

Rethinking Sonic Interaction

The Physicality of Sound

(Digital Tangibility through Dynamic
Audiotactile Feedback)

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Connecting People

Multimodality

Crossmodality

Vision (graphic) - Light

Touch (haptic) - Touch

Hearing (auditory) - Sound

Chemical senses (Taste, smell)

Others senses

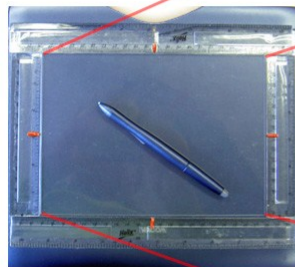
Previous experience

Cognition, expectation, personal goals,

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Classic Sonic Interaction Design

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62990	61252	78202	60073	78202	60629	60255
77327	80137	76129	76329	78172	80083	79115
72362	75306	74039	73644	72402	74290	73509
77424	72057	74503	73522	72173	75398	73257
74293	76649	75002	76224	74151	75046	74220
74206	76178	75438	74967	76843	76949	77625
79122	81579	80229	81620	77252	77768	81480
80447	78475	78504	82942	79679	81552	81867
77977	76932	78888	81039	80918	80666	81894
75282	76220	77252	75390	76861	76280	76456
78360	80530	78793	82061	78002	82644	82537
81930	82683	78879	80409	82399	82789	82653
80493	79647	78670	77294	80160	80124	78071
77126	72833	75770	73530	76117	72447	72588
70609	71454	69448	71382	67003	71334	69089
71935	68943	73637	70015	72224	70106	73368
74309	74096	74880	70932	74154	74302	73128
74457	74277	71373	72871	73069	71640	73715
78268	74478	76823	78169	77840	76497	77895
81803	83956	83704	83566	79876	83833	79497
83424	85723	85555	82359	82403	85446	83026
85210	85985	85169	86189	83203	83936	81797
79231	82386	81356	80109	81761	79581	83029
80642	76131	78330	78139	80482	79480	75770

Kildal, J. and Brewster, S.A. *Providing a Size-Independent Overview of Non-Visual Tables*. ICAD'06, (2006), 8-15.

Kildal, J. and Brewster, S.A. *High-Density Sonification: Overview Information in Auditory Data Explorations*. *Sonic Interaction Design: Fresh Perspectives*, K. Franinovic and S. Serafin Eds. MIT Press (2013), 299-306.

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High-Density Sonification (HDS)

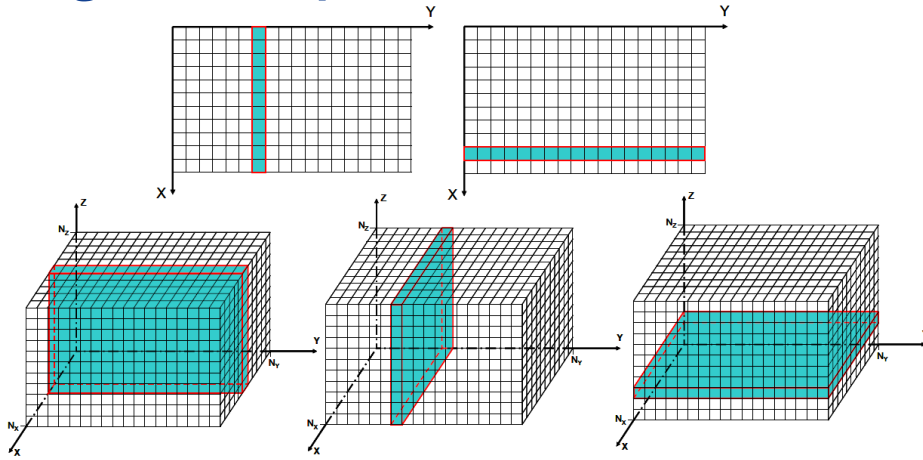


Figure 5. Data subset patterns for canonical HDS of 2D-tables (above) and 3D-tables (below). The canonical sonification of 2D-tables generates two complementary views of the data set, whereas for 3D-tables it generates three complementary views.

