

Designing bio-wearable computers to expand interactions between bodily spaces and physical environments

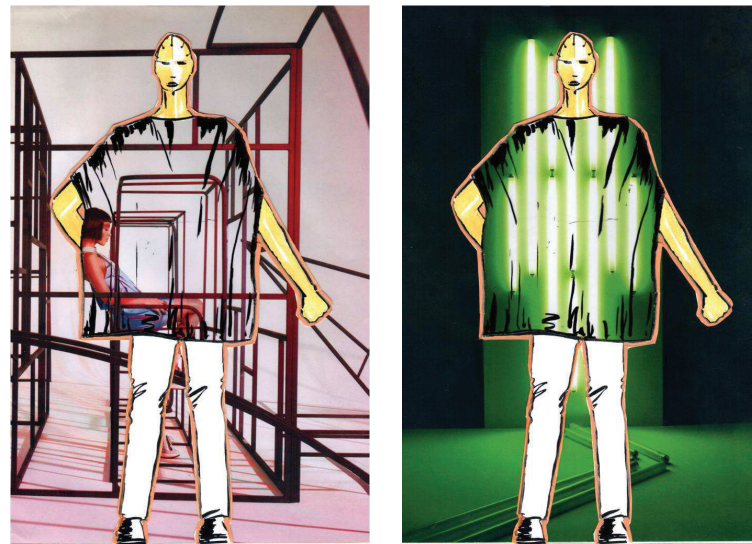
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I. EXTENDED ABSTRACT

This research presents and discusses the Design-Neuroscience cooperation in the design of organic interactions with the physical environment afforded by wearable bio-computers. It is based on the contributions of studies related to the paradigm environment / behavior / neuroscience¹ and emotional processing in the human brain^{2,3,4,5,6,7} regarding the identification and recognition of neurophysiological information relevant to design research and practice. It also discusses the Neuroscience-Design relationship in the projectual practice of the biowearable computer NeuroBodyMimeses addressing the interaction between the body's user (neurophysiological signals and brain waves), the digital technological system and the physical environment by employing wearable bio-computers.^{9,10,11,12,13}

According to Poissant¹⁴, interfaces are becoming more natural and may take, alternately or simultaneously, extensible, enlightening, rehabilitative and filter functions or act as agents of synaesthetic integration. In the opinion of Bureaud¹⁵, interfaces, seen as sensory organs, generate a deconstruction of the usual modes of perception, as a kind of fragmentation/displacement of the body that leads to reflection on these modes of perception, to questions about the nature of space in which this body exists and fundamentally redefines itself as human.

As a device focused on the social interaction in physical space, the wearable biocomputer NeuroBodyMimeses establishes a direct relationship between the physical environment and the user's body, from the real-time detection and interpretation of the user's emotional state. In situations of increased anxiety and stress, for example, this wearable bio-computer modifies the visual appearance of its surface, in immediate response to the user's neurophysiological changes due to their interaction with the surrounding space, and it can even mimic the visual standards of this environment. Thus, this device intends to give to the user's body the "regency" of social visibility in physical environments, releasing it, for example, from facing confrontational situations when it is not prepared for such, from the neurophysiological standpoint.



FIGS. 1 AND 2. NEUROBODYMIMESSES WEARABLE BIO-COMPUTER (© 2012, ZUANON & LIMA JÚNIOR)

As "agent of stable mediations between thought and matter, thought and sensibility"¹⁵, NeuroBodyMimeses enlarges the notions of complexity, affectiveness and naturalness to an organic scale, in which the neurophysiological information (biological signals) of the users is translated as digital data. It is done to configure an interaction that responds to their emotional state in order to match their body state specifically at that moment of their interaction with the surrounding physical environment.

