Urban Vibrations Lab: Vibrotactile Communications

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HUMMING WALL

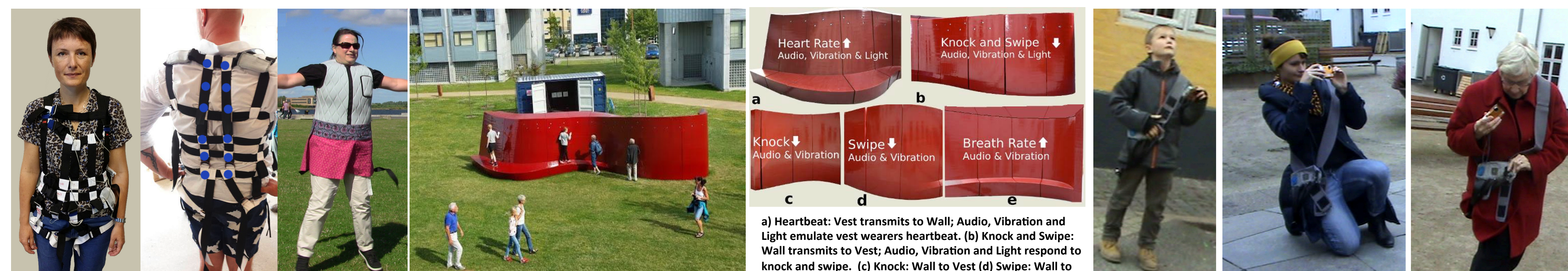AALBORG UNIVERSITY — BREAKING NEW GROUND

The work, the focus and perspectives

Wearable Computing has a wide range of applications and forms. We focus on vibrotactile communication as a way to communicate effectively with less cognitive load on the wearer—leaving eyes, ears and hands-free for other activities. We research and implement the development of vibrotactile patterns that emulate human touch with an aim to assist the wearer in order that the vibrotactile sensations become as if a part of the persons own autonomous nervous system. We have worked with sensitivity ranges for vibrotactile responses and purposefully work with a broad demographic—in terms of age and variety and breadth of experience. We situate the experimentation in urban spaces with a view to enhancing mobility, responsiveness and interaction possibilities in future mediated public environments. ´

a) Heartbeat: Vest transmits to Wall; Audio, Vibration and Light emulate vest wearers heartbeat. (b) Knock and Swipe: Wall transmits to Vest; Audio, Vibration and Light respond to knock and swipe. (c) Knock: Wall to Vest (d) Swipe: Wall to Vest (e) Breath Rate: Vest to wall

Our core **research questions** are:

Can vibrotactile technology (touch) make managing information easier?
Designing and implementing wearable systems and language patterns for testing, e.g. building a prototype
How, where and for who?
Test, Design and work with multiple subjects and across multi-disciplines, e.g. working on pattern language with a Kinesiologist
How can we extend this work into everyday life and environments?
Implement as intended for use in 'future versions' for e.g. pedestrians in the city

How do we conduct our research?

There are many factors to be considered with designing for the body, for long term wear, for comfort, for accuracy, to support movement, for a variety of body shapes and sizes etc. Placement location, number and types of tactors, types of sensors, arrangement, frequency, spacing, tempo, sequencing, connection methods and duration are all important factors when designing a wearable vibrotactile 'outfit' and to support the intended affect. Our current focus addresses a range of vibrotactile patterns in a wearable computing vest to communicate three states: calming and relaxation; activation; and navigation or information prompts—such as full body turning or warning to slow down or stop. To this end, we have developed the vibroacoustic *Humming Wall* that reacts to human touch—knock, swipe etc.—and conveys sensations both at the wall and to the vest and responds to and displays the heart beat and breath rate of the vest wearer. Additionally, we teach Physical Fabrication Prototyping, Ethnographic Research Inquiry and Interaction Design as part of three different degree programs and run sympathetic student projects which also enhances our research workforce.

How are we organised?

Emerging from HCI, we form a core team of 4 people at Aalborg University with 1 Associate Professor, 1 Assistant Professor, 1 Research Assistant and 1 Lab Engineer, with additional contribution from 1 Professor and 1 external PhD and 1 external Postdoc. We employ student helpers for trials, building or analyses and meet most days.

More info: www.create.aau.dk/hummingwall/ and https://www.facebook.com/groups/UtzonParkDemoEvent/
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Future research directions

Basic research:	Applied research:
- Managing Multiple Measurement Streams	- Responsive Clothing and Environments
- Long term robustness, comfort and ease of wearing	- Assistive technology
- Language Patterns	- Vibroacoustic architecture
- Vibrotactile inspired by human understanding of toucn	- Improving Measurement technology

Funding

2010	2013 - 2014
Topic: Urban Vibration Lab—basic set up	Topic: Responsive Urban Environment
Funding: Obel Family Foundation ~ 20,000 DKK	Funding: Obel – 50,000 DKK
2013 - 2015:	**2013 - 2014:**
Topic: Culturally Enhanced Augmented Reality (Wearable and Audio Technologies)	Topic: Responsive Urban Environment
Funding: EU 7th Framework: ICT for access to cultural resources- Share ~ 570,000 EUR	Funding: RealDania- ~ 50,000 DKK
	2013 - 2014:
	Topic: Responsive Urban Environment
	Funding: Obel Kommune ~ 10,000 DKK

Recent publications

Ghellal, S., & Morrison, A. (2014). Transmedia Perspective. In Convergent Divergence? : Cross-Disciplinary Viewpoint on Media Convergence. Springer. Publication Pending.

Manresa-Yee, C., Larsen, J. V., Morrison, A., & Varonaa, J. (2014). A Vibrotactile Interface to Motivate Movement for Children with Severe to Profound Disabilities. In International Conference on Human Computer Interaction (INTERACCION 2014).

Ghellal, S., Morrison, A., Hassenzahl, M., & Schaufler, B. (2014). The Remediation of Nosferatu - Exploring transmedia experiences. In Proceedings of the Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques, DIS. (pp. 617-626). Association for Computing Machinery. 10.1145/2598510.2600881

Andersen, H. J., Morrison, A., & Knudsen, L. (2012). Modeling vibrotactile detection by logistic regression. In Proceedings of the 7th Nordic Conference on Human-Computer Interaction: NordiCHI 2012: Making Sense Through Design - . (pp. 500-503). Association for Computing Machinery.10.1145/2399016.2399092

Morrison, A., Knudsen, L., & Andersen, H. J. (2012). Urban vibrations: Sensitivities in the field with a broad demographic. In 16th IEEE International Symposium on Wearable Computers: ISWC 2012.(pp. 76-79). IEEE Computer Society Press. (International Symposium on Wearable Computers. Proceedings). 10.1109/ISWC.2012.10

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