Kildal, J. and Brewster, S.A. *High-Density Sonification: Overview Information in Auditory Data Explorations*. Sonic Interaction Design: Fresh Perspectives, K. Franinovic and S. Serafin Eds. MIT Press (2013), 299-306.

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Integrated Sonic Interaction Design

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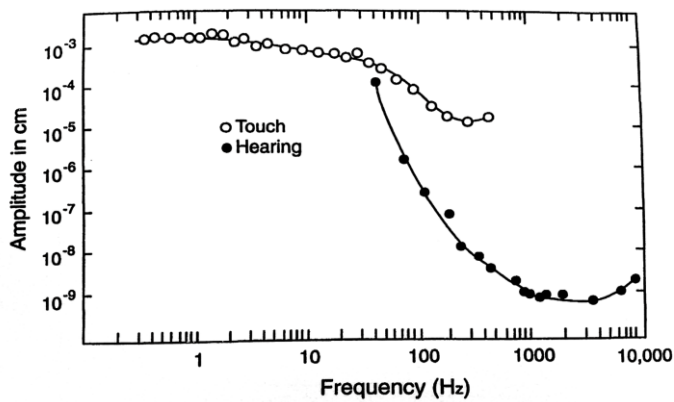
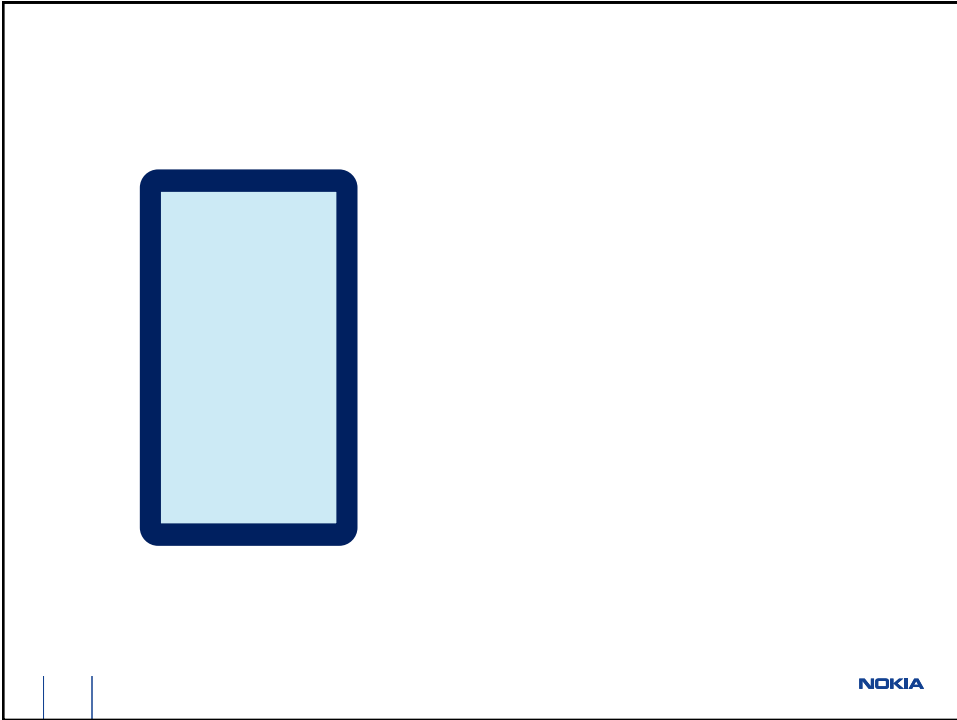


FIG. 2.7. Amplitude of vibration of the skin of the hand needed to feel the stimulus (Bolanowski, Gescheider, Verrillo, & Checkosky, 1988) and amplitude of vibration of the eardrum needed to hear (Wilska, 1935.)

Gescheider, G.A. *Psychophysics. The Fundamentals*. LEA (1997).

