of an iceberg - research programmes worldwide are proposing lifestyle data capture from devices ranging from video cameras to electricity meters to wearables. Meanwhile pervasive connectivity allows that data to be transmitted, processed through powerful machine learning tools and provided back to people in a heartbeat. While we understand the potential technologies, we do not yet know how to leverage the technology effectively to support transformative health.

Current approaches in ehealth generally only reach a small part of the population that is already interested in fitness, personal data capture, or both. Their uptake is, furthermore, of dubious effect as two recent medical reviews have shown. To have a national impact on health and wellbeing, to reduce the crippling burden of long term health conditions and to move healthcare from the clinic to the community, we need to reach everyone, across a range of abilities and aspirations. We need to connect the potential of the technology with the potential of people and realise the benefits of a healthy, brilliant, population.

Realising this potential requires research on novel technical solutions, supported by theories from sports and health sciences on blending appropriate movement strategies for particular performance aspirations to behavioural and cognitive sciences on ways to engage people to make effective and meaningful progress. We need to understand what measures are appropriate not just to evaluate progress, but to guide it and adapt to it. To have meaningful impact across these dimensions we need to combine a range of expertise including sensor networks, data analytics, interactive visualisation, human computer interaction, online citizen engagement, behaviour change, sports, exercise.

Over the coming year we will launch invitations for members to propose their own network activities and to apply for travel grants and research funds. We hope to continue to have your involvement in the next phase!

Acknowledgements

We would like to extend a huge thank you to: our funders, the Engineering and Physical Sciences Research Council (EPSRC grant number: EP/N027299/1); our keynote speaker, Rafael Calvo; Nicole Ngwan at the Holiday Inn, London Wembley for hosting us; and UCL Health Creatives for their work putting together these proceedings. And finally thank you to all our members for their participation in our calls and this event.

ATTENDEES

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KEYNOTE SPEAKER

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BIOGRAPHIES

MANAGEMENT TEAM/PROGRAMME COMMITTEE

Anna L Cox

University College London
Reader and Deputy Director of UCLIC (UCL Interaction Centre)

Anna L Cox is Deputy Director at the UCL Interaction Centre [UCLIC] and Reader in Human-Computer Interaction. Her research is motivated by an interest in the impacts of social computing technologies on how people get their work done, on how they manage their work-life boundaries, on how they spend their leisure time and on mitigating the negative health impacts of the sedentary lifestyles led by many such workers.

Ann Blandford

University College London
Professor and Director of UCL Institute of Digital Health

Ann Blandford is Professor of Human–Computer Interaction at University College London and Director of the UCL Institute of Digital Health. She is an expert on human factors for health technologies, and particularly on how to design systems that fit well in their context of use. She is involved in several research projects studying health technology design and user experience. These include both hospital and home technologies, for use by professionals and the rest of us. The question that motivates her research is: how can we design and deploy health technology that really works for people, rather than technology that forces us into undesirable modes of working, that causes stress, or that is rejected as not being fit for purpose? This includes research on technologies for wellbeing and behaviour change. She has published widely on the design and use of interactive health technologies, and on how technology can be designed to better support people's needs and values.

Ian Craddock

University of Bristol
Professor in data-driven health; SPHERE Director

Professor Ian Craddock is Director of the SPHERE, an £12M EPSRC-funded IRC. He works 60% of his time at the University leading SPHERE and also undertaking pioneering interdisciplinary research in medical imaging; he founded a company that has attracted investment of £4M to undertake clinical trials and commercialise a cancer imaging device. He serves on the Steering Board of the University's flagship Elizabeth Blackwell Health Research Institute.

For the rest of his time he is employed by Toshiba as Managing Director of their Telecommunications Research Lab in Bristol, responsible for a portfolio of both internal and collaborative communications, healthcare and smart city research.

m.c. schraefel

University of Southampton
Professor of Computer Science and Human Performance

Professor of Computer Science and Human Performance; Fellow, British Computer Society; Research Chair; Royal Academy of Engineering, Chartered Engineer; Head, Agents Interaction and Complexity Group; Deputy Head of Department, Research, and current REF champion (for those in the UK) for CS.

Wellth Lab Research FOCUS - How to design information systems to support brain-body connection for lifetime quality of life, including fitness to learn, to play and to perform optimally, always; to understand through these paths how to enhance innovation, creativity and discovery. Papers to help contextualise these aspirations include:

- Challenges in interaction design for "wellth" - wellbeing and health - performance rather than prevention oriented doi:10.1145/2690853
- Opportunities in this space for Computer Science: doi.org/10.1109/MC.2014.339
- Opportunities - for HCI/CS to consider how to translate what we know about sports performance to knowledge work doi.org/10.1145/2732479

Related Work - interaction design for data-driven (vs document driven) web-based systems for knowledge building.

Lucy Yardley

University of Oxford and University of Southampton
Professor of Health Psychology

Lucy Yardley is Professor of Health Psychology at the University of Oxford and University of Southampton, where she also has a continuing role as Director of the LifeGuide Research Programme and the Behavioural Science theme of the NIHR Biomedical Research Centre. Lucy has a long-standing interest in empowering patients and people in the community to take control over their illness and treatment. Her current research programme, funded by over £50 million from the UK research councils, NIHR, medical charities and EC, is on using the internet to support self-management of health (see www.lifeguideonline.org). Her work addresses key questions such as how to maximise engagement with digital interventions, and how best to integrate digital support for self-management of health with existing health promotion and healthcare services.

BIOGRAPHIES

KEYNOTE SPEAKER

Rafael A. Calvo

The University of Sydney

Rafael A. Calvo, PhD (2000) is Professor at the University of Sydney, ARC Future Fellow, Director of the Positive Computing Lab and Co-Director of the Software Engineering Group that focuses on the design of systems that support wellbeing in areas of mental health, medicine and education. He has a PhD in Artificial Intelligence applied to automatic document classification and has also worked at Carnegie Mellon University, Universidad Nacional de Rosario, and as a consultant for projects worldwide. Rafael is author of over 150 publications in the areas of affective computing, learning systems and web engineering, Senior Member of IEEE. Rafael is co-editor of the Oxford Handbook of Affective Computing (2015) and co-author of Positive Computing (MIT Press, 2014)

– PhD (Univ. Nacional de Rosario – Argentina, 2000)
– Grad Cert in Higher Education (The University of Sydney, 2005)
– Licenciado (Univ. Nacional de Rosario – Argentina, 1991)

BIOGRAPHIES

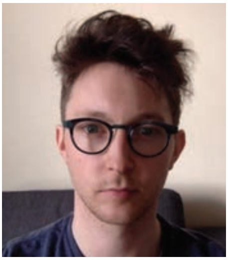
PRESENTERS

Paulina Bondaronek

I am a PhD student at the eHealth Unit, University College London, and I am funded by the Medical Research Council. My PhD is to explore the public health potential of apps, which are available on the market, for increasing physical activity. So far, I have conducted a review of the quality of physical activity apps on the market in terms of safety, effectiveness, and usability. I have also looked at what predicts higher user ratings in the app stores. My next step is to assess some of the apps on the market with potential users that are inactive. My background is in Health Psychology and I am interested in digital technologies used for health interventions. I want to contribute to the quest for finding the Holy Grail: digital interventions that are effective, used and liked.

Artur Direito

Artur trained in Physical Education and Sport at Lusofona University in Lisbon and worked as a physical education teacher and coach before doing his Masters in Lifestyle and Chronic Disorders at the Vrije Universiteit in Amsterdam. He recently completed his PhD in Health Sciences at the University of Auckland, which investigated mobile health approaches such as SMS and smartphone apps to improve physical activity and sedentary behaviours. Current research has a strong technology focus, both in terms of intervention and measurement, including the use of mobile phones, wireless sensors, and mobile games. He was a recipient of a prestigious Portuguese government PhD scholarship and serves on the Early-Career Researchers Committee of the International Society for Behavioural Nutrition and Physical Activity (ISBNPA).



David A. Ellis

David A. Ellis holds a 50th Anniversary Lectureship in Psychology at Lancaster University and an Honorary Research Fellowship at the University of Lincoln. He previously obtained an undergraduate degree in psychology from the University of Glasgow followed by an MSc and PhD. Both his Masters and PhD were funded by the ESRC. Since 2013, he has acted as principal or co-investigator on projects worth over £500k, which led to the formation of Psychology Sensor Lab. Much of his work considers how mobile and wearable technology can best serve psychological and biosocial research. He has published on these topics in PLoS Medicine, IJNS, PLoS ONE, Cyberpsychology, Behaviour and Social Networking and other journals. In addition to university led research, David continues to work collaboratively with industry and government partners. This included an ESRC funded placement at the Scottish Government in 2011.

Parisa Eslambolchilar

Parisa Eslambolchilar received a B.Eng degree in hardware engineering from the University of Amirkabir, Tehran, in 1999, and a Masters in Engineering in Robotics and AI from the University of Tehran, Iran in 2002 and PhD degree in Computer Science from the Hamilton Institute, National University of Ireland, Maynooth in 2007. In March 2007, she joined computer science department, Swansea University, and in 2013 she became an Associate Professor. In March 2017, Parisa started her new post as a Senior Lecturer at the School of Informatics and Computer Science at Cardiff University.

Parisa's current research interests include mobile human-computer interaction and dynamic continuous interaction, and their applications in promoting physical activity and mental wellbeing. She has won best paper awards at ACM conferences. She is the guest editor of the Springer Personal Ubiquitous Computing theme issue Persuasion, Influence, Nudge, and Coercion (PINC) using ubiquitous technologies.

Kathrin Gerling

Dr Kathrin Gerling is a Senior Lecturer in the School of Computer Science at the University of Lincoln. Her research focuses on the potential of interactive technology to improve wellbeing, for example, by providing opportunities for movement-based play for young people who use powered wheelchairs, and engaging older adults in motion-based games. Dr Gerling holds a PhD in Computer Science from the University of Saskatchewan, Canada, and an MSc in Cognitive Science from the University of Duisburg-Essen, Germany. Her work has been published at leading international venues such as the ACM SIGCHI Conference on Human Factors in Computing Systems (CHI), and she actively contributes to the research community in Human-Computer Interaction.

