Proceedings

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About

UD17: NOISEWISE is a doctoral forum, open to all current PhD students as well as recent graduates. The Forum welcomes researchers from all disciplines who may want to cross their ongoing research with the field of Design - both contributing to it, and/or benefiting from it.

UD17 aims at fostering the advancement of Design Research from a doctoral perspective: we believe PhD students hold a unique foresight to future developments of the discipline. Additionally, the consolidation of Design Research through doctoral studies will ensure a national and international network beyond individual contexts.

UD17 is the sixth edition of the UD conference series, held by ID+, Institute for Research in Design, Media and Culture, the University of Porto and the University of Aveiro since 2012.

The theme "noisewise" strives to bring out the wisdom of research from the noise of fake news and media, a ubiquitous problem in 2017.

Statement

The recent and growing ransomware virus trend has been raising the levels of concern for the safety, integrity and accessibility of our information; in one second, the wrong click may wipe out our personal digital heritage once and for all. Yet even more concerning may be the ways in which it has managed to wreak havoc on certain public infrastructures and private core companies: on the May 2017 cyberattack, the UK National Health Service was forced to revert to manual prescription among the infochaos, just as Portuguese emergency services reverted to radio communication as a preventative measure.

This sequence of events may be regarded as a manifestation of a broader set of challenges we face nowadays; on one hand, it exposes an ironic frailty at the core of the hyper-complex state of technology we have developed and subscribed to as an unquestionable paradigm. On the other hand, and equally as ironically, it sets a reversion into analogue, even manual procedures, that reveal themselves ultimately more reliable in times of crisis. So much for deterministic progress, then: Brave New World ends up in a black box, and the black box is bursting at the seams, and the black box is encrypted. Now, shall we wait until AI has woven itself effectively into our bodies and we have fully delegated our cognitive and vital functions? In this ever-more-likely scenario, a hacking might just turn out to be the last one.

The ransomware trend may also be regarded as a metaphor: for the ways scientific knowledge is often far from openly accessible for the purpose of scientific advancement - and equally a metaphor for the ways in which science seems to be increasingly becoming hostage to agendas, be it financial, political or other. Recent echoes from the US Government voicing its willingness to veto impartial research pertaining to climate change (and elsewhere to withdraw the funding of bodies and projects whose findings do not align themselves with political agendas) are deeply concerning signs when it comes to the continued maintenance and nurturing of the sacred principle of scientific impartiality. >>

Agenda-driven Science is, one may argue, in line with the broader phenomenon of fake news: ultimately unreliable, but more dangerously, ultimately capable of rendering impartial knowledge and information unreliable by association, as one and the other become increasingly harder to tell apart. And this happens in part through an ever-increasing access to ever more powerful design tools. Again, the irony: design sophistication has flattened the authoritative formation (and formality) of content. In a sense, all is noise already; the question is, is this syndrome reversible?

On a broader perspective, we may posit that purposeful knowledge is in the process of being neutralised by the sheer magnitude of paradoxical information, the allure of speed betraying our ontological need for depth. Our struggle with this kind of Noise is particularly challenging because it provides a very effective semblance of content - but hardly or rarely a narrative, a context or a canon.

Noise is therefore either the endpoint of encryption, or an induced omnipresence (and therefore a uselessness) of meaning.

Design Research

Which brings us to Design Research. A fairly recent endeavour in its scientific ambition, it has been consolidating itself as a discipline both by applying and customising scientific paradigms and methodologies as required by its own field - as well as by making itself available to other disciplines that may benefit from the input of design.

The premise of UD17 - noiseWise is that design research may point towards a wide range of contributions, both in the sciences and in civic environments - and we believe these contributions may be able to converge in a shared mission: to ensure, confer and preserve the presence of meaning and purpose among the current state of cognitive volatility.

Furthermore, the Humanities and Social Sciences face the challenge of incorporating a critical and interpretative voice that could attempt to regulate and harmonise what at times seems to be an exponential technological development devoid of the sense of its own social or cultural impact: case at hand, the utopia of online connectivity has at some point given way to a neurosis of ubiquitous surveillance and compulsive over-exposure. Yet the party goes on unabated and unchallenged. Make no mistake: this is not a manifesto against technological development, but rather a call for its wise and mindful mediation and incorporation.