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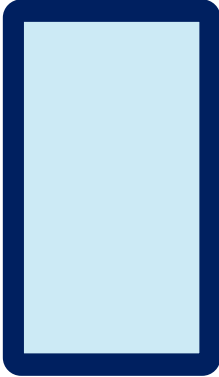
*"I call this technology **Pictures Under Glass.**"*

"Pictures Under Glass sacrifice all the tactile richness of working with our hands"



Victor, B. A *Brief Rant on the Future of Interaction Design*.
worrydream.com (2011).

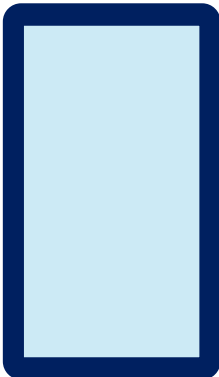

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Physicality?

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

Büscher, M. Making the Digital Palpable. *Proc. First International Workshop on Physicality*, (2006).

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


Physicality is Multimodal

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


Deceptive Physicality

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

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The screenshot shows the website for 'bestartificial plants & gardenware'. The header includes the company logo, a green banner with 'Same Day Dispatch When Ordered Before 3pm' and 'FREE UK DELIVERY ON ALL ORDERS', and a navigation menu with categories like 'Artificial Trees', 'Flower Balls', 'Topiary Balls', 'Buxus Hedging', 'Artificial Fruit', and 'Gardenware'. A search bar and user options (LOGIN, REGISTER) are also present.

The main content area features a 'SHOPPING MENU' on the left with links to various product categories. The central product listing is for '2 Artificial Lemons Fruit' priced at '£5.49'. It includes an image of two lemons and a 'SORRY WE ARE OUT OF STOCK' message. Below the product image are buttons for 'VIEW LARGE IMAGE', 'ADD TO WISHLIST', 'ADD TO COMPARE', and 'EMAIL A FRIEND'.

The 'Description' tab is active, showing the text: '2 Artificial Lemons', 'Fantastic Professional Quality.', 'Not To Be Confused With Cheap Plastic Imitations.', 'You Will Be Amazed How Life Like This Fruit Is !!!', 'Very Realistic To Touch and Most Are Weighted.', and 'Free UK 1st Class Post'. The phrase 'You Will Be Amazed How Life Like This Fruit Is !!!' is circled in red.

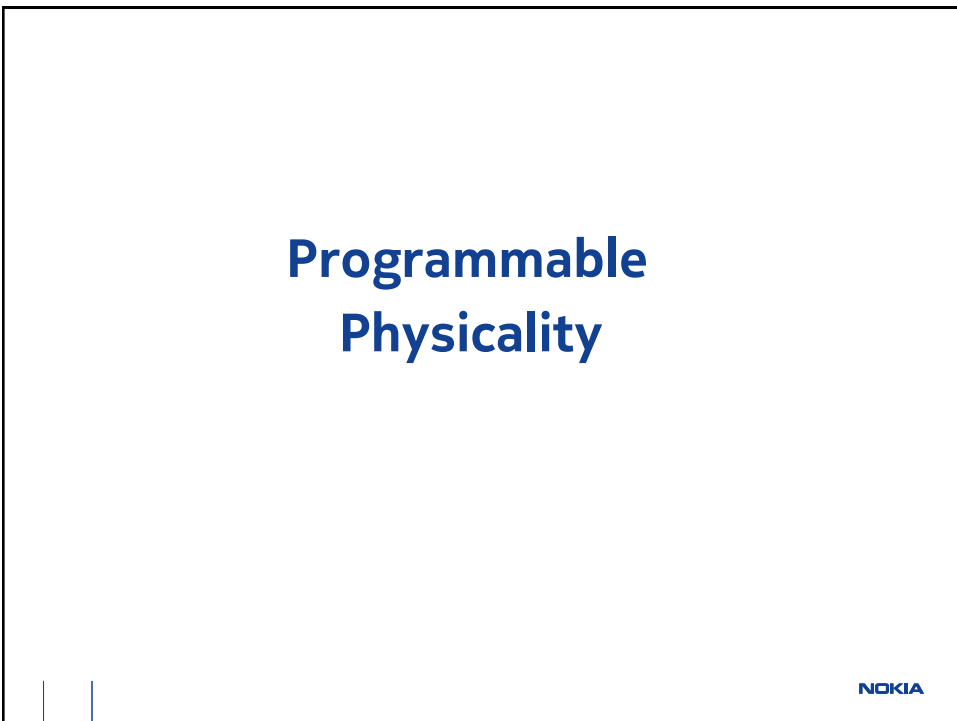
Below the description is a 'Related Products' section with three items: 'Artificial Fruit' (two oranges), 'Large Artificial Garlic String 63cm 18 garlics', and another 'Artificial Fruit' (a bunch of grapes).