Daniel Harrison

Danny is a final year PhD student in the UCL Interaction Centre, with a background in computer science. He has taken a pragmatic and situated approach to studying how people integrate and use tracking devices in their everyday lives. His particular interest is in understanding long term use of commercial devices and how this changes over time. Alongside his PhD research, he is also a researcher at Microsoft Research in Cambridge. There, he has worked on new forms of personal informatics for digital and physical collections, and is currently using his expertise in human-computer interaction and health to collaborate on the development of a new medical system. He has presented his work at CHI, Ubicomp and RTD. He has a personal collection of activity trackers which he uses to track his bicycle rides, a hobby he enjoys alongside photography to balance out his two jobs.

Matthew Higgs

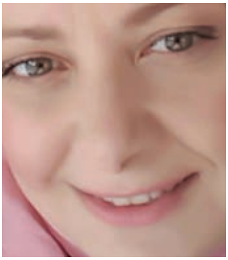
Matthew is a Postdoctoral Research Associate and Data Scientist based at Glasgow University and working to bridge Computational Statistics and Machine Learning with Social, Ubiquitous and Mobile technology. His research focuses on the application of Data Science methods to mobile data and collaborates with researchers from The Glasgow Interaction Group and The Institute of Health and Wellbeing. He has worked in academia and industry and completed his PhD in Computational Statistics and Machine Learning at University College London in 2011. Outside of academia, Matthew runs the Glasgow AI Meetup and advises companies on AI and Data Science technology.

Kiran Ijaz

Kiran Ijaz is a PhD research scholar with the Positive Computing Lab and Virtual Reality Technical Assistant in the Faculty of Engineering and Information Technology, at the University of Sydney. Her research interests include immersive virtual reality exergames, artificial intelligence and human-computer interaction applications for health, education and tourism. She is currently investigating immersive VR exergames platform to promote physical and cognitive health and how this innovative technology can motivate people to adopt an active lifestyle. Kiran has previously worked as a university lecturer in computer science for a number of years. During this time, she was active part of various research projects and published about immersive technology for education, artificial intelligence and crowd simulations.

Hadiza Ismaila

Hadiza Ismaila is a second year PhD student at the UCL Interaction Centre, University College London. She received her bachelor's degree in Software Engineering from the American University of Nigeria, and master's degree in Human-Computer Interaction and Design from the University of Washington. Her main research interests are design for health and wellbeing, human-computer interaction for development (HCI4D), and ubiquitous computing.



Eiman Kanjo

Eiman is a Senior Lecturer at Computing and Technology, NTU. Eiman is a hands-on technologist who has written some of the earliest papers in the research area of mobile sensing. She currently carries out work in the areas of data science and mobile technologies for behaviour change, mental health, and environmental and wellbeing monitoring. She has also built the first noise monitoring system using the phone's microphone. Also, she worked previously as a research fellow at the University of Cambridge, Nottingham University and many other research and industrial organisations. She has authored over 50 papers in international journals and conferences. Major news outlets that have covered her work on mobile pollution and health monitoring include the BBC, New Scientist, German TV and newspapers and radio stations. Typically, she works in multidisciplinary teams who build whole engineering systems with end users fully engaged as participants. She is also a competent mobile developer and she has been speaking recently at various international mobile development events and conferences.

Joe Marshall

My work is a mixture that focuses on how people interact with computers in ways which use their whole bodies, something which I studied in my recent Leverhulme Early Career Fellowship titled 'Interaction in Motion'. As part of this work, I have been involved in designing, deploying and studying games which require full body exertion in order to play them. As an international expert in such 'exertion games', I am often involved in reviewing work on them, which has led to an interest in the nature and quality of evidence provided for the use of such games as health interventions.

Sumit Mehra

Sumit Mehra is a senior lecturer and researcher at the Amsterdam University of Applied Sciences. He has a dual background in cognitive psychology and informatics (human-computer interaction). His research topics include persuasive technology, behaviour change and healthy lifestyle. He has been awarded a NWO fund for his research on a blended mHealth intervention to increase the physical activity of older adults in the Netherlands.

Andre Matthias Müller

Trained as a sport scientist in Germany my research primarily focuses on e- & mHealth physical activity interventions. During my PhD I developed, implemented and evaluated an mHealth exercise intervention targeting older adults in multi-ethnic Malaysia. With this, I have a strong background and interest in behavioural health research in diverse populations (older adults and culturally diverse people). Due to my excellent collaborative ties with colleagues from various regions I am fortunate to be able to support the development of respective research initiatives. Currently, I am a research fellow in Health Psychology at the University of Southampton. Here, I am leading the physical activity component of various multi-component digital health interventions. As a committee member of the e- & mHealth Special Interest Group affiliated to the International Society of Behavioural Nutrition and Physical Activity (ISBNPA) I also contribute meaningfully to various efforts to progress the field.

Joe Newbold

Joe is a third year PhD student at the UCL Interaction centre with a background in electronic and audio engineering. He is currently working on how musically-informed sonification can be used to support physical activity. This work specifically focuses on how musical expectancy can be used build motivation and reward into movement sonification that helps build self-efficacy for people who struggle with physical activity.

Emma Norris

Emma is a Research Associate on the Human Behaviour-Change Project in the Centre for Behaviour Change at University College London. Her PhD, completed at UCL in 2017, involved the development and testing of behaviour change interventions to integrate physical activity into primary school teaching. She has research experience in systematic reviews and mixed-methods intervention evaluation. She is interested in using health psychology theory and principles to improve a broad range of public health issues, with specific interests in physical activity and technological interventions.

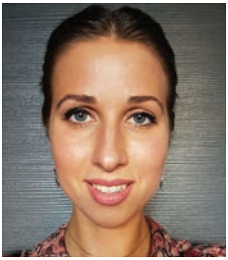
Johanna Nurmi

Johanna Nurmi works as a visiting researcher at the Institute of Public Health, the University of Cambridge, and is finalising her PhD for the University of Helsinki, Finland. As part of an EU consortium, she developed a smartphone service for physical activity motivation and self-regulation: the Precious app. Currently she focuses on learning new methodologies for analysing smartphone data, including within-person designs, multilevel modelling, time-series analysis, and graphical representations of these. Johanna completed her Master's degree in Social Psychology in the University of Helsinki, including three semesters at the University of Geneva, Switzerland. She is fascinated by the possibilities that artificial intelligence, social media, and sensor technology open up for behavioural sciences.

Charlie Pinder

Charlie Pinder is a PhD student at the HCI Research Centre at the University of Birmingham's School of Computer Science. She is exploring nonconscious behaviour-change interventions using technology: how we can change people's behaviours by changing nonconscious default biases or patterns of thought and behaviour. Charlie has previously worked in a variety of research and technical roles in universities and industry, and holds a first degree in PPE.

Charlie was recently awarded a "Best Provocation Award" for her 2017 alt. chi paper "The Anti-Influence Engine". She is passionate about diversity in CS, particularly in supporting women to explore the joys of creative coding, and received a Google Anita Borg Memorial Scholarship in 2012.



Nora Ptakauskaite

Nora Ptakauskaite is currently doing a PhD in Human-Computer Interaction at UCL's Interaction Centre. Her research involves exploring whether wearable activity trackers can support users in linking physical activity to its effects on stress levels through visualisation of biosignal-based data. Nora's research also investigates how the link between physical activity and stress could be quantified and how to best communicate it to the user to facilitate behaviour change and physical activity.

Nora completed her MSc in Cognitive Science at the University of Edinburgh, where she focused on HCI and adaptive educational technology. Her undergraduate degree was in psychology, also from the University of Edinburgh, where she focused on developmental science, mental health, and cognitive psychology.

Ian Renfree

Ian Renfree is a current PhD student at the UCL Interaction Centre. His main research focus is how to leverage emerging technologies to support behaviour change. More specifically, his work explores how tangible objects and interactions can be designed to reduce office based sedentariness. Ian has a BSc in Computer Science from the University of Exeter, and a MSc in HCI with ergonomics from University College London.

Anna Roberts

Anna Roberts is an MRC funded PhD candidate based in the Department of Behavioural Science and Health, University College London. Anna's research aims to develop and evaluate a smartphone app intervention to increase cancer survivors' participation in physical activity. Her previous work included the evaluation of digital health interventions to promote physical activity among people with knee osteoarthritis at the University of Nottingham, where she also completed her BSc in Psychology and MSc in Health Psychology.

Aneesha Singh

Aneesha Singh is a Human-Computer Interaction Researcher at the UCL Interaction Centre. She is interested in the design, adoption and use of personal health and wellbeing technologies in everyday contexts. She is working in the research areas of digital health, ubiquitous computing, multisensory feedback and wearable technology. She received her PhD in Human-Computer Interaction from UCL and her MSc in Evolutionary and Adaptive Systems from University of Sussex. Before that she worked in industry in various roles, as a software developer, analyst and project leader, and as a technical journalist.

Aoife Stephenson

Aoife Stephenson is a second year PhD candidate within the School of Sport, Ulster University working under the primary supervision of Dr Jacqueline Mair. Her PhD research revolves around the development of a digital behaviour change intervention through the application of behavioural science theory, to modify sedentary behaviours in office workers. Prior to this she worked as a research physiotherapist at the School of Health and Rehabilitation Sciences, University of Queensland, Australia. She holds an MSc (by research) in physiotherapy and BSc (Hons) in physiotherapy, both from University College Dublin.

Yasmin van Kasteren

Yasmin van Kasteren joined Flinders University in September 2016 after six years with CSIRO where she worked in Energy and eHealth. She has a business background with an MBA (Lean Thinking) and a PhD in Business with a focus on consumer behaviour. Yasmin is an experienced qualitative researcher who has contributed to a range of health projects from a mobile app to support patient participation, to in-home sensors to facilitate ageing in place, and projects to enhance lean thinking for hospital bed flow management.