Could design research lead this process of decipherment and re-centering of current scientific progress? We believe the answer may be in the affirmative: from research that casts light into contemporary communication phenomena, to projects that reveal the dynamics and conflicts between tradition and progress. From pedagogical assets in our relation with technology, to the actual aesthetic and functional betterment of that same technology. From the tangible facilitation of emerging communities to ensuring existing communities avoid the traps of exoticisation and loss of self-determination.

"A Better World"

More importantly, we believe design research needs to build and maintain bridges with other disciplines if it is to flourish in its own terms, and effectively contribute to that truthful cliché we have all wanted all along as researchers: "A Better World". And a Better World needs to be built just as it needs to be interpreted, communicated, provided with forms, translated into tools and the means to flourish. A Better World is based on a wealth of meaningful and purposeful knowledge; in other words, it is based on wisdom. As design researchers, we will be delighted to provide a continued contribution; and as doctoral students, we will do our darn best to ensure the future turns out to be wiser than the present.

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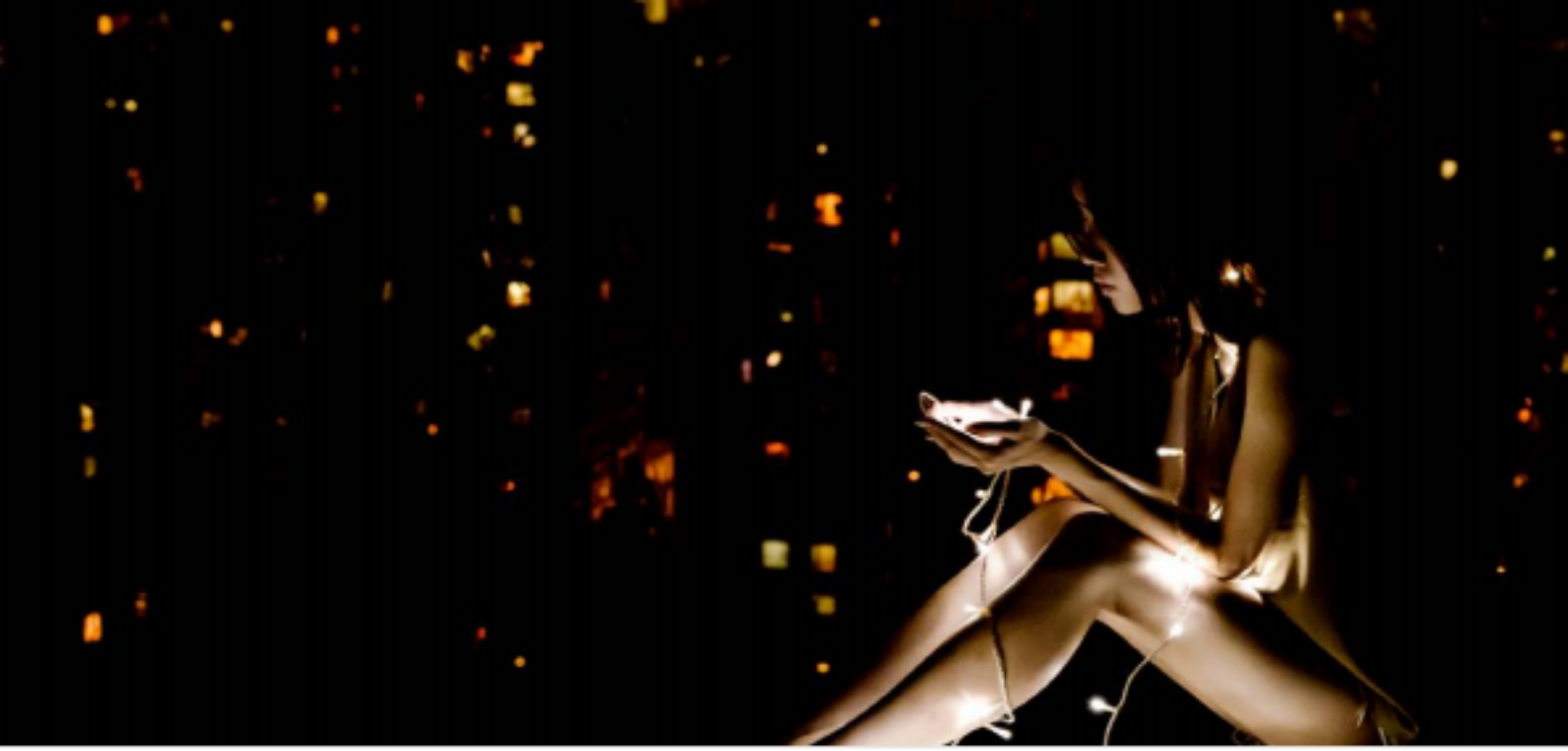