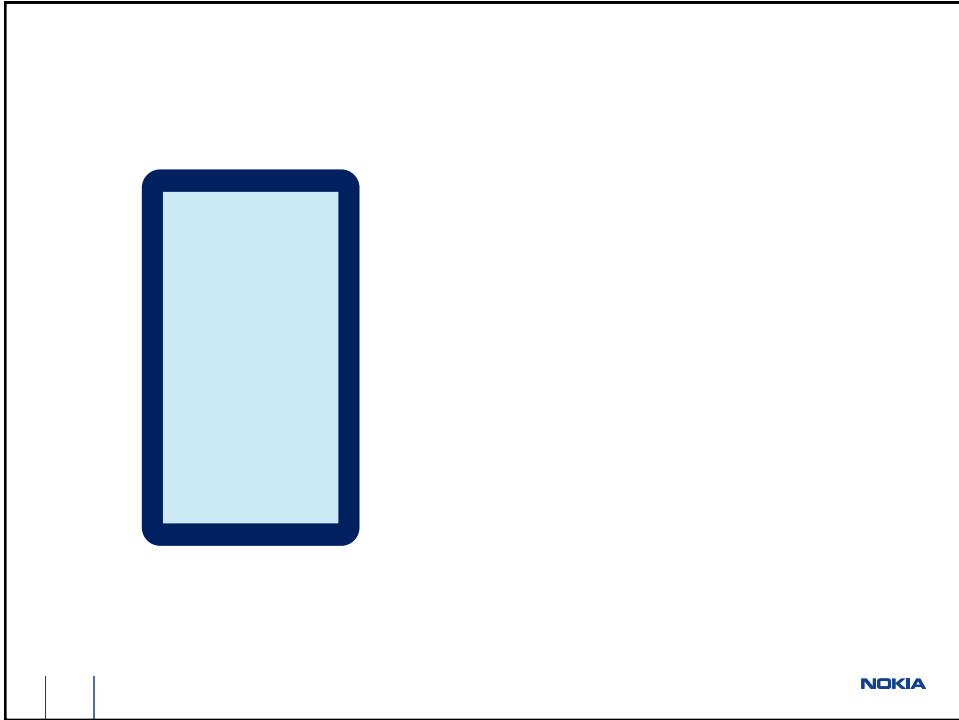
The URL 'http://www.bestartificial.co.uk/' is visible in the bottom left, and the 'NOKIA' logo is in the bottom right.

A high-resolution image of a white ceramic cup. The cup has a wide rim and a body with a series of horizontal, slightly raised ridges or ribs. The surface is smooth and glossy.

The text 'REVOL ceramics, France' is located in the bottom right corner of the image area.

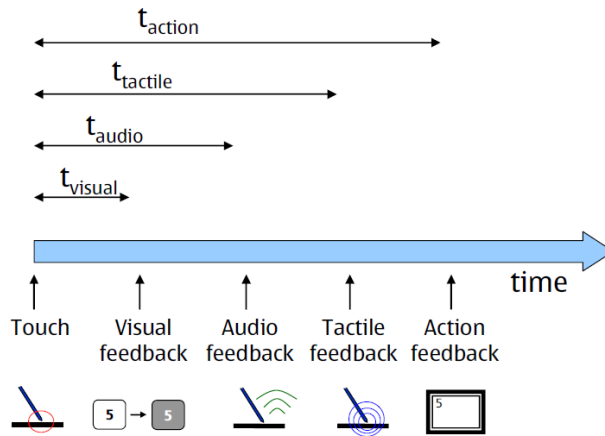
The 'NOKIA' logo is in the bottom right corner of the overall slide.





