Rethinking Sonic Interaction

The Physicality of Sound
(Digital Tangibility through Dynamic Audiotactile Feedback)

Johan Kildal
Teemu Ahmaneni
Nokia Research Center

Koray Tahiroğlu
Aalto University

Multimodality
Vision (graphic) - Light
Touch (haptic) - Touch
Hearing (auditory) - Sound

Crossmodality
Chemical senses (Taste, smell)
Others senses

Previous experience
Cognition, expectation, personal goals,
Classic Sonic Interaction Design


High-Density Sonification (HDS)

Figure 5. Data subset patterns for canonical HDS of 2D-tables (above) and 3D-tables (below). The canonical sonification of 2D-tables generates two complementary views of the data set, whereas for 3D-tables it generates three complementary views.


Rethinking Sonic Interaction
Integrated Sonic Interaction Design

FIG. 2.7. Amplitude of vibration of the skin of the hand needed to feel the stimulus (Bolanowski, Gescheider, Verrillo, & Checkosky, 1989) and amplitude of vibration of the eardrum needed to hear (Wilska, 1935).

“I call this technology **Pictures Under Glass.**”

“**Pictures Under Glass** sacrifice all the tactile richness of working with our hands”
Physicality?

“Physicality is the way in which matter gets expressed when interacting with it”


\[ \phi = \phi_{\text{Haptic}} + \phi_{\text{Audio}} + \phi_{\text{Visual}} \]

Physicality is Multimodal

\[ \phi = \phi_{\text{Haptic}} + \phi_{\text{Audio}} + \phi_{\text{Visual}} \]
Deceptive Physicality

http://www.bestartificial.co.uk/
http://www.bestartificial.co.uk/

REVOL ceramics, France
Programmable Physicality
Latency Research: Multimodal Touch

Kaaresoja, T. and Brewster, S. Feedback is... late: measuring multimodal delays in mobile device touchscreen interaction. Proc. ICMI'10, ACM, (2010)
Perception of Compliance

\[ \phi = (\phi_{Tactile} + \phi_{Kinesth}) + \phi_{Audio} + \phi_{Visual} \]
Creating Haptic Illusions --- *Kooboh*


Creating Haptic Illusions --- *Kooboh*

http://www.youtube.com/watch?v=57_hR3ILfM
http://www.youtube.com/watch?v=RTkr9ISjDAA

---

**Force Input**

$$\varphi = \varphi_{\text{Haptic}} + \varphi_{\text{Audio}} + \varphi_{\text{Visual}}$$

Conclusions

\[ \varphi = \varphi_{\text{Haptic}} + \varphi_{\text{Audio}} + \varphi_{\text{Visual}} \]

Flexible Devices at Nokia Research
From vision to Implementation

http://www.youtube.com/results?search_query=nokia+kinetic+device&oq=nokia+kinetic+device&gs_l=youtube.3..0.99239.101950.0.102169.14.6.0.8.8.0.235.877.0j4j2.6.0...0...1ac.1.11.youtube.wucjADqKLdw

Bend

Twist
Research Publications


Towards tangible interfaces
Augmenting input with tactile textures