Corneel Vandelanotte

Professor Corneel Vandelanotte leads the Physical Activity Research Group at the Central Queensland University and is Adjunct Professor at Curtin University. Prof Vandelanotte's research has a population-based approach to health behaviour change and is focused on the development and evaluation of computer-tailored and web-, app- and tracker-based physical activity interventions. Prof Vandelanotte is an author on 124 peer-reviewed publications (2161 citations) and has been awarded a total $7 million of competitive research money either as principal or co-investigator. He has received two prestigious research fellowships (NHF, NHMRC) and has been named on three National Health and Medical Research Council Grants. He is leading the web-based 10,000 Steps Australia program (Queensland Health Funded), which has attracted nearly 350,000 members and has over 50,000 app downloads. He is a 'Member-at-Large' on the Executive Committee of the International Society for Behavioural Nutrition and Physical Activity (ISBNPA). He is also the Founding Chair of a Special Interest Group within ISBNPA on e-and mHealth intervention research. He has received several awards to recognise research excellence (e.g. Queensland Young Tall Poppy Science Award).

Laura Wilde

Laura Wilde is a PhD research student in the Centre for Technology Enabled Health Research at Coventry University. She has a BSc in Psychology from the University of Winchester and an MSc in Health Psychology from the University of Southampton. She has previously worked at the University of Southampton in the Centre for Clinical and Community Applications of Health Psychology. Her research interests include health, chronic illness, behaviour change, physical activity and technology. Her current research is investigating how we can prolong the use of mobile phone apps and wearable technology to support health and lifestyle. She is currently working towards conducting a qualitative systematic review investigating users' experiences (barriers and facilitators) of mobile phone apps and wearables that support physical activity tracking.

1ST GETAMOVEON SYMPOSIUM 2017

08:00 REGISTRATION

08.30 Welcome, introductions & overview of the network+

09:00 Keynote: Rafael A. Calvo Technology innovation and physical activity: towards a transdisciplinary research program

09:50 SESSION 1

09.50 Pauline Bondaronek: Physical activity apps – does popularity mean quality?

10.05 Matthew Higgs: Step-by-step: exploring the use of artificial intelligence methods to evaluate physical activity apps through the app store

10.20 Eiman Kanjo: Can BLE Beacon technology play a role in increasing physical activities?

10.35 Corneel Vandelanotte: Integrating Fitbit activity trackers into a computer-tailored physical activity intervention

10.50 Parisa Eslambolchilar: Modelling physical activity: from Play-Doh to 3D digital artefacts

11:05 COFFEE

11.35 SESSION 2

11.35 Parisa Eslambolchilar: Validating a fluid dynamic model for a randomised controlled trial of a smartphone app in increasing physical activity amongst male adults

11.50 m.c.shraefel: Wellth by design: a focus on the infrastructure of performance to Make Normal Better

12.05 Yasmin van Kasteren: Increasing physical activity at work: understanding office routines

12.20 Sumit Mehra: Getting older adults to exercise with a blended intervention

12.35 Emma Norris: Virtual Traveller: a behaviour change intervention to increase physical activity during primary school lessons

12.50 Kiran Ijaz: VR-Rides: Immersive virtual reality exergames for health

13:05 SESSION 3

13.05 Laura Wilde: Long-term use of mobile phone apps and wearables to support physical activity: from barriers and facilitators to guidelines.

13.06 Aoife Stephenson: Facilitators, barriers and technology supported strategies to reduce sedentary behaviour: a focus group study of office workers and their employers

13.07 **Anna Roberts:** Cancer survivors' experiences of using publicly available physical activity mobile apps: a qualitative analysis

13.08 **Ian Renfree:** Reducing sedentariness in office workers: a tangible intervention

13.09 **Nora Ptakauskaite:** Using wearable activity trackers to quantify the relationship between physical activity and stress

13.10 **Charlie Pinder:** Targeting the automatic for sustainable behaviour change - how to implement subliminal priming techniques on mobile phones to prompt activity

13.11 **Johanna Nurmi:** Examining within-person variation of the effects of Firstbeat biofeedback and motivational interviewing on physical activity: N-of-1 field trial with the Precious app

13.12 **Joseph Newbold:** Supporting physical activity with musically-informed sonification

13.13 **Artur Direito:** Feasibility and acceptability of an adaptive smartphone-delivered intervention for physical activity and sedentary behaviour change

13:15 BUFFET LUNCH & POSTER SESSION

14:15 SESSION 4

14.15 **Aneesha Singh:** Going beyond motivation! A framework for design of body-aware technologies for supporting physical activity where mobility is restricted.

14.30 **Kathrin Gerling:** Designing for agency and compassion: critical reflections on technology to support physical activity in late life

14.45 **Joe Marshall:** A scoping review of the evidence for games as movement-oriented health interventions

15.00 **Hadiza Ismaila:** Exploring the relevance of social practice theory to inform the design of technology for encouraging more physical activity in everyday life

15:15 COFFEE

15:35 SESSION 5

15.35 **Andre Matthias Müller:** Sedentary behaviour and physical activity interventions in older adults using digital technologies with special emphasis on Just-In-Time Adaptive Interventions (JITAIs)

15.50 **David A. Ellis:** When wearable devices fail: towards an improved understanding of what makes a successful wearable intervention

16.05 **Daniel Harrison:** The current state of self-tracking technologies and interventions for encouraging increased activity and how to assess them: a critical review

16:20 **Identification of future GetAMoveOn themes: an active activity**

17:00 **Announcements of upcoming calls**

17:15 Closing remarks

17.30 DEPART

"Technology innovation and physical activity: towards a transdisciplinary research program"

Rafael A. Calvo
The University of Sydney

In this presentation I will summarise my experiences and current ideas on how to create a transdisciplinary program of research that focuses on promoting exercise in ways that take into account the whole experience: technology, service providers and end-users. In particular I will propose that such a program needs to take into account not only the direct health outcomes, but also their impact on psychological wellbeing. In the process I will describe projects from my own laboratory, and take-aways that may be appropriate for this new endeavour.

ABSTRACTS - SESSION 1

Physical activity apps – does popularity mean quality?

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Background
The benefits of physical activity (PA) on disease prevention are well documented. Within the new digital health care landscape, the rise of health applications (apps) creates novel prospects for behaviour change opportunities. The commercial market is saturated with apps that aim to increase PA. Despite the wide distribution and popularity of PA apps, there are limited data on their effectiveness, safety of personal data, and user experience.

Aim
The aim of this review and content analysis was to ascertain the quality of the most popular PA apps using healthcare quality indicators: 1) safety 2) effectiveness, 3) positive experience, and to determine if the likelihood of effectiveness is associated with user ratings.

Methods
The top-ranked 400 free and paid apps from the Health & Fitness categories of iTunes and Google Play stores were screened. Apps were included if the primary behaviour targeted was PA; targeted users were adults; the apps had stand-alone functionality. The apps were downloaded on mobile phones and assessed by two reviewers against the following quality assessment criteria: 1) data safety as indicated in privacy policies, 2) presence of Behavioural Change Techniques (BCTs), 3) usability measured by System Usability Scale. The relationship between the number of BCTs and user ratings was assessed using logistic regression.

Results
156 apps met the inclusion criteria and 65 apps were randomly selected and assessed. The privacy policy was not available for 29.2% of the sample. Most of the apps collected personally-identifiable information and shared users' data with 3rd party. Every app contained at least 1 BCT, with an average number of 7, and a maximum of 13 BCTs. The median number of user ratings was high (4.4 in iTunes and 4.5 in Google Play). The median usability score was "excellent": 86.3 of out 100 possible. Across both stores, there was no relationship between the number of BCTs and user ratings. The analysis showed that users in iTunes and Google Play differ in how they assign user ratings. The effect of the total number of BCTs was not consistent across stores: with each increase in the number of BCTs, the iTunes users were 15% more likely to assign higher user rating (OR 1.15, 95% CI 1.06-1.25, $p<0.001$). There was no effect of BCTs on user ratings in Google Play users.

Conclusions
The privacy and security of PA apps on the market data could be improved. PA apps included on average 7 out of 93 possible BCTs. The relationship between the likelihood of effectiveness and the user ratings differs by the app store and it is likely that different BCT groups are more likely to be rated higher than others.

Step-by-step: exploring the use of artificial intelligence methods to evaluate physical activity apps through the app store

Matthew Higgs, Claire McCallum, John Rooksby, Parvin Asadzadeh, Cindy Gray, Matthew Chalmers. University of Glasgow.

Background: Thousands of smartphone physical activity (PA) apps are readily available through app stores. In addition to exploring user experience and engagement with these apps, it is important to test their effectiveness in changing behaviour. In previous work involving a sensor-based self-monitoring and goal-setting PA app, we explored whether we could use the Apple App Store to conduct an effectiveness trial that required little researcher-participant contact, yet was scientifically rigorous. By embedding appropriate experimental phases (i.e. baseline and intervention periods) and data collection procedures, we found that we could design the app to facilitate a basic 'single case design' (SCD) experiment for use in an app store deployment. However, we encountered trade-offs between designing to increase experimental quality (i.e. confidence in the overall results) and meeting user needs (i.e. ensuring the app remained usable, and fostered engagement and positive user experience). Furthermore, results from our 6-month App Store deployment indicated high variability and missing data in control baseline phases. Our findings suggest that further methodological work is needed to facilitate greater control during online app store experiments. One potential solution could employ intelligent algorithmic delivery of experimental phases based on users' data.

Aim: Explore how artificial intelligence methods can be used to evaluate a physical activity app by formulating the algorithmic delivery of experimental phases as a sequential decision-making problem.

Content: We attempt to frame the problem as a sequential decision-making problem in which an autonomous agent decides how and when to initiate experimental conditions to different users. We envision discretising time into time-steps (e.g. days) such that at each time-step our agent: (i) observes any new data, (ii) decides what to do, and then (iii) acts accordingly. This general formulation can accommodate situations in which the decision logic in task (ii) is handcrafted by a researcher, and, situations in which the agent uses machine learning and/or Bayesian decision theory to learn an optimal sequence of actions. In this presentation we will focus on results from our previous App Store deployment and draw on ideas from experimental design and user experience to discuss the challenges in designing an autonomous delivery agent. Challenges include: designing agent objectives, balancing experimental quality with user engagement, privacy constraints, and real-world deployment and evaluation of the agent.

Conclusions: Algorithmic delivery of experimental phases can be formulated as an artificial intelligence problem. However, it is the responsibility of researchers to either handcraft a solution or design agent objectives that align with research goals. This will require a multidisciplinary approach involving researchers from artificial intelligence, behaviour change and user experience. We believe the methods we propose are a step towards contextualised evaluations of behaviour change in the wild.

