

Stane: Synthesized Surfaces for Tactile Input

Seminar

22.04.2008

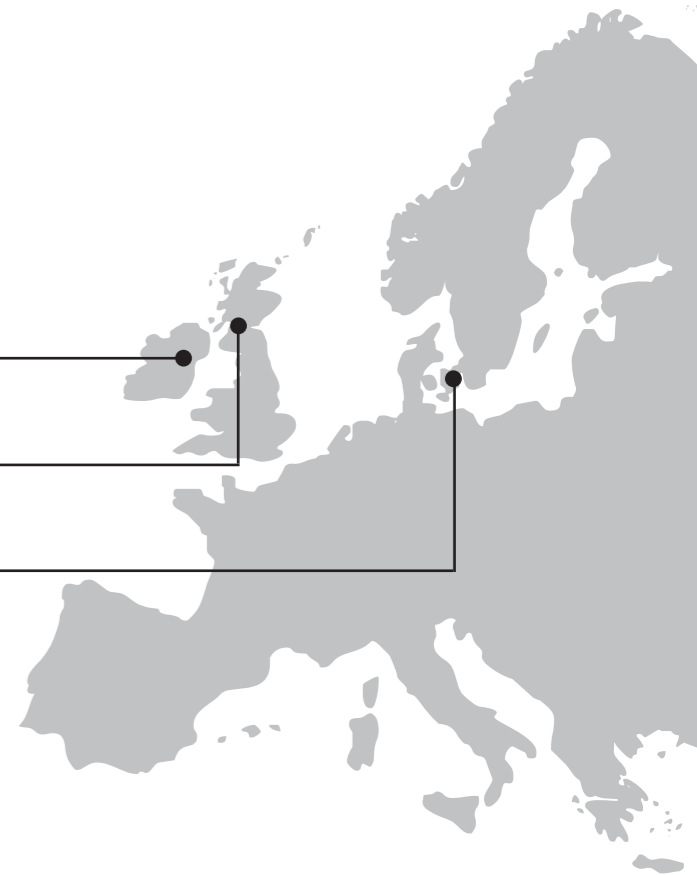
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SS 2008

Gist

- Stane is a hand-held interaction device to control another device such as a mobile phone, music player or computer
- varying surface textures around the device
- Tactile input: User can stroke, rub, scratch or tap the case
- the system has a range of sensors, including contact microphones, capacitive sensing and inertial sensing, and provides audio and vibrotactile feedback



The persons behind the names



Roderick Murray-Smith

Senior Researcher at the Hamilton Institute at NUI Maynooth

Professor in the Department of Computing Science at University of Glasgow

- member of GIST (The Glasgow Interactive Systems Group)
- author of several books, e.g. „Haptic Human-Computer Interaction“ (2001)

John Williamson

Research Assistant
Department of Computing Science University of Glasgow

- reasearch is focused on continuous interaction systems

Stephen Hughes

B.Sc. (Engeneering) at Trinity College Dublin

- involved in computer music (composotion and hardware)

Torben Quaade

Procut Designer
Studio BackToHQ Aps
Copenhagen

Motivation

- to detect the position of touch in touch screens and touch pads, capacitive sensing is widely used
- but there is one problem with touch-based interaction:
there is no proprioceptive feedback during interaction
and:
the lack of coupling between the functionality accessed, and the feedback perceived by the user
- that's why the user have to devote more visual attention to interaction based on touch, and makes it impossible to use reliably in an eyes-free manner
- mobile use of capacitive sensed touch screens is often challenging, and again, in-pocket interaction is almost impossible



Contribution

similar sensing and the haptic approach: *Pebble Box*

- interface for music expression
- consists of a foam-padded container, which holds a number of pebbles
- the sound produced by such grains is **detected by a microphone**, and used to manipulate granular synthesis algorithms - the result is a new sound in real-time, e.g. water splashing



rubbing motions: *SOAP*

- pointing device that works in mid-air
 - > appropriate to interacting with large screens
- consists of an optical sensor device moving freely inside a hull made of fabric
- interactions:
 - > click operation:
squeezing the device
 - > joystick interaction:
dragging the fabric on the top using the thumb
 - > belt interaction:
dragging the fabric on the top in one direction and the fabric on the bottom in the opposite
 - > Soap interaction:
keeping the hull stationary and instead flipping the core



tapping or stroking: *TAICHI Project*

(Tangible Acoustic Interfaces for Computer-Human Interaction)

- uses tiny piezoelectric sensors to sense surface vibrations
- the sensors are connected to a desktop computer and track up to two objects at once by sensing vibrations



