

Ubiquitous Computing

1. Getting in Touch (2001) – Paul Dourish
2. Skinput: Appropriating the body as an input surface (2010) – Chris Harrison, Desney Tan, Dan Morris

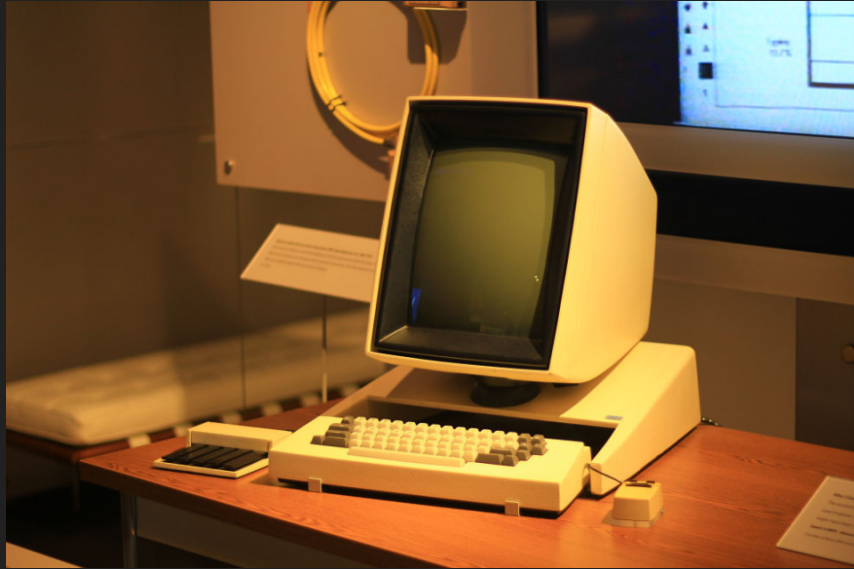
“Getting in touch”*

* Dourish, P. (2001). In *Where the action is: The foundations of embodied Interaction* (pp. 25–53). MIT Press.

Goals

Understanding the implications of ubiquitous computing in our daily lives.

Discuss on the evolution of computing technologies and whether the visions of early researchers in the field of ubiquitous computing came to existence ?

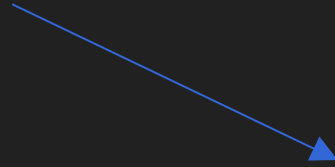


Xerox's Alto (1970)

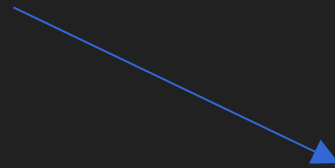


21st Century modern scientist
(2017)

Mainframe Computing



Personal Computer (PC)



Ubiquitous Computing

Ubiquitous Computing

Everywhere

Transparent - “invisible computing”



[The Computer for the 21st Century, Mark Weiser,](#)
[Scientific American, September 1991](#)

“.. power of computation could be seamlessly integrated into the objects and activities of daily life” - Paul Dourish on Weiser’s vision of “ubiquitous computing”

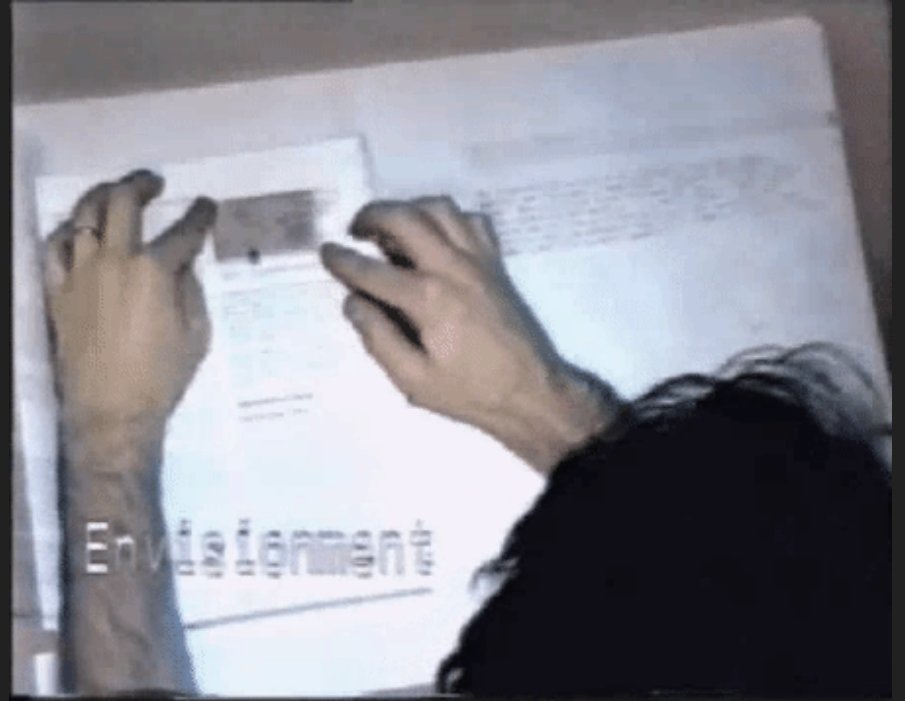
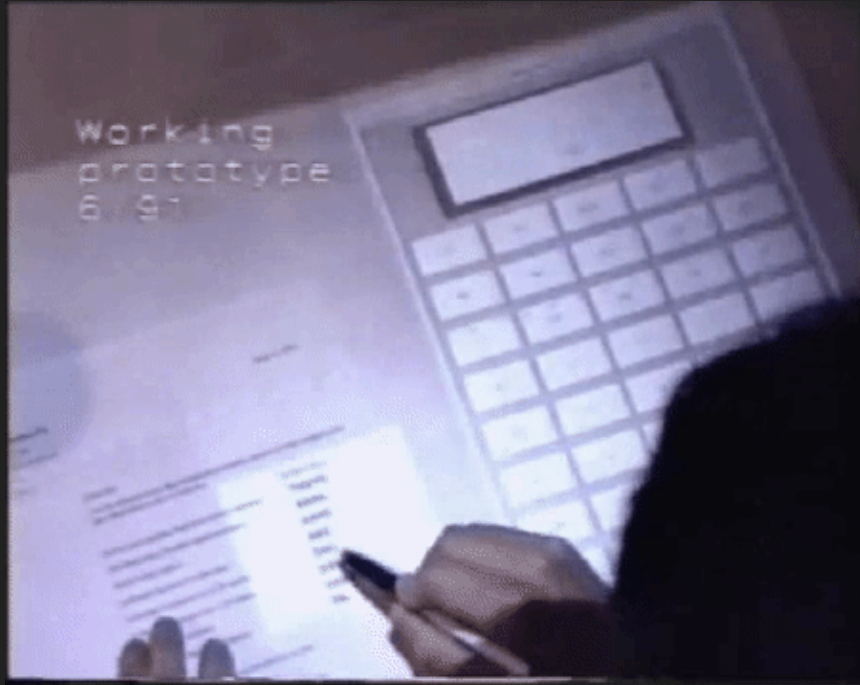
“The idea of leveraging context to inform computation exists, but the context doesn’t come from what room you are in. Apps represent a context that dictate how you would like to use the data your phone has access to.” - IxD Student