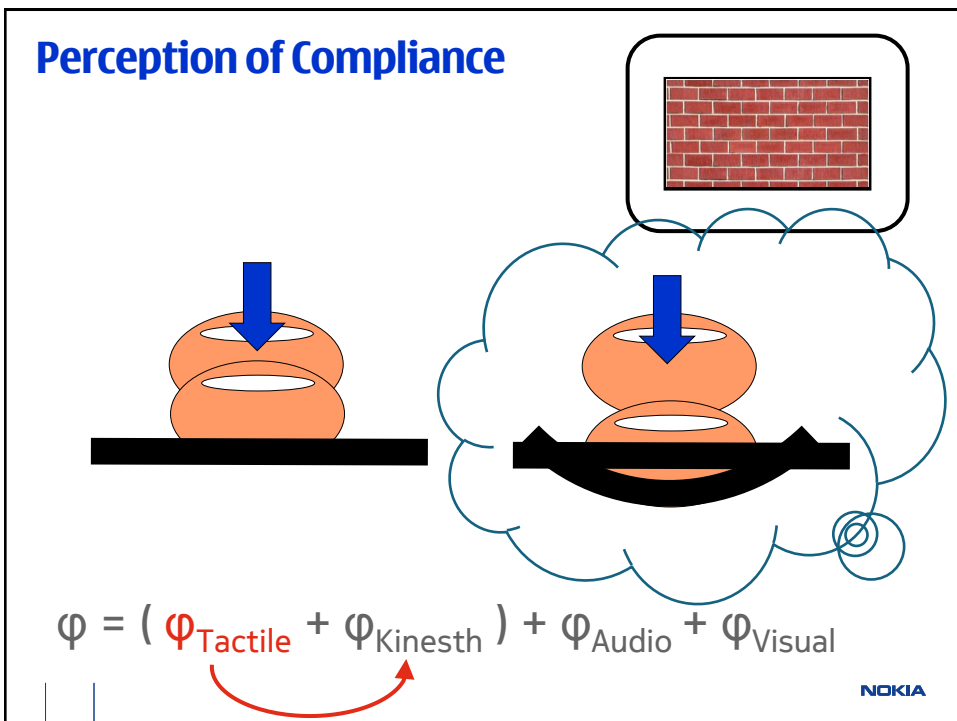
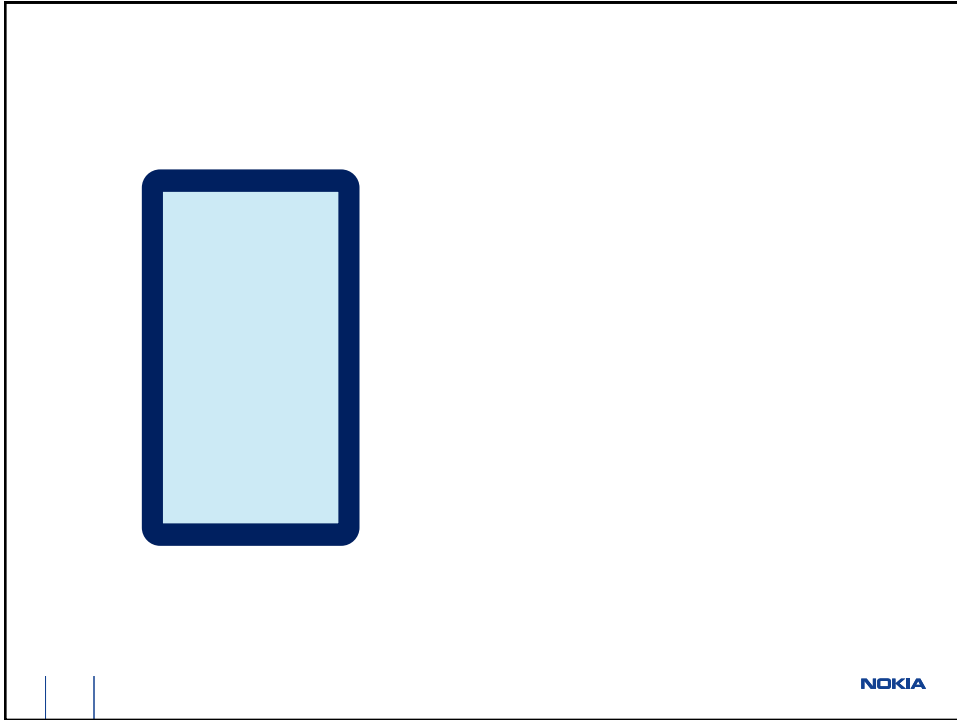
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Latency Research: Multimodal Touch