Video

<http://www.youtube.com/watch?v=dEOXgWYGN9A>

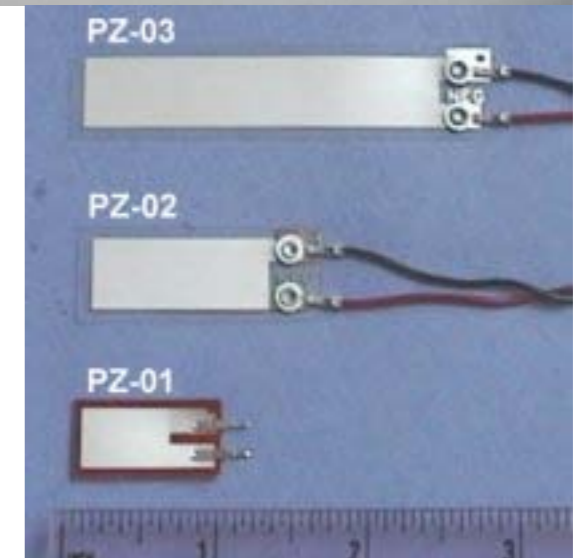
Approach

- the use of case texture design to explicitly support vibration-controlled interaction

Evaluation

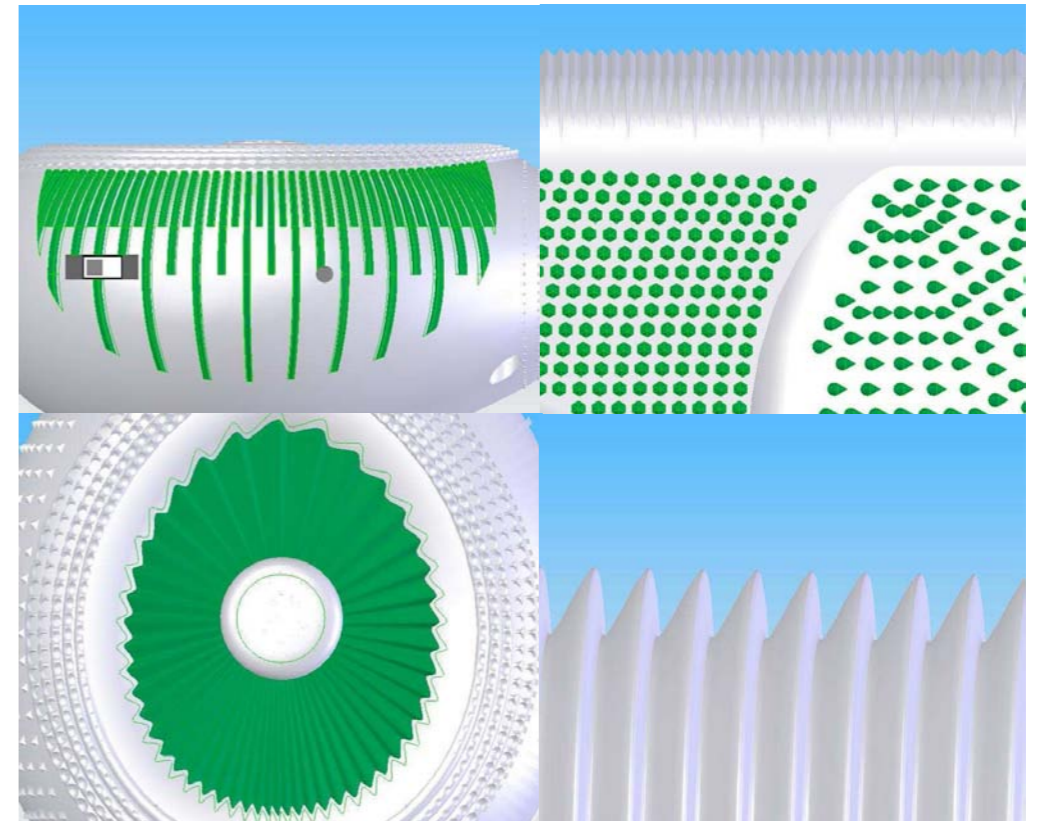
Case and internal electronics

- rigid shell
- designed in Solidworks and created using SLA resin 3D-printing technology
- a texture composed of individual elements such as lines, dots, dimples or other geometric forms
 - > easy to classify vibrations
- piezo - microphone
- SHAKE (Sensing Hardware Accessory for Kinesthetic Expression)
 - > small wireless sensor-pack
 - > integrated rechargeable battery
 - > tri-axis accelerometer, tri-axes angular rate sensor, tri-axis magnetometer
 - > dual channel analog inputs
 - > dual channel capacitive sensing
 - > internal vibrating motor



Design

- aims of the case texture design:
 - > aesthetically pleasing
 - > textures which can be easily recognised
 - > fit appropriately with the form of the device
- > invite to different styles of interaction (rubbing back and forth, stroking, scratching, picking with finger nail etc)
- > vibrations generated by the user acting on the textures should be as easy to classify as possible