“The idea of leveraging context to inform computation exists, but the context doesn’t come from what room you are in. Apps represent a context that dictate how you would like to use the data your phone has access to.” - IxD Student

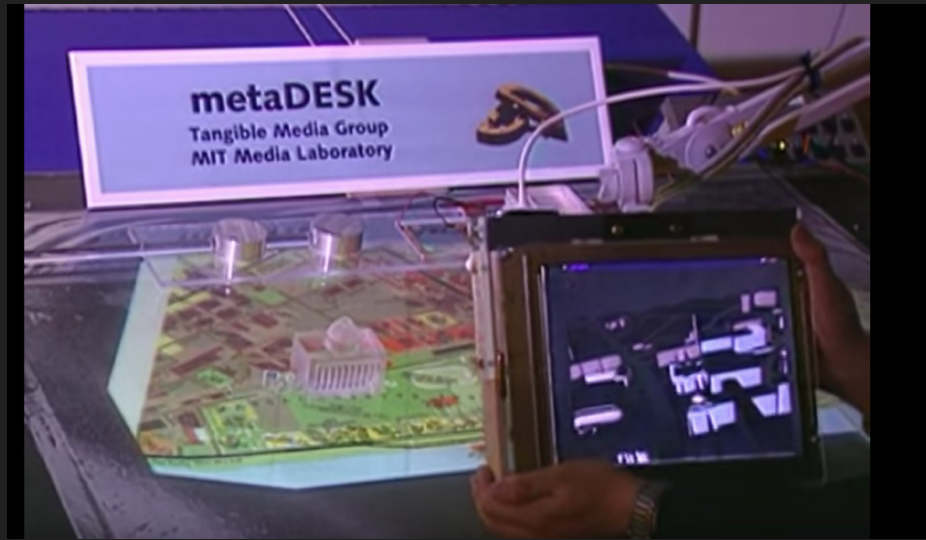
Newer Model of Interaction ?

Tangible Computing -> bridging the gap between the physical world and the virtual world.

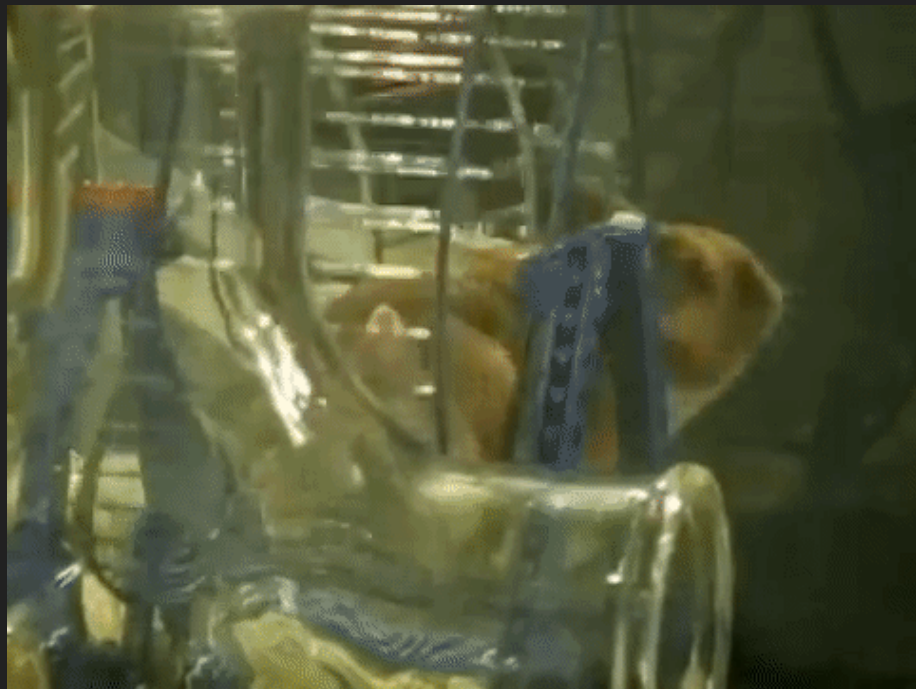
Digital Desk



Tangible Bits - metaDESK



Tangible Bits - Ambient Room



Discussion Questions ?