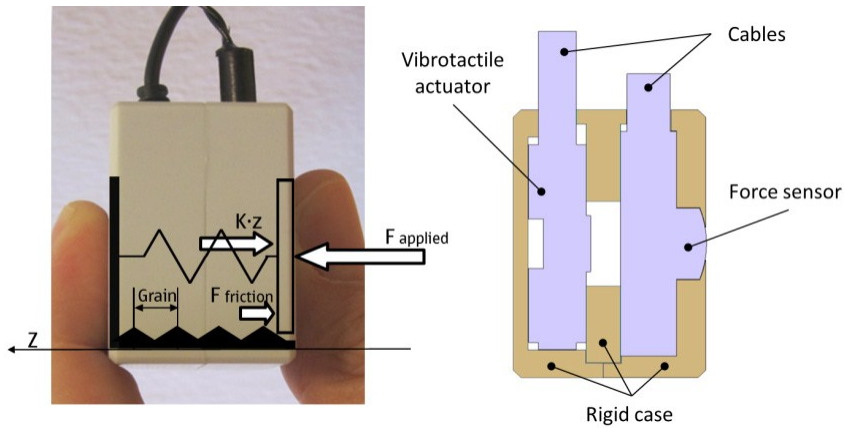


Kaaresoja, T. and Brewster, S. *Feedback is... late: measuring multimodal delays in mobile device touchscreen interaction.* Proc. ICMI'10, ACM, (2010)

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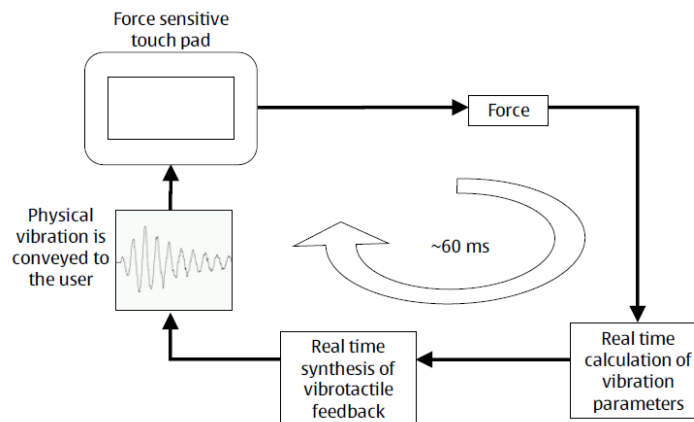
Creating Haptic Illusions --- *Kooboh*



Kildal, J. Kooboh: Variable Tangible Properties in a Handheld Haptic-Illusion Box. *Proc. EuroHaptics '12*, P. Isokoski and J. Springare Eds. Springer, (2012), 191-194.

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Creating Haptic Illusions --- *Kooboh*