Video

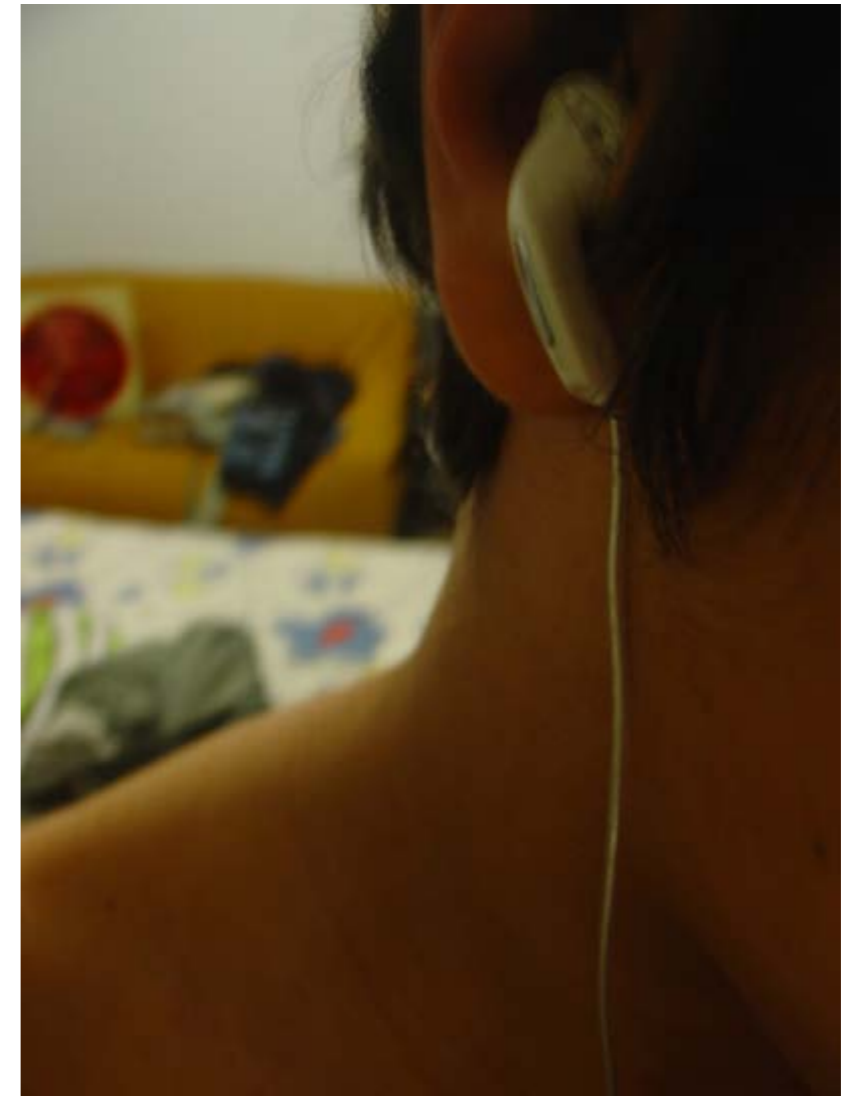
http://www.dcs.gla.ac.uk/~jhw/i_chi2.mov
(first half)

Use case scenario

- a user walking, listening to their **music player**, and controlling the volume and track choice while the Stane is in their jacket pocket
 - > start/stop
 - > controlling the volume
 - > track choice

Result

- system was tested with five different users, who were able to use it without problems, despite the system being calibrated for a single user
- the rotary texture was felt to be particularly pleasant to use, while the dimples at the tip were perceived to be 'more fiddly'



Video

http://www.dcs.gla.ac.uk/~jhw/i_chi2.mov
(second half)

Conclusions

This technology...

- > allows the use of very cheap sensing hardware, coupled with an arbitrarily textured device case
- > can compete with or be combined with capacitive sensing, buttons etc.
- the experiment demonstrated robust classification of stroking movements on a custom-designed case
- the texture provides immediate feedback to the user about the likely consequences of their actions, and they can be used in an eyes-free context, such as in the user's pocket, or with blind users.

So far

- a media player interaction device is a nice and simple example for demonstrating the idea of tactile input
- currently only audio augmentation is implemented, but with the in-built pager motor a proprioceptive feedback will be possible

Outlook

varying design:

- > different materials
- > user driven design, „skins“

- could be a productive research tool which stimulates a wide range of applications
- combinations with gross motor activity, such as shaking or twisting the device
- interaction with other devices (e.g. bluetooth pairing)
- the tactile feedback from the physical case can be augmented with context-dependent audio and vibration feedback
- use of magnetometers for bearing allows us to also use the device for pointing at objects in mobile spatial interaction settings, where the rubbing is used to tease out properties of the content