What computing technologies mentioned in the paper did not work or might not be there in the future (in our everyday lives) ? Why not ? Why did they fail ?

What are the ones that did ? Why ?

Discussion Questions ?

What computing technologies mentioned in the paper did not work or might not be there in the future (in our everyday lives) ? Why not ? Why did they fail ?

What are the ones that did ? Why ?

"The vision articulated in Dourish's paper has largely come to fruition"? -

"I think his vision is finding its way through labs and even industry. By looking at recent products such as interactive conference rooms, wearable sensors, IOT, and new home technologies, one can say that his idea is becoming to fruition by a good margin." Alireza - IxD student

Paperless office

Electronic cash

Electronic Mail

Video Conferencing

E-books

Playing in virtual world

Home office



“Triumph of the virtual over real ????”

Skinput*

Appropriating the Skin as an Interactive Canvas

Skinput

Wearable armband that transforms the skin into an always available input surface



goals

understand the paper relevance

explain technical details behind the system

discuss its limitations and future work

paper relevance

introduces an always-on, touch-based interface

tackles the problem of limited space for interaction

leverages proprioception for an eyes-free natural user interface

builds on the acoustic properties of the human body to transform an array of cheap, simple sensors into a novel device

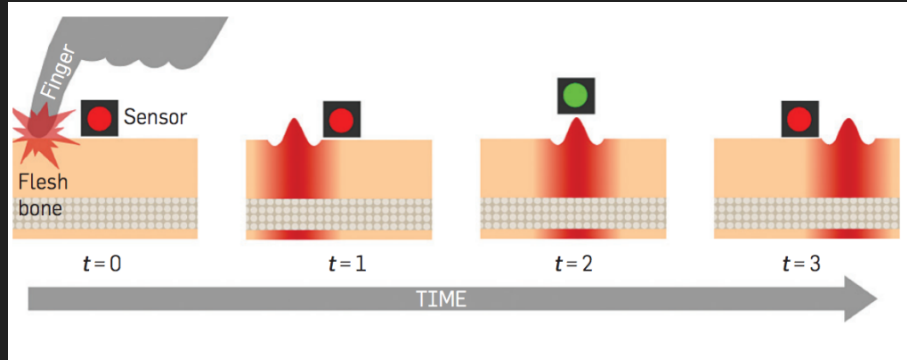
how it works



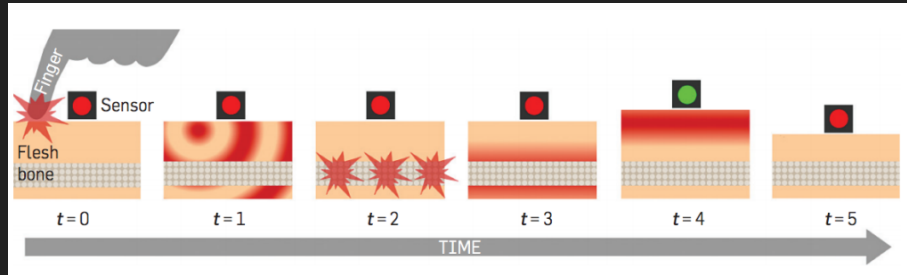
A transversal wave (ripple)
(video was slowed down 14 times)

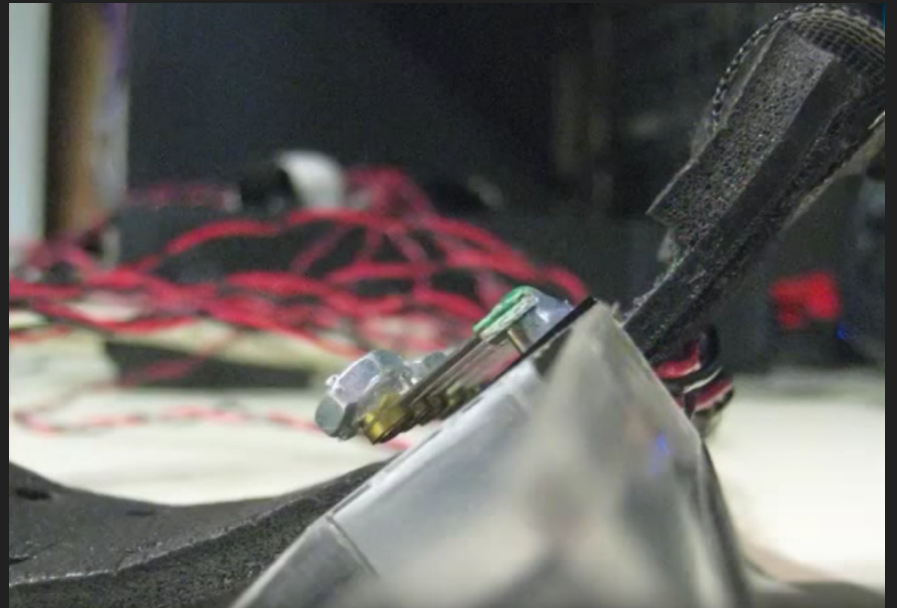
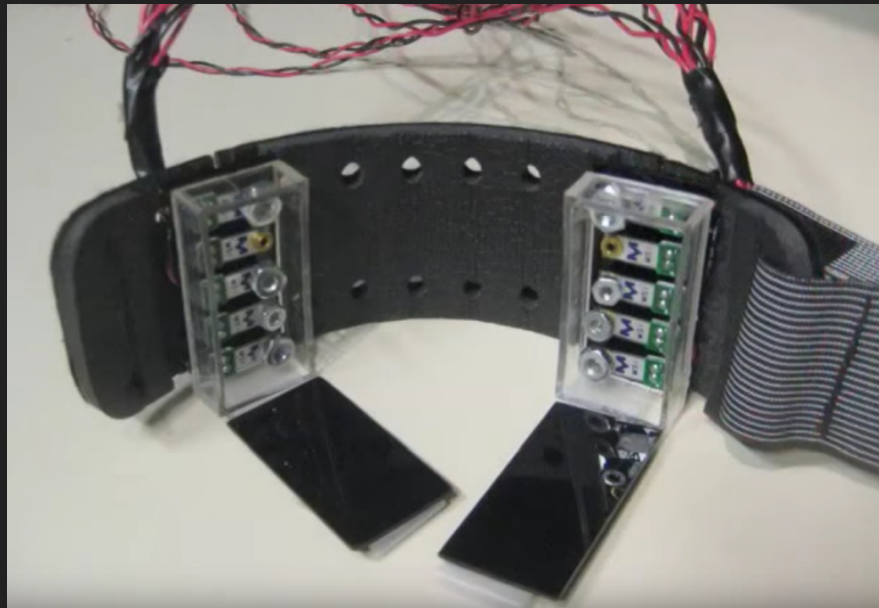
Tapping one's skin creates a multitude of acoustic signals