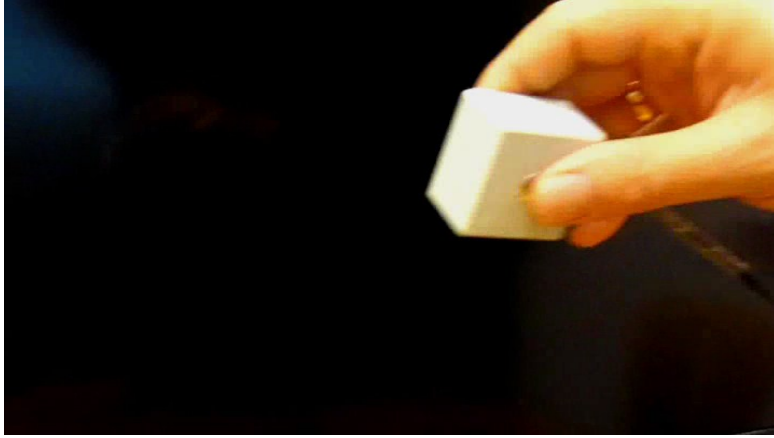


• Kildal, J. Kooboh: Variable Tangible Properties in a Handheld Haptic-Illusion Box. *Proc. EuroHaptics'12* Springer, (2012), 191-194.

• Kildal, J. 3D-Press: Haptic Illusion of Compliance when Pressing on a Rigid Surface. *Proc. ICMI'10* ACM, (2010), 8pp.

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Creating Haptic Illusions --- *Kooboh*



http://www.youtube.com/watch?v=57_hRI3ILfM

<http://www.youtube.com/watch?v=RTkr9ISjDAA>

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Force Input

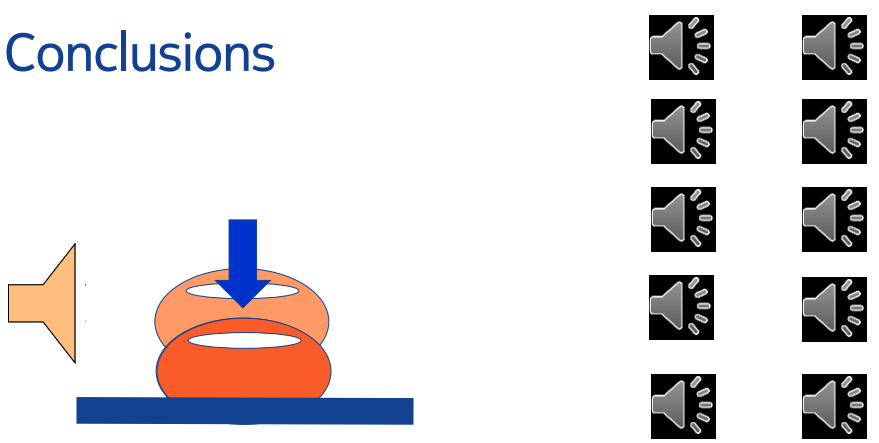


$$\Phi = \Phi_{\text{Haptic}} + \Phi_{\text{Audio}} + \Phi_{\text{Visual}}$$

Lai, C.-H., Niinimäki, M., Tahiroğlu, K., Kildal, J. and Ahmaniemi, T. Perceived Physicality in Audio-Enhanced Force Input. *Proc. ICMI'11 ACM*, (2011), 287-294.

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Conclusions



The diagram shows a haptic device (orange) on a blue surface. A blue arrow points down to the device. To the left is a yellow speaker icon. To the right is a 5x2 grid of black speaker icons.

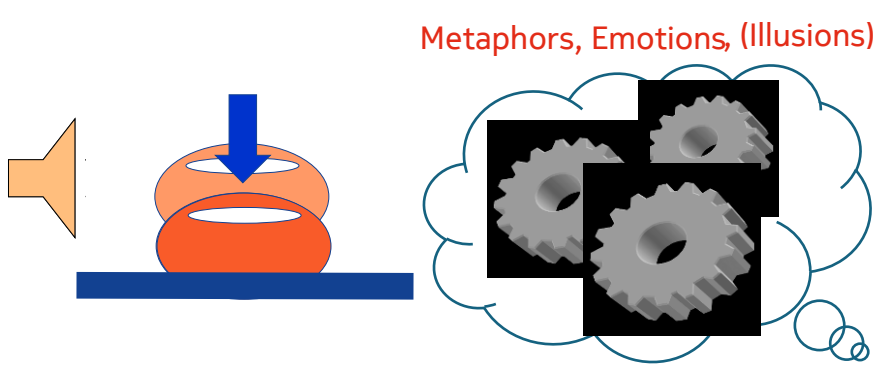
$$\Phi = \Phi_{\text{Haptic}} + \Phi_{\text{Audio}} + \Phi_{\text{Visual}}$$

Lai, C.-H., Niinimäki, M., Tahiroğlu, K., Kildal, J. and Ahmaniemi, T. Perceived Physicality in Audio-Enhanced Force Input. *Proc. ICMI'11 ACM*, (2011), 287-294.