Can BLE beacon technology play a role in increasing physical activities?

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A century ago, we had to be quite active to just live normal life. Now, in the developed world, so much of what we used to do is done by machines. We drive cars, cleaning and washing are done by a machine and we spend a long time in front of a TV or other screens. At work, we rely on computers, and for socialising we rely on digital social networks; even shopping is nowadays often done online.

Research has shown that keeping physically active influences certain chemicals in the brain, like dopamine and serotonin. Brain cells use these chemicals to communicate with each other, so they affect mood and general wellbeing. Also, research has shown for mild depression, physical activity can be as good as antidepressants or psychological treatments like cognitive behavioural therapy (CBT).

Keeping physically active doesn't require an expensive gym membership or running around a track. Walking or taking the stairs are as effective as some of the gym activities if done regularly. Walking and going around a village or city places, can also alleviate stress and offer some opportunities to socialise and engage with local communities.

Healthcare professionals are always on the look-out for new techniques to motivate individuals to increase their physical activities. The growing ubiquity of smartphones and Internet of Things (IoT) integrated into personal and social life, facilitated by expansive communication networks globally, has the potential to have a positive impact on health and wellbeing. New technologies are transforming our ability to capture lifestyle data on individuals in real time.

Bluetooth beacon technology has been developed by both Apple and Google to situate digital information within physical spaces. In this work, we highlight the potential of Beacon technology to create a connected physical activity around physical spaces, shopping malls, city centres and green parks. Shopping mall managers for example can reward people for walking longer around shops while promoting their products and draw higher footfall to the mall. Also, the Beacon technology can be utilised further to support social interaction around everyday city places for individuals or groups.

Integrating Fitbit activity trackers into a computer-tailored physical activity intervention

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Introduction: Physical inactivity increases risk for developing cardiovascular disease, diabetes, cancer and depression, yet less than half of Australians meet the recommended guideline of 150 minutes of activity per week. This causes a high burden of disease and health care costs. Therefore, population-based physical activity interventions are needed. Web-based interventions that provide participants with highly personalised physical activity advice are effective. However these interventions depend on online self-report measures to assess activity. Many people overestimate their self-reported activity levels. This means that the advice provided is often inaccurate, limiting intervention effectiveness. New high-tech activity trackers (e.g. Fitbit) provide an excellent opportunity to enhance traditional tailored interventions. Advanced activity trackers conveniently and accurately assess physical activity and their data can automatically be integrated into web- and app-based interventions. Therefore, the aim of this study was to examine if the effectiveness of a computer-tailored physical activity intervention was increased by integrating physical activity data extracted from a Fitbit activity tracker.

Methods: A 2-group randomised trial was conducted in 243 overweight or obese participants. Participants in both groups received 8 modules of highly personalised physical activity advice (spread over 3 months). In one group the activity advice was based on a self-reported physical activity measure (adapted Godin exercise questionnaire). In the other group the advice was based on data automatically extracted ('synced') from a Fitbit Flex activity tracker. Participants were able to live anywhere in Australia; all communication was via e-mail or phone; trackers were sent by postal mail. Self-report measures (e.g. Active Australia Questionnaire) were assessed at baseline, 1, and 3 months. Linear mixed models were used to analyse the data.

Results: Drop-out was high, but substantially less in the Fitbit group at 3 months (Fitbit group completers: n = 72; non-Fitbit group completers: n = 44). The Linear mixed model analyses showed a significant increase in total physical activity (adjusted mean increase = +169min/wk, 95%CI=47-292, p=0.007) and moderate-to-vigorous physical activity (adjusted mean increase = +80min/wk, 95%CI=21-139, p=0.008) in the Fitbit group compared to the non-Fitbit group at the 3-month follow-up. Meeting the physical activity guidelines increased from 22% to 65% in both groups combined.

The computer-tailored intervention and website were used a lot more (50% vs. 71%), and rated of higher credibility (74% vs. 85%), quality (64% vs. 70%) and convenience (57% vs. 82%) when the Fitbit data was integrated. Compliance with Fitbit wearing was very high, with over half the sample wearing it 24/7 for the entire study duration. Participants indicated that the Fitbit was easy to use (96%), that it was easy to sync Fitbit data with the computer-tailored website (87%) and that it improved the personal relevance of the advice (87%).

Discussion: The lack of any face-to-face contact may have caused the high attrition. However, the study outcomes indicate that integrating Fitbit data into a computer-tailored intervention significantly increased the effectiveness of the intervention. Future research should examine the effectiveness of advanced activity trackers as part of computer-tailored interventions in more rigorous conditions (e.g. control group, objective measures, longer follow-up).

Modelling physical activity: from Play-Doh to 3D digital artefacts

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Purpose World Health Organisation guidelines recommend that children achieve at least 60 minutes of moderate-to-vigorous physical activity (MVPA) every day. However, many children and adolescents often cite understanding these guidelines and relating them to daily life as a barrier to achieving the recommended levels. Therefore, the aims of the present study were to develop novel methods of visualising current physical activity (PA) levels and their relation to recommended levels utilising Play-Doh, and to translate Play-Doh artefacts into digital models and 3D printed artefacts through an iterative design process.

Methods Twenty-seven primary (15 boys; 8.4±0.3 years) and forty-two secondary (22 boys; 14.4±0.3 years) school children from four schools (2 primary, 2 secondary with 1 high and 1 low socio-economic status school in each level) participated. Fourteen focus groups were conducted to explore facilitators, motivators and barriers to 3D printing children's PA, incorporating the Model, Show and Tell method, whereby children created their own Play-Doh 3D models of PA. Using OpenJSCAD, a web-based 3D modelling tool, examples of these models were digitally created and printed in 3D.

Results The Play-Doh models revealed a preference for depictions of weekly physical activity, although the representation of this activity differed according to age. Primary school children predominantly preferred abstract designs related to objects such as the sun where the rays depicted daily PA, with the length of each ray indicative of total volume achieved that day. In contrast, models designed by secondary school children focused on different visualisation for graphical displays, such as musical notes on a sheet of music with higher notes representing a greater total volume of PA. The complexity of some of the models designed by the children prohibited their translation to a digital format, leading to two models being chosen for future pilot testing, the sun and bar graphs, through an iterative design process. Furthermore, initial attempts to interface these models with the PA data revealed significant time costs, leading to the automatisation of the process using a digital gateway to transmit PA data to an online server where they could be accessed by OpenJSCAD to model, and another digital gateway to print the 3D models. These steps significantly reduced the time associated with digitally developing the models.

Discussion Overall, the present study highlights the potential utility of 3D printed models as a tool to stimulate changes in PA related behaviours in children and adolescents. Whilst individually designed 3D shapes depicting PA would be preferable, the present study highlights the limitations of 3D printing, as not all the Play-Doh models could be converted to digital models due to complex modelling involved and substantial 3D printing time and resources. Indeed, this study demonstrates the need for future research investigating the relative effectiveness of 3D printed artefacts in comparison with online, interactive screens for enhancing the understanding of, and motivating children to achieve, recommended levels of physical activity.

Validating a fluid dynamic model for a randomised controlled trial of a smartphone app in increasing physical activity amongst male adults

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A number of papers have been published using a fluid dynamic model to assess a computational model of Social Cognitive Theory (SCT). SCT provides a recognised theoretical framework that can be applied to explain changes in behaviour over time. Smartphones with embedded sensors have created an ideal platform to deliver physical activity (PA) intervention programmes to those with little intrinsic motivation for walking. Such interventions offer the opportunity for applying control engineering and system identification concepts in behavioural change settings. A semi-physical system identification approach is developed in Arizona State University (ASU) for interventions associated with improving PA using a semi-physical parameter estimation procedure where input-output data from an experiment under real-life circumstances must be collected. Proper measurement is essential for success of the identification procedure, and steps must be followed to guarantee reliability of the information, i.e. observational studies, software development, prototyping, among others.

An RCT of bActive, an always-on smartphone app, examined the effect of personal feedback and social feedback in attitude towards PA. The RCT showed that step-counts can increase PA in young to early-middle-aged men but the provision of social feedback had no apparent incremental impact. To gain a better and deeper insight into the use of social feedback in PA interventions and how this cue could be designed more successfully in bActive and similar apps, the bActive RCT input and output data is used to test the prediction ability of the SCT model. This technique allows the use of a specific state space structure where the value of a set of unknown model parameters must be defined.

The computational model of SCT considers six inventories (as outputs) and eight exogenous inflows (as inputs). The inputs from bActive RCT used to study and test the model include: environmental context, skills training and perceived social support. The outputs include: self-management skills, outcome expectancy, self-efficacy, behaviour, and cue to action. With these input-output data, the model is verified using a set of model parameters that are selected to match the performance of the outputs (RCT behaviour outcomes); this procedure is implemented in MATLAB. Noise and external disturbances can be fed into the model to create a close-to-real simulation of intervention. A formal semi-physical system identification procedure must be later implemented to find more precise values for model parameters. In this sense, an optimized experiment could be designed where behavioural outcomes follow a desired pattern, here increasing the social norm. The focus of the experiment can be directed to search for the best inputs (intervention components) considering the estimated initial model from bActive study and expected performance requirements.

Indeed, this collaborative work demonstrates the need for future research investigating the effectiveness of SCT simulation in comparison with initial bActive study, to estimate and optimise intervention profiles for enhancing moderate level of PA in middle-age men.

Wellth by design: a focus on the infrastructure of performance to make normal better

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Those of us designing health interventions are keen to help people have better quality of life. We embrace accepted health messages like ‘sit less’; ‘move more’ and, on the techno side of people here, we generally endeavour to create designs that will help enable these practices. On the psychology side, we focus on behaviours to deliver these ‘changes’.

These approaches aren’t surprises: technologists want to build technologies to solve problems; psychologists want to build behaviours and habits to solve the same problems - sometimes we attempt to blend the best of both. There may be apps for that as our presentations show today.

Our current approaches, however, also raise some interesting questions: why do we need these apps at all? and why do we tend to focus on individuals to ‘change’?

Surely if so many people need these interventions, it’s a sign that our culture, what is encoded as normal, is itself the problem.