transversal waves



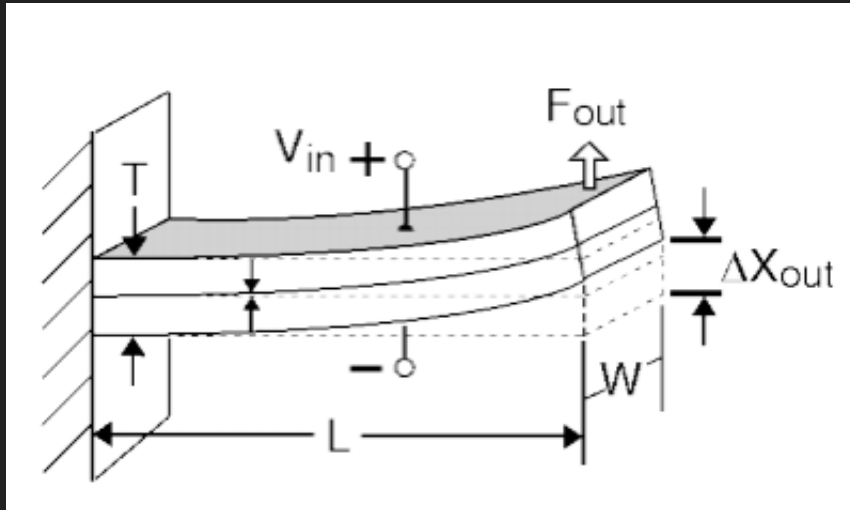
longitudinal waves



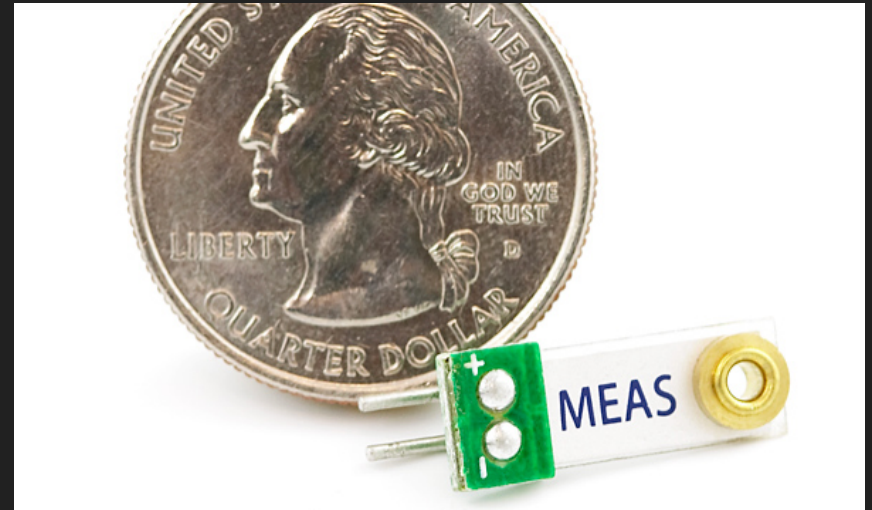


Wristband: Two arrays of five piezoelectric transducers

Cantilevered piezoelectric film