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Conclusions

Metaphors, Emotions, (Illusions)



The diagram shows the same haptic device setup as above. To the right of the device is a thought bubble containing three interlocking grey gears on a black background.

$$\Phi = \Phi_{\text{Haptic}} + \Phi_{\text{Audio}} + \Phi_{\text{Visual}}$$

Lai, C.-H., Niinimäki, M., Tahiroğlu, K., Kildal, J. and Ahmaniemi, T. Perceived Physicality in Audio-Enhanced Force Input. *Proc. ICMI'11 ACM*, (2011), 287-294.

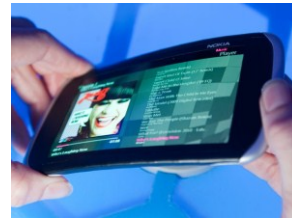
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Flexible Devices at Nokia Research

From vision to Implementation



Kinetic Device (2011)



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...0.0...1ac.1.11.youtube.wucjADqKLdw

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Bend

Twist

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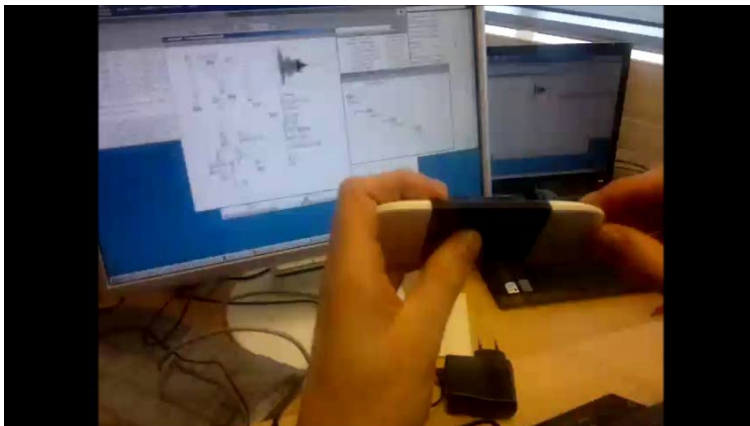
Research Publications



- Kildal, J., Paasovaara, S. and Aaltonen, V. *Kinetic Device: Designing Interactions with a Deformable Mobile Interface*. Proc. CHI EA'12 ACM, (2012), 1871-1876.
- Kildal, J. *Interacting with Deformable User Interfaces: Effect of Material Stiffness and Type of Deformation Gesture*. Proc. HAID'12 Springer, (2012), 71-80.
- Kildal, J. and Wilson, G. *Feeling It: The Roles of Stiffness, Deformation Range and Feedback in the Control of Deformable UI*. Proc. ICMI'12, (2012), 393-400 .
- Kildal, J. and Boberg, M. Feel the Action: *Dynamic Tactile Cues in the Interaction with Deformable UIs*. Proc. CHI EA'13 ACM, (2013), 1563-1568.
- Kildal, J., Lucero, A. and Boberg, M. *Twisting Touch: Combining Deformation and Touch as Input within the Same Interaction Cycle on Handheld Devices*. Proc. MobileHCI '13 ACM, (2013), 237-246. --- **BEST PAPER AWARD**

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Towards tangible interfaces



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Augmenting input with tactile textures



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<http://vimeo.com/28447850>

Väänänen-Vainio-Mattila, K., Suhonen, K., Kildal, J., Tahiroğlu, K., Laaksonen, J. and Ahmaniemi, T. User Experience and Usage Scenarios of Audio-Tactile Interaction with Virtual Objects in a Physical Environment. *Proc. DPPI'13*, (2013)

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