In this wee talk, I’d like to pull back from our seemingly constant focus on the individual to look at the infrastructure level, the cultural, societal and value level to explore what effects we might have if our interventions around health and wellbeing focus (i.e. Wellth) on how to Make Normal Better at a cultural level.

The rationale for this shift is simple: first, by being effective at a cultural, social level, we get the impact of scale - impact few would deny that we are lacking; second, if the new Normal we support is Better and enables Wellth, we get health and wellbeing simply as a side effect of that normal - the need for ‘move more; eat better’ apps and habit changes disappear - other opportunities for us emerge.

Such an aspiration - to effect culture - may seem too blue sky. But let’s check it out: as a thought experiment, in this talk we’ll assume that this moon shot to Make Better Normal is possible. From that perspective, based on work with organisations in the UK and abroad, I’ll offer some ideas of where our applications may be focussed to help support and deliver that Better Normal at scale. To help with this part, I’ll also offer a model to better understand the in-bodied self - why we’re doing all this ‘move more; sit less’ stuff - as it engages in an em-bodied normal to help frame some new opportunities in approach. The time is right for such a culture shift - else we wouldn’t be having this symposium.

The goal for this talk is simply this: that we ask, if everyone embraced all these right practices for which the talks today are aiming and used all these apps/interventions - if we had in other words an effect at scale, what would the new normal that sustains those practices look like? Then, we’ll start from that Better Normal and work back from that to today. Let’s see if we’d be doing the same thing. If yes, great; if not, how can we use this symposium to help deliver a Better Normal together?

I look forward to hearing your ideas, to move us towards a more resilient, brilliant, wellthier society. This is what I’d suggest is Wellth by Design

Increasing physical activity at work: understanding office routines

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It is now widely accepted that sedentary behaviour at work is a health issue. Sedentary behaviour, and in particular, prolonged sedentary behaviour has been linked to an increased the risk of cardio vascular disease, cancer, weight gain, obesity and musculoskeletal pain. The workplace environment can contribute to sedentary behaviour, and levels of activity at work vary with the type and location of job and across occupational groups and sectors. Office workers are most likely to engage in sedentary workplace behaviour, with up to 77% of their time spent sedentary and often for prolonged periods of time. Reducing prolonged sedentary behaviour at work can benefit both employee and employer. Healthier and more active workplaces can lead to reduced sick leave, productivity loss, workers compensation and disability management costs.

Technology based behaviour interventions have the potential to trigger increased active behaviour at work and reduce prolonged sedentary time. This paper explores the potential for use of commercially available wearable technology to detect patterns in movement based on personal work place routines and prompt healthier workplace behaviours.

Work place routines exist at some level or another in every workplace, and are individually determined through a complex mix of the nature of work, workplace design, personal characteristics and social and workplace practices. Routines can also be determined at a cohort level through germane start times, number of hours worked, and timing of drink or food breaks at a work location. Work routines can exhibit minor variation but generally form a regular pattern over time with activities and movement behaviours becoming habitual.

This paper presents a review of preliminary findings from reviewing current literature and recording and analysing daily diaries from a small group of administrators, academics and researchers in an Australian university setting for one month. The overarching aim of this preliminary analysis was to identify personal workplace behaviours and monitor activity patterns across a single setting. The review and initial data analysis was used to measure the potential of using commonly worn personal activity tracking devices such as Fitbit to develop a personalised work place activity intervention and behaviour change plan.

Given the complexity of workplace behaviours and routines, determining individual patterns of activity and inactivity through application of personal technologies and providing a personalised workplace activity plan is believed to offer the potential for greater compliance and increased positive benefit to both the employee and employer.

Getting older adults to exercise with a blended intervention

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Physical activity is vital to a healthy life. Not only can it lower the risk of various diseases, older adults can also delay the onset of functional impairments and prolong the ability to live independently if they exercise sufficiently. As a result many community programs have been developed, like the Dutch 'Meer Bewegen voor Ouderen' (MBvO). As part of this program weekly 300,000 older adults exercise in groups under the guidance of an instructor.

Due to its limited frequency, however, the weekly MBvO program is not sufficient to attain the proclaimed health benefits. Guidelines prescribe 30 to 60 minutes of moderate intense physical activity for 5 days a week. To achieve those recommendations a home-based exercise program could prove a useful addition to a community based program: in the convenience of their home older adults can continue the exercises they have learnt during the weekly community classes. A focus-group study showed that the MBvO-participants believed additional home exercises would be useful, but also had worries about the safety, self-efficacy and adherence to such an intervention. It was conceived that a blended approach would increase the chances of success.

An app for a tablet was developed to support the self-regulation. It featured 48 instructional videos that demonstrated exercises that were designed by human movement scientists. With a wizard a tailored exercise program could be drawn up in line with personal goals. Furthermore, users could track this progress and evaluate exercises. This can be remotely monitored by a coach with whom users can video call for guidance.

To ascertain the app was sufficiently user-friendly, 15 older adults, ranging from 69 to 99 years old, were asked to perform 11 tasks in a usability lab. The participants were instructed to think aloud and after completing the tasks they were interviewed briefly about their general impressions. All responses were classified independently by two researchers.

The results from the usability study indicate that the app appears to be sufficient user-friendly. The vast majority of the users could complete the assigned tasks within reasonable limits: on average within a minute, with occasionally one or two hints. The authors found this not to be alarming. The majority of the users, ranging from 69 to 99 years old, had no prior experience with tablets. It can be presumed that their ability to operate the app will increase with time. Furthermore, being able to get support from a coach is part of the envisioned blended intervention.

Future work will include interviews with long-term users to chart out the experience in course of time. With a currently ongoing randomised controlled trial the effectiveness of the blended intervention will also be determined. Amongst 160 older adults the effects on physical and mental health will be measured over a 12 month period.

This work is part of the research projects VITAMINE (funded by the AUAS program UrbanVitality) and MOTO-B (funded by NWO, the Netherlands Organisation for Scientific Research, grant number 023.006.013)

Virtual Traveller: a behaviour change intervention to increase physical activity during primary school lessons

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Background: Children spend a large amount of their time in obligatory seated lessons, with notable effects on health and cognitive outcomes. The 'Virtual Traveller' programme is the first to test Virtual Field Trips (VFTs) as physically active lessons and behaviour change interventions. VFTs utilise existing classroom interactive whiteboards to integrate globe-based educational content with related physical movements. Virtual Traveller was developed around the COM-B model and integrated behaviour change techniques into its teacher training and intervention sessions.

Aims: This study aimed to test the effects of a 6-week 'Virtual Traveller' intervention on physical activity, on-task behaviour and student engagement outcomes in primary-school children.

Methods: A Randomised Controlled Trial compared pupils receiving the six-week Virtual Traveller intervention and waiting-list control. N=219 pupils from ten Year 4 classes (8-9 years old) provided usable data across all data collection points. Data was collected before (T0), during (T1 & T2), 1 week- (T3) and 3 months (T4) post intervention. Physical activity was assessed via Actigraph GT1M accelerometers, on-task behaviour was observed using the Observing Teachers and Pupils in Classrooms (OPTIC) tool and student engagement was assessed with the Student Engagement Instrument-Elementary Version (SEI-E) questionnaire. Multilevel modelling was used to assess outcomes.

Results: Intervention pupils demonstrated significantly less sedentary behaviour (B=-6.45 (0.31); 95% CI, -6.46, -5.27; $p<0.001$), more light (B=4.42 (0.26); 95% CI, 3.90, 4.94; $p<0.001$) and moderate-to-vigorous physical activity (B=2.02 (0.13); 95% CI, 1.76, 2.27; $p<0.001$) and better on-task behaviour (B=0.09 (0.01); 95% CI, 0.06, 0.11; $p<0.001$) during lessons than control pupils.

Conclusions: Virtual Traveller was successful at increasing classroom physical activity and on-task behaviour.

VR-rides: immersive virtual reality exergames for health

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Physical activity is widely recognized as key for reducing risk of many health issues and to improve overall wellbeing. According to the World Health Organization's report, the lack of physical activity is the fourth leading risk factor for mortality, causing an estimated 3.2 million deaths worldwide (World Health Organization, 2016). An active life style is particularly vital to control rising medical costs for those suffering various cognitive and physical problems who often have great difficulty navigating and recognizing familiar locations (Zakzanis, Quintin, Graham and Mraz, 2009). There are also alarming obesity rates among children, teenagers and adults globally (World Health Organization, 2015). In addition, age has a profound effect on mobility and can turn a simple walk around the neighborhood into a frustrating and frightening experience. Many seniors live an understandably sedentary life.

Exergames—games that encourage physical motion – have grown in popularity recently. Health professionals use them as an alternative form of treatment and to promote an active lifestyle (Osorio, Moffat, Sykes 2012). Some of these games were initially designed for entertainment (Nintendo Wii Sports, 2006), while others were specifically designed to motive people to change their sedentary behaviour (Anderson-Hanley et al., 2012). Virtual reality (VR) can provide compelling experiences which might enhance users' engagement with physical activity. Yet the exergames literature using immersive virtual reality is still under-explored. Moreover, despite the known health benefits of exergaming, there is a limited understanding of how various game designs impact user experience. In this project (Ijaz, Wang , Milne and Calvo, 2016) we are developing "VR Rides", a virtual reality exergaming platform that combines a recumbent tricycle, real-world panoramic images, an Oculus Rift headset and a Microsoft Kinect camera, where the player can navigate real locations in a safe virtual environment.

Having established the platform described above, the key challenge is to translate it into an experience that both young and older players will find appealing. Unlike younger people, older adults are unlikely to engage with technology simply for technology's sake, and may not be familiar with or respond well to traditional game mechanics. Consequently, we are developing two distinct game modes: Affiliative and Competitive. Competitive Guess Game aims to challenge players to navigate familiar environments; in contrast, Affiliative Virtual Tour allows players to share memories and locations that are of personal significance. We plan to conduct various user studies to test feasibility and effectiveness of this platform and related games to promote physical and cognitive activity. The primary measures of these experiments will focus on engagement and motivation: e.g. whether players voluntarily register for future sessions with VR-Rides platform. However, we would also ideally measure whether access to these games has a lasting effect on one's mobility and causes continuing behaviour change.

Long-term use of mobile phone apps and wearables to support physical activity: from barriers and facilitators to guidelines.