© Piezo Systems, CATALOG #8 (2011), page 23



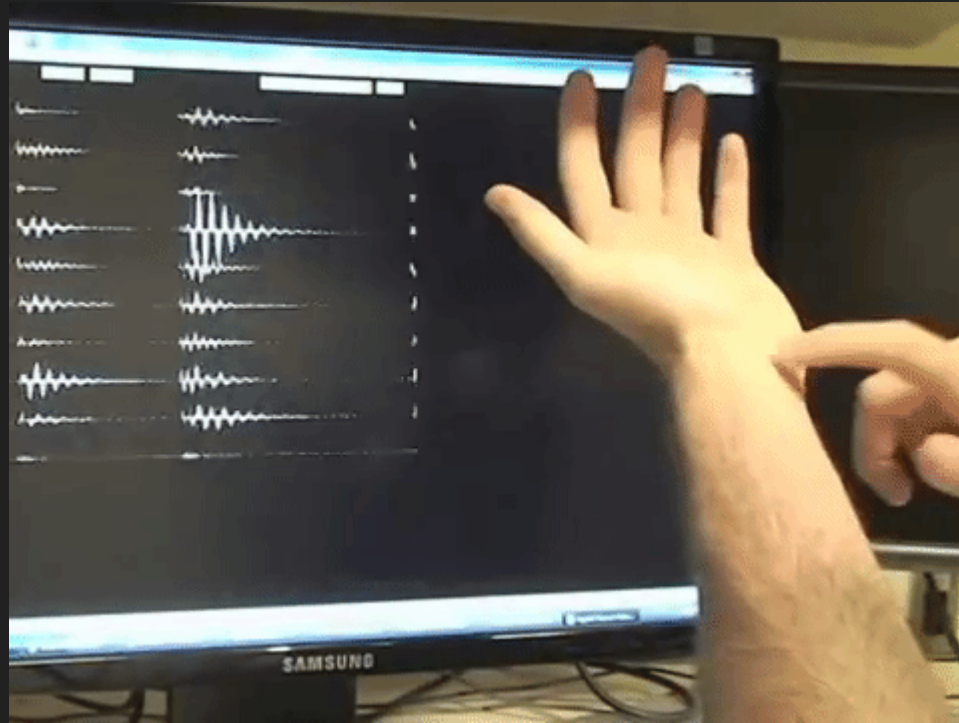
© SparkFun

reverse engineering time

Any reasons for this architecture?

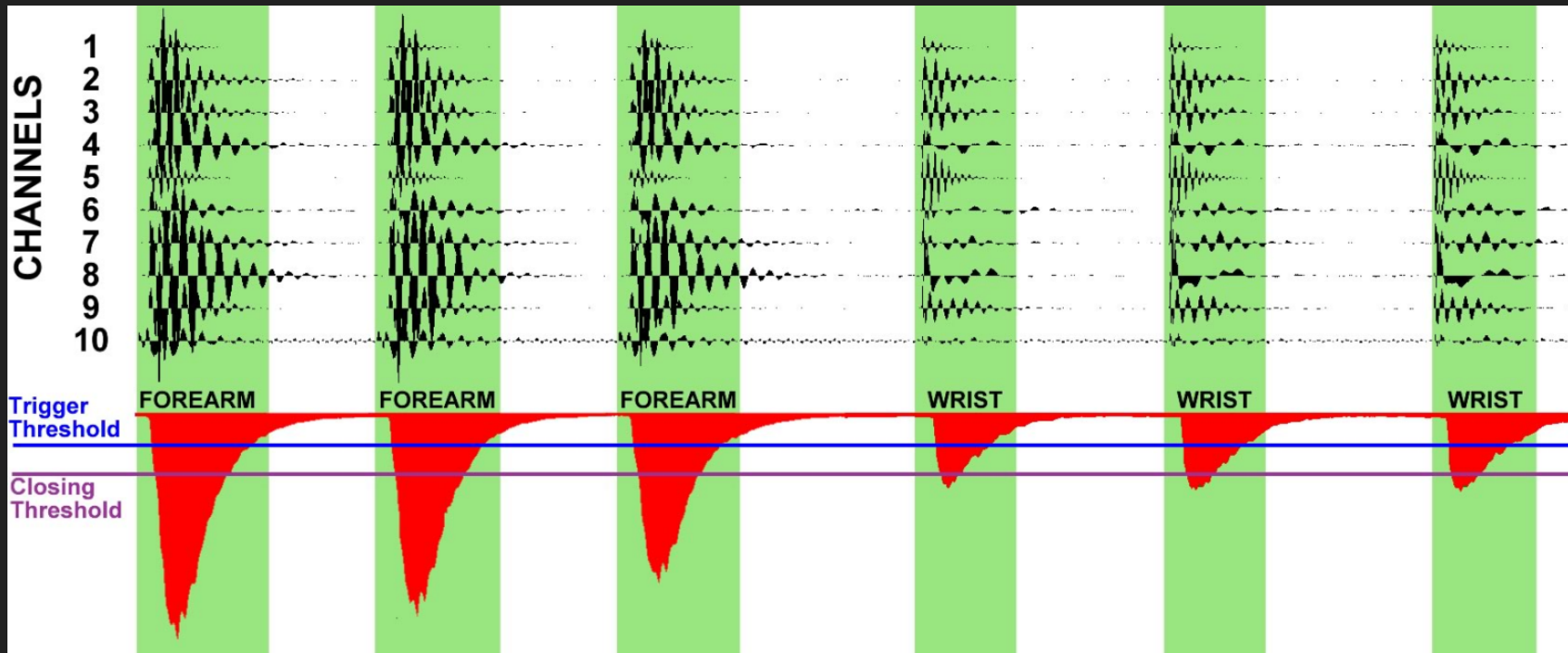
Any reasons for this architecture?