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UNDER DESIGN CONTROL. Technologies that mould user's behaviour in sensorimotor rehabilitation after stroke

Keywords

Medical Design, Design Sciences, Neuroplasticity, Technosophy, Stroke Rehabilitation

Abstract

Even if we aren't yet prepared to accept the idea that an old woman with a pacemaker is perfectly suited by the definition of "cyborg", the incorporation of modern technologies with the human body is a pervasive side of our hyperconnected times, and their impact has become overwhelming. The delegation of memories to technologies, the immediacy of information and the ubiquity of the self are enhanced by the use of personal devices connected 24/7 in almost every place, and are translated by the sci-fi imaginary as dystopic scenarios aiming to advice the users on the dark sides of a techno-centric world. The presented design research aims to investigate how the contemporary discoveries of neurosciences about the brain shaping in function of the external environmental stimuli can be applied contrariwise, and therefore how designers can contribute to sensorimotor rehabilitation after a stroke by designing technological systems that stimulate the neural plasticity and fasten the recovery. As the research is still under development in collaboration with a Stroke Unit and a Robotic Engineering Lab, this paper introduces the theoretical basis and the premises to design an engaging and efficient system.

Introduction

We are aware that the environment in which we live has a strong impact on our brains in terms of culture, language, behaviour and sensory abilities. Thanks to the recent neuroscience discoveries we also know that our behaviour is the consequence of our experience of the world: the relations we have with other persons and the things we look at are relevant to build our self. In this scenario, everything we get in contact with through our senses, from a painting (Gallese, 2014) to an architecture (Mallgrave, 2015), from a sound to a smell, contributes to mould our language and motor ability by teaching us how to feel our bodies in space (Gallese, 2005), to recognise the feelings and movements of other persons (Rizzolatti & Sinigaglia, 2006) and to manage our cognitive system to reach goals by avoiding distractions (Gazzaley & Rosen, 2016).

On one side, contemporary neuroscientists are studying how the body and the mind are structured and how they react to an external environment in terms of adaptability, aiming to make progresses in the study of neural nets and provide strong basis for the development of Artificial Intelligence (Cingolani & Metta, 2015; Gallina, 2015), meanwhile on another side modern medicine takes advantage of the humans' resilience to strengthen and repair the body through additional technologies and prosthetic elements (Pullin, 2009), giving a chance of good life to hybrid creatures that less than a century ago were more closer to science fiction than to reality. Even if we aren't yet prepared to accept that an old woman with a pacemaker is perfectly suited by the definition of cyborg (Haraway, 1991), the incorporation (Clark, 2004) of technological elements with the human body is a pervasive side of our hyperconnected times, and the impact of technologies has become overwhelming. The delegation of memories to technologies, the immediacy of information and the ubiquity of the self are enhanced using personal devices connected in 24/7 in almost every place, and they have been translated by the sci-fi imaginary into dystopic scenarios that disclose the dark sides of a techno-centric world

and warn against them. The *Black Mirror* series distributed by Netflix since 2016 and the best seller *The Circle* by David Eggers are two examples of the current popular imaginary related to the spreading of technologies.

The core of this research lies in the belief that, through the design of a product, technologies can drive behaviours: sharing the knowledge between different professions is important to drive social innovation, giving voice to the weakest persons and driving to an ethical and sustainable product development. A better understanding of the technologically-driven dynamics that elicit distraction make possible the reversibility of that effect and therefore guide the design to enhance the cognitive abilities and improve the brain plasticity.

Focus on the context and problem introduction

The area of intervention of the research has been identified in the early rehabilitation after stroke. Rehabilitation is an experience that needs to be tailored on the patient's residual abilities and on her exigencies (Taylor, 2015; Vallar & Papagno, 2007), the path is determined according to the national guidelines by a multidisciplinary team of physicians and therapists according to the patient's needs, her previous lifestyle and the ability of the family to give support during and after the hospitalization. The parameters that determines the efficacy of the rehabilitation vary depending on the area of the brain affected by the stroke and the extension of the trauma, on the immediacy of the recovery, the age of the patient, her motivation to follow the therapy, and the frequency of the exercises. The stimulation needs to take place at both cognitive and physical level, it must be the consequence of the integration of sensory and motor stimuli and most of all the experience needs to be engaging and show the progresses.