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There are over two million mobile phone applications (apps) available to download from the Apple app store, with approximately 3% in the Health and Fitness category. Access to personalised data from apps and wearable technology (wearables) has the potential for individuals to become more aware of their health, facilitate healthy behaviour changes and manage chronic illnesses. However, interventions have only utilised technology, such as activity trackers and smart watches, for short periods of time with its effects not being maintained longer term. There is great potential for such technology to increase physical activity levels and reduce sedentary behaviour through the provision of this information direct to the end user, however we ought to better understand adoption and longer term use of devices and apps.

This PhD research aims to 1) describe the duration and frequency of app and wearable use over time in individuals with and without chronic illness 2) identify the determinants, barriers and facilitators of long term use of apps and wearables and 3) develop guidelines on how to prolong the use of apps and wearables for lifestyle management.

Firstly, the literature will be systematically searched for qualitative studies describing users' experiences (barriers and facilitators) of mobile phone apps and wearables that support physical activity tracking. The data will be explored for differences in experiences over time and differences between healthy participants and participants with chronic health conditions. The literature review will identify any research gaps to inform the designing of subsequent PhD studies to fill those gaps. Finally, the findings will be translated into guidelines on how to prolong mobile phone app and wearable use in health and lifestyle interventions.

This poster will present an overview of the PhD research project investigating the continued use of mobile phone apps and wearables to support health and lifestyle, including background, aims, proposed methodology and contributions to current knowledge.

Facilitators, barriers and technology supported strategies to reduce sedentary behaviour: a focus group study of office workers and their employers

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Background: High levels of sedentary behaviour (SB) are associated with negative health consequences such as cardiovascular disease, Type 2 diabetes and several types of cancers. A large proportion of office workers total SB time occurs in the workplace, with 71% of their working hours spent sitting. Therefore, to reduce the risk of negative health outcomes, interventions to change SB in the workplace are required. The Theoretical Domains Framework (TDF) provides an approach for identifying potentially relevant influences on behaviour that can be mapped to theory. Utilising this system, this study aimed to collect qualitative data via focus group interviews of employees and their employers on barriers, facilitators and potential technology supported interventions that may reduce workplace SB.

Methods: Focus groups are ongoing with two completed, final results will be available for the symposium. Focus groups were conducted with desk-based employees and their employers, in three private sector workplaces in Northern Ireland. They were conducted separately for employers and employees. The topic guide centred on attitudes toward workplace sitting, perceived effects on productivity, difficulties in reducing sitting and strategies to reduce employee SB. Focus groups were audiotaped and transcribed verbatim. The transcripts were analysed by applying categories from the TDF in a recursive process that followed the customary steps of thematic analysis using the NVivo 11 software package.

Results: Preliminary results (n=13) have identified barriers and facilitators to reducing SB connected with five broad themes: 1. Individual factors, 2. Environmental context, 3. Social context, 4. Organisational context, 5. Behaviour change strategies. Both employees and employers identified lack of environmental opportunities, habitual nature of sitting, office social norms and workload as barriers, while facilitators were increased knowledge of negative health impacts of SB, work tasks on the move or standing options and social interaction. Suggested strategies for reducing SB included adapting office design, education, wearable activity monitors, mobile apps and software prompts. Both employee and employer groups suggested a preference for wearable devices. Employers felt they were responsible for driving behaviour change in the workplace, however, employees believe the responsibility lies with policy makers.

Conclusion: Strategies such as education, office restructuring and self-monitoring/prompting technologies are perceived by employers and employees to be realistic and useful in reducing workplace SB, however, there are several major challenges to overcome, such as modifying workplace cultural and social norms. The recommendations and ideas discussed in this study will contribute to the theoretical understanding of the required behaviour change and may facilitate the development of an effective theory-based technology enhanced intervention to reduce employee SB.

Keywords: Occupational sitting, sedentary behaviour, focus groups, office employees, qualitative research, behaviour change, technology interventions.

Cancer survivors' experiences of using publicly available physical activity mobile apps: a qualitative analysis

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Rationale: Regular physical activity (PA) improves cancer survival and reduces risk of breast, prostate and colorectal cancer recurrence. PA can also reduce fatigue, pain and sleep problems. Effective interventions to promote PA in cancer survivors are needed and mobile interventions have shown potential. There are many PA mobile apps available for public use but none specifically developed for cancer survivors have been identified.

Aims: We aimed to assess breast, prostate and colorectal cancer survivors' opinions and experiences of using PA apps designed for public use.

Methodology: We identified four PA apps (Human, The Walk, Johnson & Johnson's 7 Minute Workout, Gorilla Workout) publicly available to download on iOS and Android devices. Each participant was randomly assigned to two of the apps during an initial telephone interview where details of diagnosis and treatment, current PA and use of PA digital technologies were collected. Participants used both apps during a 2 week period, focusing on one app during each week. A recorded semi-structured telephone interview was conducted to understand participants' experiences of downloading and using each app, the content, features and relevance to them as a cancer survivor and how PA apps should be developed or adapted in the context of cancer.

Analysis: Qualitative thematic analysis was used to identify themes related to the participants' feedback and experiences of using each app and PA following cancer diagnosis and treatment.

Results: The use of apps to deliver a PA intervention among cancer survivors was supported. Whilst generic PA apps are satisfactory for people who have completed cancer treatment, the participants identified many ways in which a PA app could be developed to better suit their needs. This included the addition of information about the importance of PA after cancer (e.g. improved survival, reduced recurrence) and the need to address common concerns regarding PA participation after cancer (e.g. fatigue, reliable guidance and support for safe and appropriate PA after treatment). Those participants who had recently finished treatment tended to report the highest need for a cancer-specific PA intervention that should be delivered soon after treatment, when side effects are most apparent and support is most required. Apps which suggested specific strength/resistance-based exercise programmes were preferred by those with higher levels of PA and motivation. Those with low levels of PA/motivation generally found that the perceived difficulty of strength/resistance-based PA was demotivating and elicited feelings of fear/uncertainty about engaging in this type of PA after cancer treatment. Promotion of walking was recommended as an achievable and enjoyable type of PA among this group, and cancer nurse specialists (CNS) were identified as the preferred method of intervention delivery/implementation within the existing cancer care pathway.

Conclusions: There is a need for cancer-specific, tailored PA apps, targeted towards survivors who have recently finished treatment, with the possibility of a focus on walking. CNS nurses could be an acceptable way to signpost survivors to PA support via an app.

Reducing sedentariness in office workers: a tangible intervention

Ian Renfree (UCL), Anna Cox (UCL) and Benjamin Gardner (Kings College London)

Background: It is claimed sedentariness is as much a threat to long term health as smoking or unhealthy eating, and is not mitigated by bursts of physical activity. Desk bound office workers are particularly vulnerable to this risk, given the inherently sedentary nature of their roles. To tackle this problem researchers in HCI have focused largely on smartphone apps and reminders, whilst embracing a general trend towards automating data collection of behaviour. However, such approaches are limited as users often report that reminders arrive at inopportune moments, with little appreciation for context, evoking frustration and annoyance. Whilst relying on automated collection of behavioural data may reduce the burden on users of monitoring their own behaviour, it also removes a regular interaction that provokes engagement and reflection on data and behaviour. This is important because it is this reflection that is theorised to be the mechanism with which self-monitoring works. We argue that placing cues in the environment, and supporting users in monitoring their own sit -> stand transitions using a simple tangible interaction, can be an effective intervention component for tackling sedentary behaviours in an office environment.

Aims: This study aimed to investigate experiences of a 2-week intervention intended to support office based workers in increasing their sit -> stand transitions.

Method: 34 adults took part in a mixed methods study during which a tangible tracking intervention was deployed. Post-intervention interviews with participants were conducted at the end of the 2-week period. Themes were developed based on thematic analysis of transcriptions. A questionnaire containing standardised questions to capture sedentary behaviour and measure constructs from the HAPA+ model (Maher & Conroy 2016) was completed by participants before and after the intervention.

Results: Preliminary analysis suggests participants found the novel interaction engaging and appreciated the simple desk based device, in contrast to PC or smartphone based apps. Participants mostly found the passive cue from the device on the desk sufficient to frequently remind them of their intentions to increase sit -> stand transitions. Adherence was strong; all 34 participants tracked consistently for the whole intervention period, suggesting manual self-monitoring is feasible for tracking sit -> stand transitions in an office context.

Conclusions: A simple desk based cueing and self-monitoring device can be an effective intervention component for tackling sedentary behaviours in an office environment. Our results have implications for the design of tangible digital interventions to reduce sedentary behaviour.

Using wearable activity trackers to quantify the relationship between physical activity and stress

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UCLIC (UCL Interaction Centre), University College London

Stress is a serious and widespread public health issue. Millennials, a cohort born after the 1980's, report higher levels of stress than other age groups (APA, 2014). When experienced over long periods, stress can lead to more serious mental health issues such as anxiety and depression (Thoits, 2013). Even though people report being aware of the stress-relieving properties of exercise, their physical activity levels are still low. For example, 53% of millennials report that exercise is important to them, however, 71% claim that they do not engage in enough physical activity (APA, 2013). A lack of self-efficacy was found to be a strong predictor for low activity rates. Low self-efficacy can result in higher stress sensitivity, creating internal barriers to adaptive coping strategies such as exercise (Bandura, 1986; Stutts, 2002), explaining why so many people choose to manage their stress through sedentary activities (e.g. watching television, browsing the internet) (APA, 2014). Furthermore, motivation to engage in physical activity for stress management can deteriorate quickly as the link between exercise and stress is not as easily observable as the more quantifiable outcomes such as weight loss (Patel et al., 2015). To maintain motivation and engagement, this link needs to be quantified and presented to the individual in a meaningful and intelligible way.

Activity tracking applications can store and interpret sensor data (e.g. heart rate variability) gathered through a wearable device. These tools can continuously monitor physical activity, and, with the aid of digital logs, also have the capacity to relate this data to outcomes such as mood and stress levels (Bort-Roig et al., 2014; Patel et al., 2015). This can be done by utilising interactive infographics that enable users to visualise their progress and goals (Dillon et al., 2016; Sandhu et al., 2007) effectively quantifying the relationship between physical activity and stress. Currently, none of the existing activity tracking applications take stress management into account, nor try to quantify this relationship (Conroy et al., 2014; Coughlin et al., 2016). However, results coming from research on relaxation and stress management support the notion that the addition of meaningful visualisation of sensor data to relaxation training can promote engagement and interactivity (Dillon et al., 2016; Sandhu et al., 2007).