“While we do not explicitly model the specific mechanisms of conduction, or depend on these mechanism for our analysis, we do believe that the success of our technique depends on the complex acoustic patterns that result from mixtures of these modalities”



“Different locations are acoustically different”

<https://www.youtube.com/watch?v=g3XPudW9Ryg>



Segmenting input

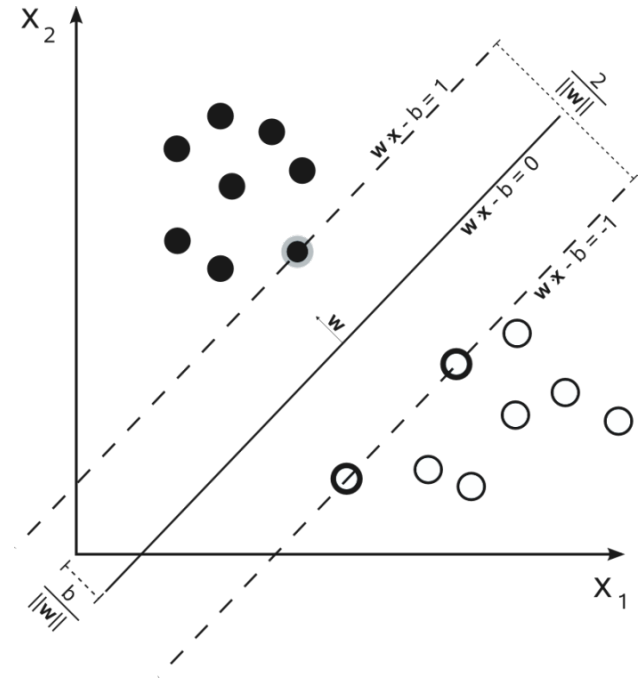
programming time

**Can you devise an algorithm to
distinguish between different
locations?**

**Can you devise an algorithm to
distinguish between different
locations?**

your machine can!

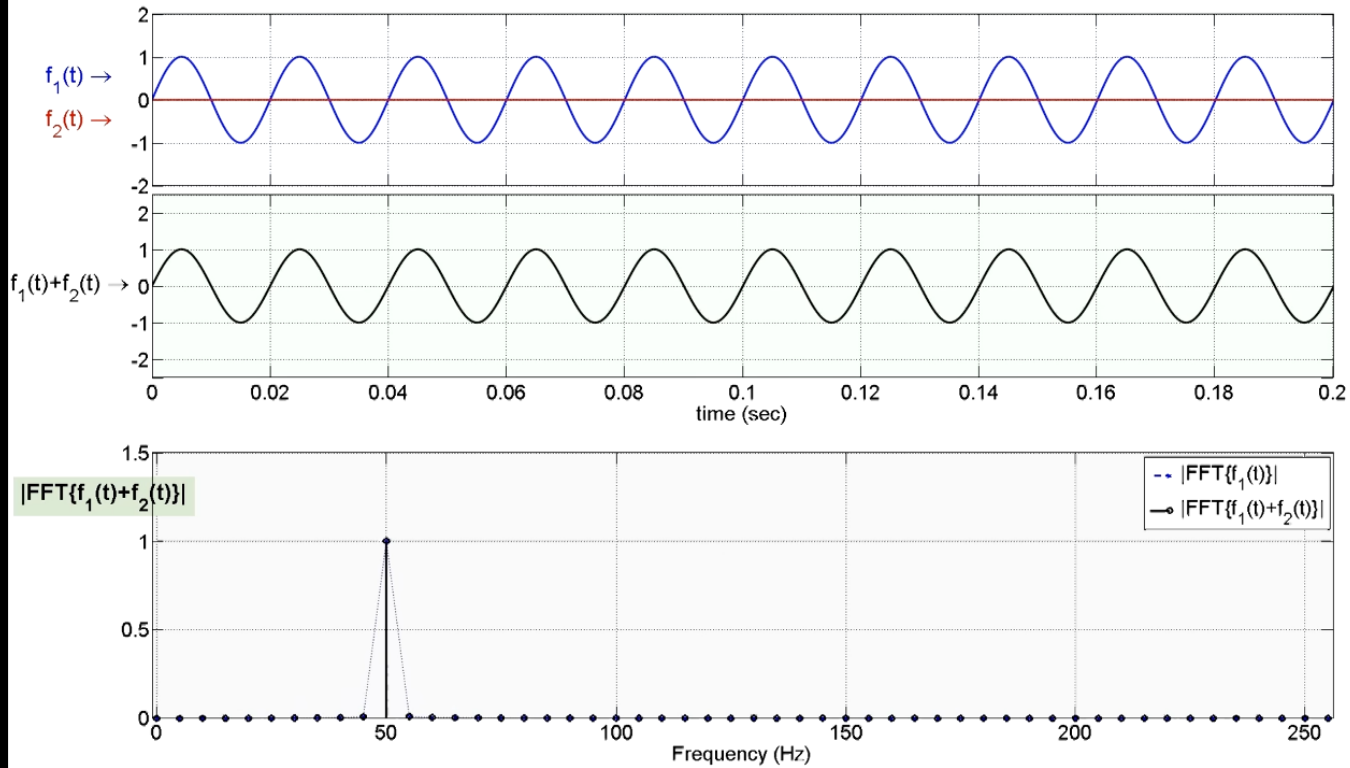
Support Vector Machines (SVM)