This research addresses those problems using design as a facilitator in bridging knowledge from neurosciences and engineering: the output (Oregon State University, n.d.) of this research is the development of a system, made of a physical

device and a digital interface, that supports the therapist into an early rehabilitation of the lower limb of bedridden patients.

Development and core concepts

The path that has driven to the final design has been built upon the Design Research Methodology (Blessing & Chakrabarti, 2009), with the identification of the context and the definition of the research questions. The second step has been an investigation of the literature of three main fields: engineering, focusing on the state of art of the technologies applied in sensorimotor rehabilitation after stroke (Dzahir & Yamamoto, 2014; Guo, Han, Li, Fang, & You, 2016; Huang, Wolf, & He, 2006; Johnson, 2006; Maggioni et al., 2016; Sawers & Ting, 2014), neurology, on the relation between mirror neurons, cognition, movement and the application of advanced technologies (Hancock, Shepstone, Rowe, Myint, & Pomeroy, 2011; Martin, Abogunrin, Kurth, & Dinet, 2014; Rosati, Masiero, et al., 2007; Rosati, Gallina, & Masiero, 2007; Scrivener, Sherrington, & Schurr, 2013), and design, on the approaches used for the study and the development of devices and interactions oriented to a medical use, and on the social perception of the use of technologies in strict connection with the bodies (Anselmi, 2010; Biondi, Rognoli, & Levi, 2010; Briganti, 2010; Colomina, 2016; Corà & Bellasi, 2009; Fortunati, Katz, & Riccini, 2002; Maiocchi, 2010; Rawsthorn, 2013).

This first phase has allowed the researcher to make some preliminary assumptions on the objective of the system, but to verify them an on-field observation(Calabrese, n.d., pp. 27–35) has been conducted. The ethnographic approach (Calabrese, n.d., pp. 16–24; Clarke, 2010, pp. 45–55) followed for the on-field observation has seen the researcher attending the Stroke Unit and collecting qualitative data in different ways: the observations have always been combined with notes, sketches and questions to the professional figures involved, the resulting data have been written down, compared with the hospital's guidelines and elaborated after a questionnaire. The output is a detailed patient journey, helpful to identify the range of time, the

place and the actors involved in the use of the device, and the constraints for designing the system.

The applicative part of the research, the design of the system itself, has involved the parallel development of the physical device and the interactive application. While the first has been based upon human factors (Sanders, 1993), cognitive response to environmental stimuli such as affordances (Gibson, 2014), and the elicit of empathy, the second has been built following the dynamics of gaming, challenging distraction (Gazzaley & Rosen, 2016) by bringing the patient into a flow (Csikszentmihalyi, 2009) through the use of the six dimensions of player involvement (Calleja, 2011). Merging the efficacy of the learning process with a flow experience might engage the patient undergoing the rehabilitative therapy to enjoy it and feel committed to it, pursuing a higher motivation to carry it on and reaching better results both psychologically and physically.

The impact of the designed system is given by its ability to adapt to the different patient's needs and skills, it aims to be an instrument that improves the work of the therapists instead of substituting it, allowing to start the rehabilitation since the early stages of the hospitalization (sub-acute phase) thanks to the possibility of use with bedridden patients. Furthermore, the project has been thought for being cheaper than the existing robots used for the rehabilitation of the lower limbs and it has been designed to fit and move into restricted spaces, as hospital aisles and rooms.

Conclusions

Design has been applied here for the development of a system that supports the work of the therapists and adapts to the needs of the patients, driving the interaction through the creation of "constraints to the human body that are perceived like affordances" (Moray, 1993), and increasing the active participation through dynamics of distraction, flow and player involvement. These dynamics needs to be addressed since the beginning of the design to avoid the development of a system in which the performance becomes the goal and the gaming

support transforms the experience from playful to working (Han, 2015, p. 49), therefore it is relevant that the design of the technological support is driven by a technosophical (Moray, 1993) approach, combining the rigor of engineering with the human factors.

Further development of this research would be the engineering of the system, followed by a usability and acceptability testing oriented to the implementation of the system for a clinical testing.

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The research presented in the present paper is still under development, some considerations may need to be further defined and some might be found irrelevant for the near future. The author thanks all the persons who provided helpful comments on the previous version of this document. The representative image of the paper is a photo uploaded by Tommy Tong on Unsplash.

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