Therefore, the aim of the present research is to build on the findings of past studies done on relaxation training for stress and anxiety management, and to explore the feasibility of wearable sensor based activity tracking for stress management. We will explore whether data from wearable activity trackers can support users in establishing the link between physical activity and its effects on stress levels through visualisation of biosignal based data. The outcomes will indicate how the link between physical activity and stress could be quantified and how to best communicate it to the user. This research will also provide insights in to how such technology could be adapted to facilitate behaviour change and physical activity, and identify the user needs in relation to using wearable sensors for stress management through physical activity.

Targeting the automatic for sustainable behaviour change

Charlie Pinder, University of Birmingham

My research in HCI for behaviour change focuses on how to use technology to alter the default, automatic system. The approach is rooted in dual process theory and modern habit theory. Dual system theories view human behavioural decisions as arising from two distinct sets of processes: the automatic system, which is rapid, highly associative, cue-based and inaccessible to introspection; and the deliberative system, which is slower, reflective, goal-based and conscious. Modern habit theory suggests that habits are cognitive constructs within the automatic system which encode a cue-response impulse such that cues, including environmental features and moods, can trigger a given behaviour without conscious awareness. There is also some indication that goals can operate automatically. My research assumes that at least some of the input to a decision to be active (or inactive) arises from the automatic system. I am therefore investigating how best to use technology to prime and/or alter the automatic system to make active behavioural decisions more accessible and therefore more likely to be enacted. In particular, I am investigating how to implement subliminal priming techniques on smartphones to prompt activity.

My research has highlighted the following principles for designing interventions that target the automatic system:

- Do not assume user attention. Dual process theories predict that due to limited cognitive resources, no user can be guaranteed to be able to dedicate either attention or reason at a given time. My approach therefore moves away from just-in-time information provision to longer-term strategies that focus on altering the automatic system, which generates default behaviour when cognitive resources are in short supply.
- Appropriate measurement. Interventions need to measure the activities of the automatic system by techniques other than traditional self-report, given the relative inaccessibility of this system to conscious thought.
- Design for intervention persistence. Behaviour change is not a short-term process. Interventions need to be tested over the longer term. They should fit into and/or appropriate existing user behaviours.
- Design for possible reactance. Any system trying to guide behaviour risks reactance, where users reject interventions to preserve behavioural autonomy.
- Multiple routes. The optimal solution to changing habitual behaviours is likely to involve multiple possible routes of attack, both automatic and deliberative, to change such behaviour in the long term.

One active research strand is the use of subliminal priming on smartphones to prompt activity. Subliminal techniques have the advantage of avoiding reactance because they bypass the deliberative system. I have established that it is technically possible to show stimuli on smartphones for the same durations as experiments in psychology labs that have shown behavioural priming effects. We can also show subliminal primes at user unlock time, thus appropriating an existing behaviour and providing multiple opportunities to intervene per day. I have also established that users are somewhat receptive to using subliminal priming apps for behaviour change. The next step is to establish the circumstances under which these techniques can promote lasting behaviour change in the wild.

Examining within-person variation of the effects of Firstbeat biofeedback and motivational interviewing on physical activity: N-of-1 field trial with the Precious app

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Background: Within person designs are necessary to understand the individual responses to specific interventions and to collect precise evidence on factors that predict behaviour change. To measure how behaviour change techniques affect daily physical activity, smartphone apps may be used to offer repeated interventions while continually collecting outcome data. The Precious Project (thepreciousproject.eu) developed an app that offers randomised intervention elements, and studied the subsequent fluctuations in physical activity, self-efficacy, motivation, and service engagement.

Method: Fifteen participants used the Precious app and an activity bracelet for six weeks during which they received repeated, randomised interventions of digitalised motivational interviewing features, prompts to conduct 24h measurements with Firstbeat heart-rate variability sensors, prompts to download and read biofeedback reports from the Firstbeat device, and daily questions on motivation, self-efficacy and perceived barriers. Physical activity was tracked with smartphone sensors, activity bracelet, and self-reported activities with the app.

Exit interviews focused on feasibility, user perceptions of motivation, self-regulation, physical activity, and the role the Precious app played in these. Interview data was analysed with thematic analysis. The N-of-1 intervention effects on physical activity and goal setting were analysed with multilevel modelling and time-series analysis.

Findings: Small changes in physical activity and motivational variables were observed over the course of the study. All participants completed the intervention and most reported sustained motivation to continue tracking their physical activity. Specifically the Firstbeat biofeedback on physical responses to activity (stress, recovery, and sleep quality) was of high interest to some users. Most participants found the step tracking features useful for understanding how activity accumulates during the day. Motivational features were considered less useful, potentially due to the high level of motivation to increase physical activity reported at baseline. Some participants wished the app offered more detailed physical activity prescriptions, but most appreciated the autonomy supportive features which allowed users to choose and adjust their own activities and goals. Several users indicated that offering more interactive, tailored features might maintain interest and engagement with app features for a longer time. The challenges relating to intervention delivery included push notifications, used as reminders, which sometimes went unnoticed.

Discussion: The lack of dropout is a positive indicator of the usability of the Precious service. Participating in the Precious trial helped users to reflect on factors related to their physical activity and self-regulation, and ways to improve these. Most insights were related to self-monitoring of steps and activity logging, especially how steps accumulate during the day and during different activities. Testing the app among people with low baseline motivation for physical activity would allow for better testing of the motivational interviewing features. Analysing data with multilevel modelling enabled observing trajectories of each participant in comparison to group level changes. It remains a challenge to include tailored or gamified elements (and maintain user interest) while testing the impact of prespecified, randomised elements in a controlled N-of-1 trial.

Supporting physical activity with musically-informed sonification

Joseph W. Newbold - UCLIC (UCL Interaction Centre), University College London

While engaging in physical activity is important for a healthy lifestyle, previous works shows how people struggle to maintain a routine of physical activity. One of the key aspects to engaging in physical activity is one's belief in one's own ability, our self-efficacy. There have been many works investigating how real-time feedback for physical activity can be used to inform people on their activity and help them improve their technique. Specifically, the use of sound-based feedback (sonification) has been used to improve the quality of people's movement and allow them to meet the desired trajectory. However, these sonification works do not consider the individual's self-efficacy and how sound can be leveraged to encourage and reward movement. Conversely many previous works have explored how motivational tools and rewarding mechanisms can be used to encourage people to engage in more exercise. However the majority of this work has focused on how to encourage and reward increased activity; little work has explored how we apply these mechanisms in the moment of exercise, arguably where it is needed most to increase self-efficacy.

Our work investigates how these two concepts can be used together to create real-time feedback for physical activity, that not only informs people about their movement, but also encourages and rewards. To this end, we design a sonification of people's body movements, through mapping specific movements to sound, that uses implicit and embodied aspects of music to both motivate and reward people's movement. Specifically, we investigate the role of music expectancy to leverage people's implicit and embodied understanding of music to both provide information on technique while also motivating continuation of movement and rewarding its completion. Our work explores both how this can be used to support physical activity and how our relationship with music and can be used to increase self-efficacy.

Feasibility and acceptability of an adaptive smartphone-delivered intervention for physical activity and sedentary behaviour change

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Purpose:
To investigate the feasibility and acceptability of an adaptive proof-of-concept smartphone-delivered intervention that captured movement data to inform behaviour change content delivery.

Methods:
A single group, 8-week study with pre- and post-intervention assessments was conducted. Healthy participants aged 17-69 years who owned an Android smartphone were recruited via online advertisements. Acceptability was assessed using 10 items previously used in qualitative research on desired app features (e.g. "The app gave me positively phrased alerts"). Perceived usefulness of behaviour change techniques (BCTs) was assessed using 23 items based on previous research evaluating adults' ratings of BCTs in apps (e.g. "It was important for me that the app prompted me to plan how/where/when to be active"). Answers were provided on a 5-point Likert-type rating scale. Feasibility was assessed using attrition and adherence data as well as technical issues. Simple descriptive statistics were used to describe usage and the percentage of answers to each category of usability and acceptability items. Coding of the survey acceptability items was done using MaxQDA.

Results:
Participants were predominantly female (78%, n=54/69) with a mean age of 34.5 years (SD 11.8) and a BMI of 25.6 kg/m2 (SD 4.95). Among the 69 participants that successfully started the app, 62 (90%) completed the post-intervention assessment. Participants opened the app on average 11.4 days throughout the intervention (SD=10.1, median=8, min=1, max=54). 54.3% of participants agreed the app was low effort and pleasant to use (18.7% disagreed). 52.6% agreed it provided guidance on how to increase activity and interrupt sitting (18.7% disagreed) and that it gave positively framed messages (64.4% agreed, 5.1% disagreed). 30.5% reported the app negatively impacted other uses of their device (e.g. battery). Feedback on behaviour (72.8%), behaviour substitution (71.1%), instruction on how to perform the behaviour (61%), and discrepancy between current behaviour and goal (57.7%) were rated more favourably for perceived usefulness. Other BCTs, such as social support and credible source were rated frequently as not applicable, indicating participants were likely not exposed to such BCTs.

Conclusion:
While largely acceptable to users, future iterations are needed to address the identified shortcomings and optimise the intervention.

ABSTRACTS - SESSION 4

Going beyond motivation! A framework for design of body-aware technologies for supporting physical activity where mobility is restricted.