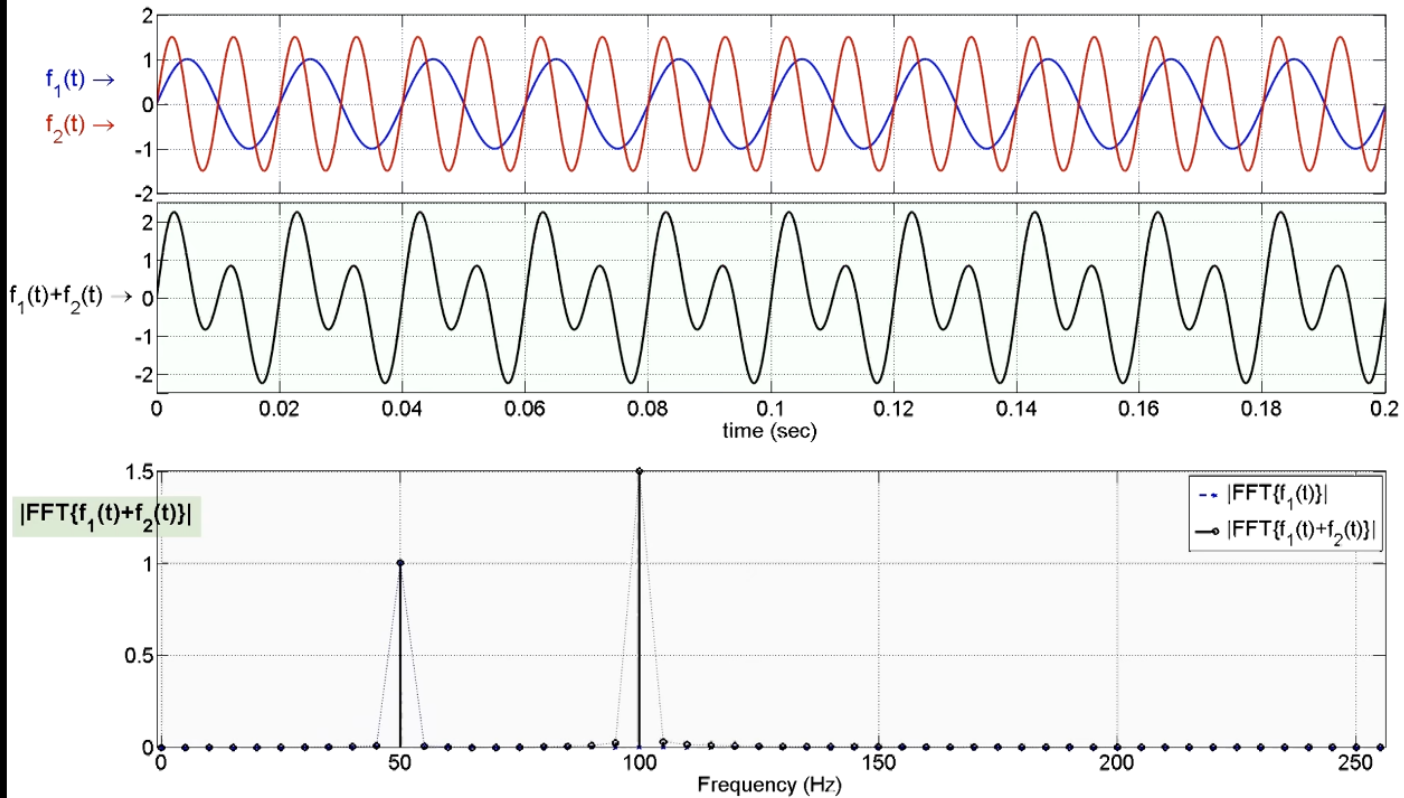
wobbly waves are hard to understand

“All waveforms, no matter what you scribble or observe in the universe, are actually just the sum of simple sinusoids of different frequencies”*