2. REFERENCES

- ¹ Zeisel, J. (2006). *Inquiry by Design: Environment/Behavior/Neuroscience in Architecture, Interiors, Landscape, and Planning*. New York: Norton.
- ² Canteras, N.S., Bittencourt, J.C.: *Comportamentos Motivados e Emoções*. In: Lent, Roberto (edit.): *Neurociência da Mente e do Comportamento*. Rio de Janeiro: Guanabara Koogan, 2008.
- ³ Damasio, A. R. (2004). *Em busca de Espinosa: prazer e dor na ciência dos sentimentos*. São Paulo: Companhia das Letras.
- ⁴ Damasio, A. R. (2000). *O Mistério da Consciência: do corpo e das emoções ao conhecimento de si*. São Paulo: Companhia das Letras, 2000.
- ⁵ Damasio, A. R. (1994). *Descartes' Error: Emotion, Reason, and The Human Brain*. New York: G. P. Putnam's Sons.
- ⁶ Lundy-Ekman, Laurie (2004). *Neurociência: Fundamentos para Reabilitação*. Rio de Janeiro: Elsevier.
- ⁷ Oliveira, Letícia de; Pereira, Mirtes Garcia; Volchan, Eliane (2008). *Processamento Emocional no Cérebro Humano*, In Roberto Lent (org.) *Neurociência da Mente e do Comportamento*. (pp. 253-269). Rio de Janeiro: Guanabara Koogan.
- ⁸ Zuanon, R. (2014). *Design-Neuroscience: Interactions between the Creative and Cognitive Processes of the Brain and Design*. *Lecture Notes in Computer Science*, v. 8510, p.167-174.
- ⁹ Zuanon, R. (2013). *Designing Wearable Bio-Interfaces: a Transdisciplinary Articulations between Design and Neuroscience*. *Lecture Notes in Computer Science*, v. 8009, p. 689-699.
- ¹⁰ Zuanon, R. (2013). *Usign BCI to play games with brain signals: an organic interaction process through NeuroBodyGame wearable computer*. In: Huggins, J. E.. (Org.). *Fifth International Brain-Computer Interface Meeting 2013*. Austria: Graz University of Technology Publishing House, p. 64-65.
- ¹¹ Zuanon, R. (2011). *Bio-Interfaces: designing wearable devices to organic interactions*. In: Anna Ursyn. (Org.). *Biologically-Inspired Computing for the Arts: Scientific Data throughGraphics*. Pennsylvania: IGI Global, p. 1-17.
- ¹² Zuanon, R., & Lima Jr.,G.C. (2008). *BioBodyGame*. Retrieved March 15, 2016, from <http://www.rachelzuanon.com.br/biobodygame>
- ¹³ Zuanon, R., & Lima Jr.,G.C. (2010). *NeuroBodyGame*. Retrieved March 15, 2016, from <http://www.rachelzuanon.com.br/neurobodygame>
- ¹⁴ Poissant, Louise. *A Passagem do Material para a Interface*. In Diana Domingues (org.) *Arte, Ciência e Tecnologia: Passado, presente e desafios*. pp. 71-90. São Paulo: Editora UNESP, 2009.
- ¹⁵ Bureaud, A. *Pour une typologie des interfaces artistiques*. *Interfaces et Sensorialité*. Stefoy: Presses de l'Université du Québec, 2003.

3. AUTHOR BIO

Dr. Zuannon is the coordinator of the PhD and Master's Design Program at the Anhembi Morumbi University, Brazil. Researcher and professor in the same Design Program, she is also a designer and media artist. CEO of the All Affective Design for Innovation and of the Zuannon Integrated Solutions. Head of CNPq research group of "Design, Creation, Language and Technology" and Brazil leader in the research project "Tremors Time Interactive Convergent Project", focused on the development of innovative wearable interfaces for games held in international cooperation with OCAD University (Toronto), Xenophile Media (Toronto) and Zuannon Integrated Solutions (Brazil) and supported by ISTEP | FAPESP. Author of several scientific works, she had presented her research in EUA, Canada, China, Japan, Singapore, Taiwan, Germany, Greece, Portugal, Turkey, UK, Vienna, and many other places around the world. She is also an Ad-hoc Assessor for the most important Brazilian Agencies for scientific research support, as FAPESP and CAPES. She is dedicated to research in design of bio-wearable computers since 1998. In 2010, in PhD and Master's Design Program, she founded and since then she coordinates the Sense Design Lab – a laboratory dedicated to support researches focused on Design and Neuroscience relationship. She was granted the privilege of displaying the "Neurobodygame - Co-evolving affective wearable computer #4" artwork as FILE PRIX LUX 2010 finalist at SESI-SP Art Gallery Exhibition. In 2008, featured "BioBodyGame - Co-evolving affective wearable computer #3" artwork at Gameplay exhibition, held by Itaú Cultural. In 2007, she won Rumos Artes Cibernética prize with Biocybernetic Relational Object - Co-evolving affective wearable computer #2. In 2006, she had the artwork "Co-evolving affective wearable computer" exhibited at Primeira Pessoa exhibition, held by Itaú Cultural. In 2003, this very same research was granted an honorable mention from Rumos Itaú Pesquisa. She was a finalist for the Rumos Dance 2003 - Videodance award, granted by Itaú Cultural. She received the APCA award in 2000, granted by Sao Paulo Association of Art Critics. In 1999, she was a VITAE fellow in two residency programs at the American Dance Festival.