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Abstract:
Being physically active is not always determined by people's motivation to move or not. It is also affected by emotional and psychological factors, such as people's confidence in doing certain movements and their perception of their body's capability. This is especially true in the case of long-term chronic conditions (e.g. chronic pain, stroke, multiple sclerosis). People with these conditions, despite being physically able to do a movement, may feel restricted in performing it due to psychological barriers, for instance, fear of falling. These barriers are underexplored in behaviour change models and theories, which focus mainly on the opportunity, physical capability and motivation to do a task. The emotional barriers are also unexplored in the field of physical rehabilitation technology, where sensing technology and games target fun as means to motivate physical exercise and make it less boring, while providing physical progress measurements. Further, these current approaches to the promotion of physical activity are often narrow in the contexts where they consider physical activity to happen. Physical activity/rehabilitation is often self-directed and occurs outside the clinic, embedded in everyday life and activities, hence it takes various forms. To address this gap in current approaches to the promotion of physical activity, we propose a new framework for the design of body-aware physical activity technology that puts emotional needs at the forefront for chronic conditions where mobility is restricted. This framework is an initial attempt to provide technology designers with systematic support for the translation of needs, aims and barriers to managing self-directed physical activity in populations with chronic conditions. We do this by considering the variety of factors and contexts that are critical to the effectiveness and adherence to a program of physical rehabilitation. The framework is built on lessons learnt from 5 years of work in the context of chronic pain physical rehabilitation. We refined the framework by conducting an extended review of HCI literature on designing for physical rehabilitation, functioning and physical activity. Finally, we evaluated the framework through workshops with designers in these areas.
Our aim is to stimulate discussion from the perspectives of researchers and practitioners working towards supporting physical activity to discuss theories, design of studies, methods and challenges in designing such body-aware technologies.

Designing for agency and compassion: critical reflections on technology to support physical activity in late life

Dr. Kathrin Gerling, University of Lincoln, Prof. Mo Ray, University of Lincoln, Dr. Adam Evans, University of Copenhagen

Abstract:
Contemporary policy on ageing overwhelmingly focuses on active ageing and the increase of disability-free years. Consequently, the research community has adopted an agenda that broadly addresses the issue through technology interventions that focus on deficits of older persons, who are often viewed as a homogeneous group, and little consideration is given to the relationship between the ageing body and physical (in)activity, the impact of the life course, and implications of the acceptance of life stages.

As a result, technology interventions can be effective on a functional level, but simultaneously fail to consider personal and emotional aspects, resulting in prescriptive, standardised interventions rather than empowering systems that emphasize agency. For example, a step-counting app may let an older person know they failed to reach their activity goal for the day, but will often cite national and international physical activity recommendations rather than adapting to individual abilities and aspirations or asking questions around contextual and situational factors.

In this presentation, we give an overview of ongoing discourses in critical gerontology questioning common approaches to active ageing to adopt a broader perspective on technology and activity across the life course. We present findings from a systematic review of existing systems that build on the model of active ageing (including our own work on playful technologies) through the lens of physical activity promotion. Through this approach, we expose shortcomings of present research.

Moving beyond critical analysis, this presentation outlines challenges that need to be addressed in order to create technology that is compassionate, offers room for the lived experiences of older adults, and empowers them to re-gain ownership of their embodied experiences of physical activity.

A scoping review of the evidence for games as movement-oriented health interventions

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Conor Linehan, School of Applied Psychology, University College Cork

There has been much recent interest from academia, industry and health professionals in using games as interventions to motivate people to engage in movement and exercise. However, there is a lack of structured analyses of the appropriateness of this approach. In this paper, we present a systematic scoping literature review of studies examining the effects of exertion games (also known as active video games, exergames etc.) on movement and exercise.

We previously argued that some exertion game health claims are overstated, and have demonstrated empirically how some exertion games research misrepresents health research to justify claims about obesity. In this review, we consider whether and in which contexts games can best function as health interventions.

We review all existing experimental work studying exertion games, analysing each article in terms of:

a) Motivations (e.g. obesity reduction, fitness improvements, fun)

b) Theoretical basis for intervention design (are theoretical models of behaviour change applied, supporting literature correctly described and interpreted)

c) The type and duration of study (experimental, cross-sectional, controlled trial)

d) Participants (school children, elderly)

e) Setting (e.g. families, school PE classes, elderly daycare)

f) Outcomes of study (self-report, behavioural, physiological).

We conclude with a discussion of the overall quality of evidence for exertion gaming as a health intervention, and discuss the contexts in which such interventions are more or less likely to succeed.

Exploring the relevance of social practice theory to inform the design of technology for encouraging more physical activity in everyday life

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The purpose of this paper is to provide a review on the application of Social Practice Theory (SPT) to the challenge of designing technology to encourage more physical activity in everyday life. Design interventions aimed at improving health and wellbeing have traditionally employed behaviour change and persuasive strategies based on social-psychological theories to encourage health behaviours like physical activity. However, these theories have been widely criticised for doing very little to effect long-term behaviour change. The main critique is that they are heavily individualistic and fail to account for the complexities involved in changing patterns of physical activity embedded within everyday life.

Researchers within public health and sociology have recently argued for a shift in theoretical perspective, suggesting that SPT provides an alternative approach for conceptualising everyday health related practices including physical activity. SPT, rooted in the fields of sociology, anthropology and philosophy, places the practice itself, rather than the individuals who perform them as the central unit of inquiry and analysis.

Therefore, this paper aims to examine the theoretical and methodological applications of SPT: to highlight promising practice-oriented design approaches, and their implications for guiding future research and design of technologies for encouraging more physical activity in everyday life.

ABSTRACTS - SESSION 5

Sedentary behaviour and physical activity interventions in older adults using digital technologies with special emphasis on just-in-time adaptive interventions (JITAIs)

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High levels of sedentary behaviour and low levels of physical activity in older adults need to be addressed with innovative behaviour change interventions. The increased use of modern technology by older adults presents an opportunity for such interventions to be delivered digitally. Just-in-time adaptive interventions (JITAIs) are an emerging behaviour change intervention form that capitalise on real time individual- and context-specific data that can be collected via mobile technology (e.g. smartphones and activity trackers). The collected data can then be used immediately to trigger appropriate intervention options so that the individual receives adequate behavioural support when and/or where needed. In order to design a potentially effective JITAI to tackle low activity and high sedentary time in older adults, behaviour change and ageing theory and research as well as knowledge around technology use need to be thoroughly integrated. The goal of such integration is a theoretical intervention model. In this paper, we present such a model which has been derived through literature research. We propose that the JITAI should target the distal outcome (ultimate goal) of regular active breaks from prolonged sitting as this has many health benefits for older adults. As a proximal outcome, the outcome that indicates short-term progress towards the distal outcome, we suggest daily activity breaks from sitting. The provision of prompts that help older adults to interrupt their sitting time should be based on a) accumulated sitting time, b) the location of the individual, c) the time of the day and d) the response to support provided previously. Data on these variables can be collected using smartphones via in-built accelerometers/inclinometers, GPS and clock. Support prompts should be delivered via traditional text messages as older adults are familiar and comfortable with this function. The content of the short prompts should encourage the interruption of prolonged sitting by highlighting immediate benefits. Light physical activities that could be done during the sitting break should also be presented. Following the design of the theoretical model we will introduce the very few JITAI studies conducted to date to highlight the infancy of the research field. Finally, we critically assess the feasibility and theoretical soundness of JITAIs to promote breaks from sedentary time in older adults.

When wearable devices fail: towards an improved understanding of what makes a successful wearable intervention

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Many champion wearables as devices that will revolutionise 21st century medicine. However, this technology has often failed to provide new insights for healthcare professionals and patients. Regarding behaviour change specifically, current research paints a mixed picture when demonstrating their effectiveness. While some patients claim that these devices are beneficial, recent clinical trials targeting weight loss observed that patients provided with a wearable tracker lost significantly less weight than patients provided with lifestyle support alone. Additional research also highlights failures in the design and implementation of similar devices. Nevertheless, these outcomes remain a key cornerstone in the literature because they emphasise the importance of understanding errors in order to capture the ideal functioning of any new device and/or intervention. Therefore, our white paper has two complementary aims that will hopefully help generate discussion and realise the potential of future technologies.

First, we identify patterns and document the key reasons why wearables and other mobile technologies often fail to change behaviour. The design of any digital device or intervention that aims to improve health and wellbeing combines elements of engineering, computer science and social science. Therefore, our paper critically considers aspects of (a) device design, (b) the value of feedback, (c) user engagement and (d) theoretical shortcomings. A clear understanding of these issues can be derived not only from the latest research, but also by looking backwards at early attempts to self-tracking within health and social care (e.g. telehealth). This, in turn, provides new insights concerning how the next wave of wearable technology can be better designed and implemented – increasing the chances of success within specific target environments (e.g. schools, workplaces) and populations (e.g., adolescents, elderly adults).

Second, we consider how study designs and outcome measures may need to be adapted in the future. For example, the vast majority of current investigations fail to adopt measures that are sensitive enough when it comes to capturing progress and accurately quantifying key outcomes. While research continues to rely on outcome measures used in traditional behavioural interventions (e.g. lifestyle modification), these are often not appropriate when it comes to real-time feedback that is ‘always on’. The absence of recording human-computer interactions is particularly evident when most wearable technology can easily collect this information (e.g. opening an application) alongside health related (e.g. physical activity) behaviours.

The current state of self-tracking technologies and interventions for encouraging increased activity and how to assess them: a critical review

Daniel Harrison, Paul Marshall and Nadia Bianchi-Berthouze. University College London Interaction Centre.

Activity tracking and other Personal Informatics (PI) devices have progressed massively over the past five years, not only attracting huge numbers of sales, but also a large amount of academic research across different fields of research. A large body of work focuses on how people adopt these trackers and integrate them into their lives, considering not only changes in the tracked behaviour, but also how the trackers become part of one's daily routine. Beyond this work focusing on the trackers themselves, an increasing number of interventions and other systems for encouraging and assessing behaviour change are centred around these devices.

Levels of engagement with such devices or interventions are often used to define their success. However, particularly in the case of self-tracking, this is often not an appropriate measure – users sometimes create long-term changes even after a short period of use, either through insights gained or by maintaining changes without engaging with the device.

This paper presents a critical overview of the current work within personal informatics for encouraging NEAT (non-exercise activity thermogenesis) physical activity – all the activities that we do that are not sleeping, eating, or sports-like exercise. We also focus on the appropriate methods for assessing success, particularly given the long-term and broad societal changes we would like to see arising from work in this area.

The paper presents an overview of: current PI technologies for measuring physical activity; research into engagement and use of these technologies and how this has impacted individuals, groups and society; considerations for using these devices in interventions; and finally, a critique of both the methods for studying PI systems, and the interventions using them, to provide new directions for future work.