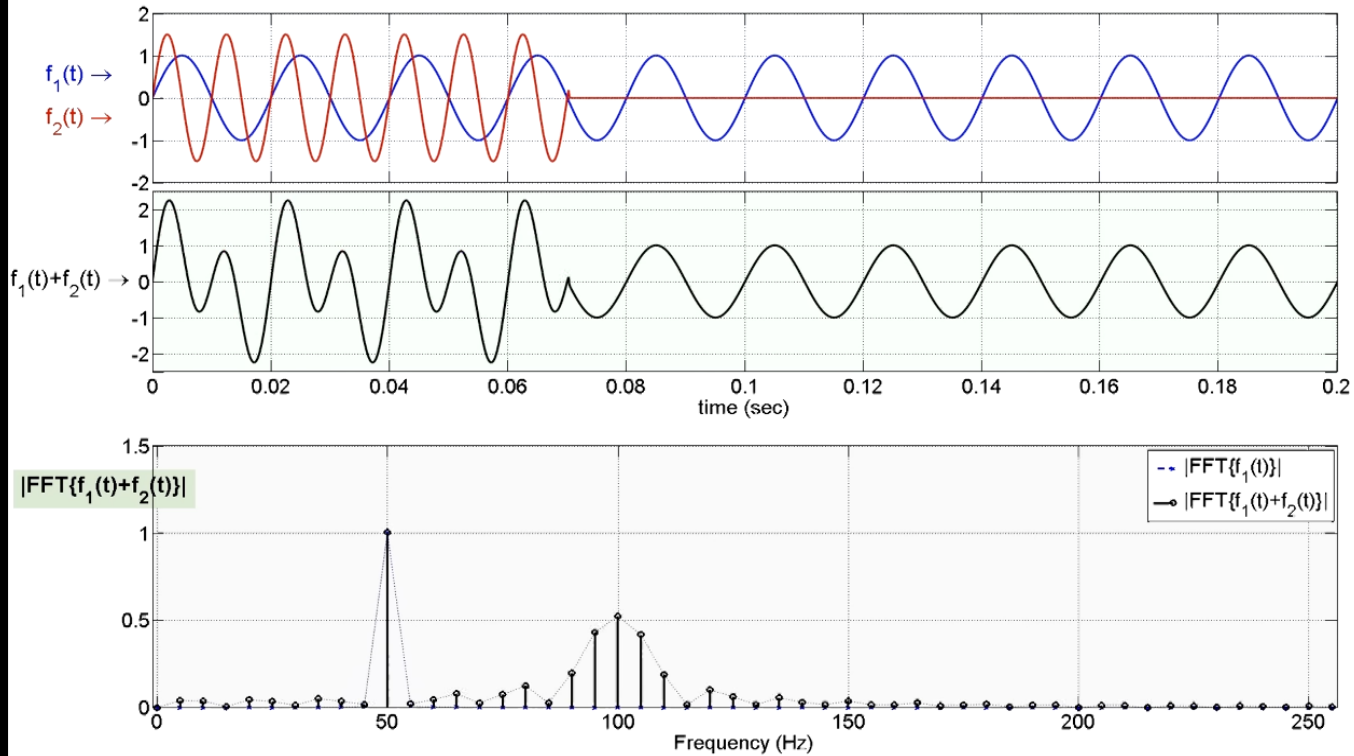
*<http://www.thefouriertransform.com>



Fourier transform: From time domain to frequency domain



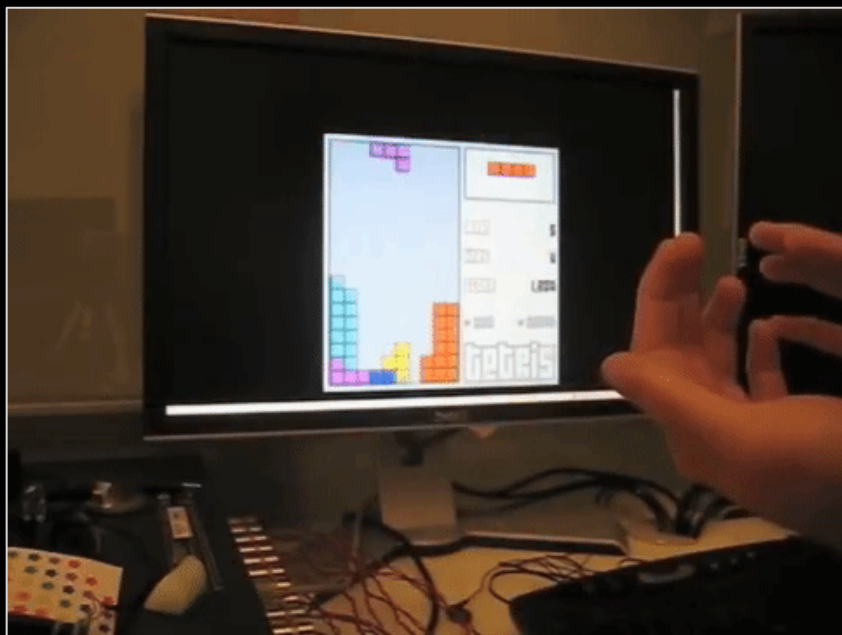
Fourier transform: From time domain to frequency domain

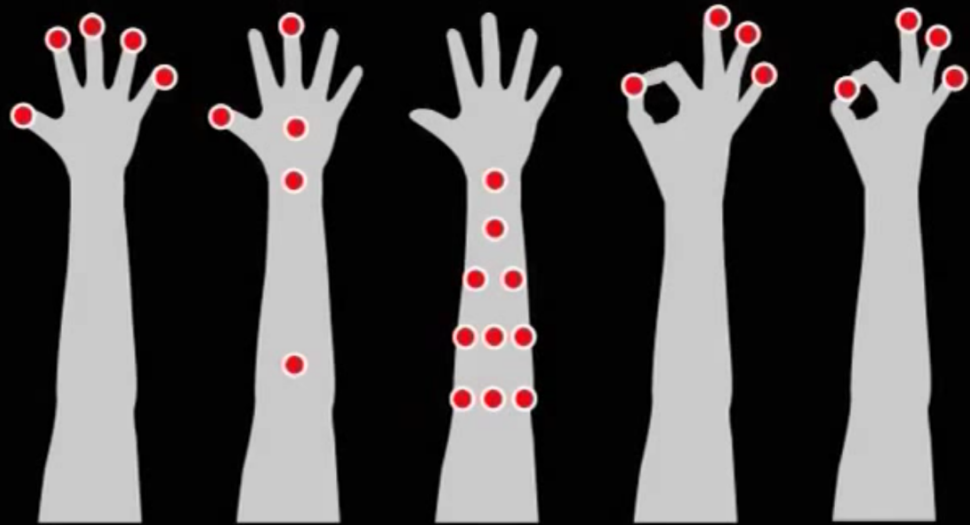


Fourier transform: From time domain to frequency domain

demo

results





**Five
Fingers**

87.7%

**Whole
Arm**

95.5%

**10 Loc.
Forearm**

81.5%

**Finger
Taps**

89.6%

**Finger
Flicks**

96.8%

discussion

When does Skinput get the input location wrong? Why is that? Is location recognition of this type intrinsically error-prone, or do you think it will get better over time? Why or why not?

as good as speech recognition
presence of sweat

metal plates and rods

movement and interaction with other people/objects

sparse dataset

cold weather

eye-free interaction

how much skin surface is really usable?

what about using knees, thighs, and abdomen?

use thermoelectric generators to create a battery-free device

the role of fashion, design and the market

the role of accessibility: design for a niche or for everyone?

more ethnographic data about subjects

a greater sample size

obrigado!