Rethinking HCI with Neural Interfaces

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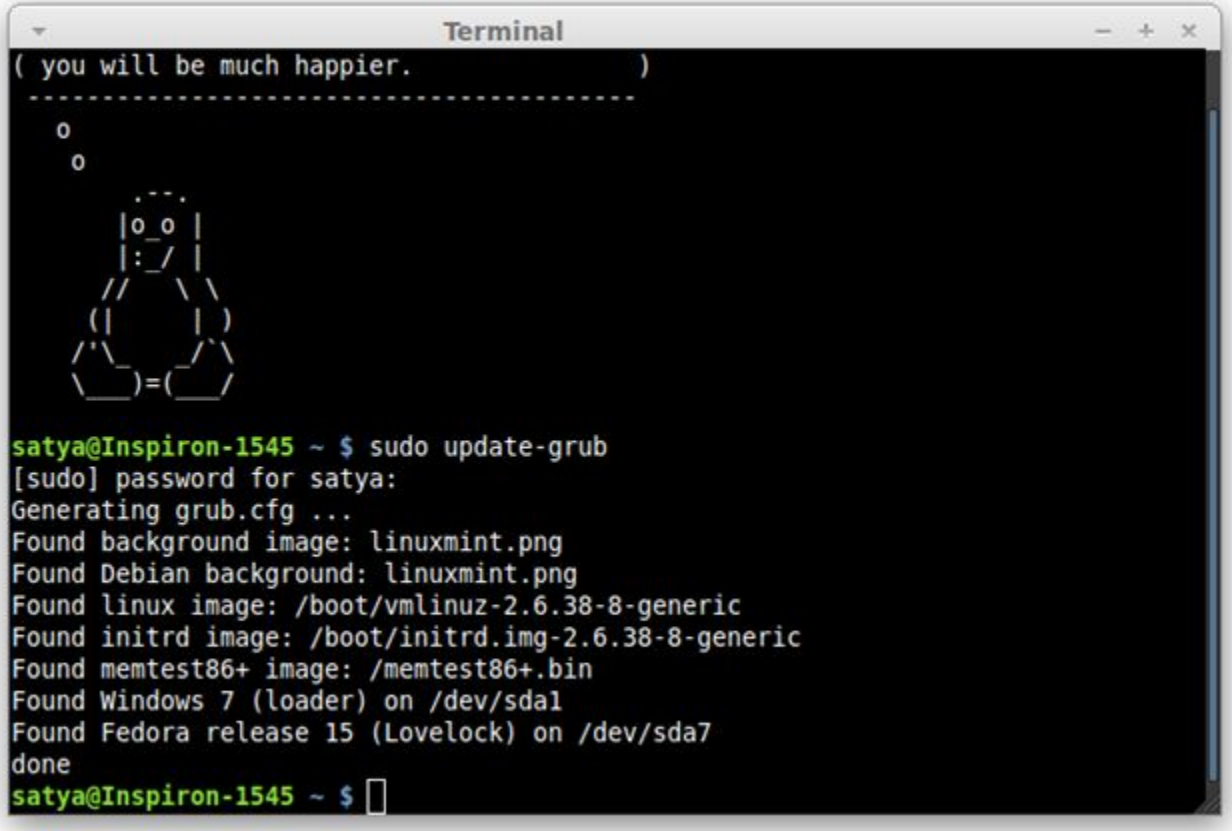
IDI Computer Controlled Display

1. **A Brief History of User Interface Paradigm Shifts**
2. Introduction to Neural Interfaces
3. Designing for Neural Interfaces


Terminal
(you will be much happier.)
satya@Inspiron-1545 ~ $ sudo update-grub
[sudo] password for satya:
Generating grub.cfg ...
Found background image: linuxmint.png
Found Debian background: linuxmint.png
Found linux image: /boot/vmlinuz-2.6.38-8-generic
Found initrd image: /boot/initrd.img-2.6.38-8-generic
Found memtest86+ image: /memtest86+.bin
Found Windows 7 (loader) on /dev/sda1
Found Fedora release 15 (Lovelock) on /dev/sda7
done
satya@Inspiron-1545 ~ $

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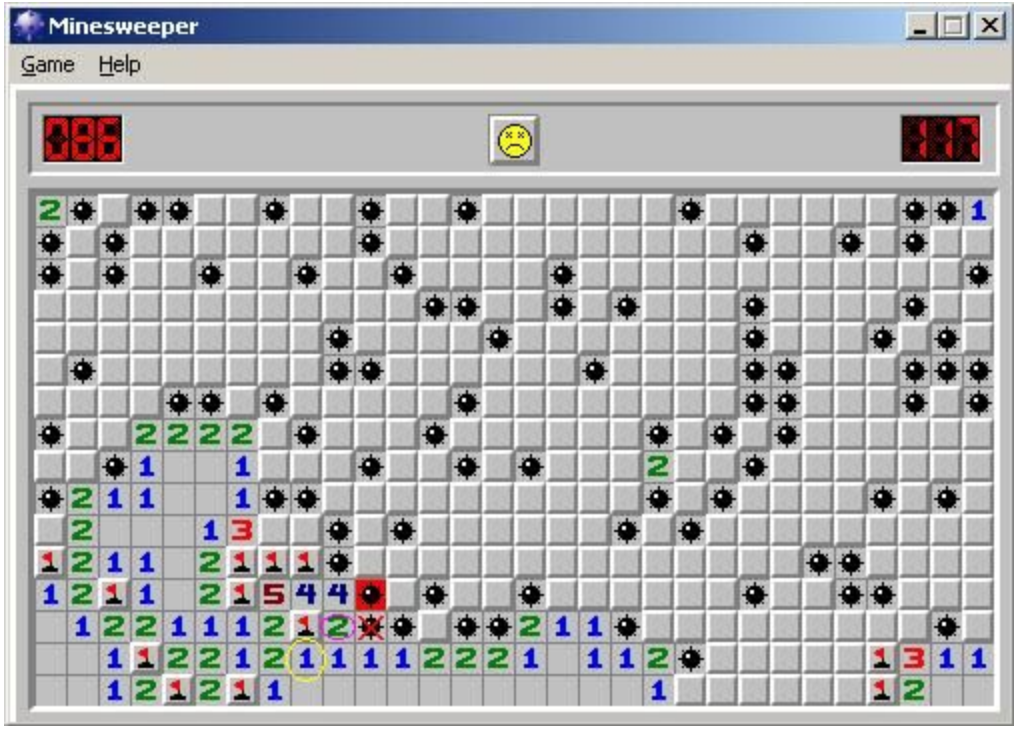
hello.



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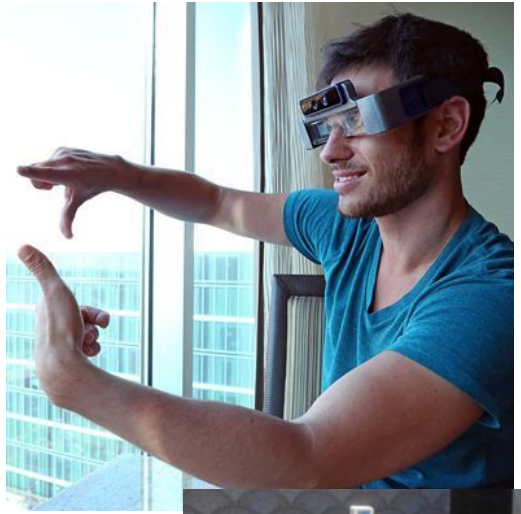
MIT Wearable Computing (1993-)

http://www.media.mit.edu/wearabl



GLASS

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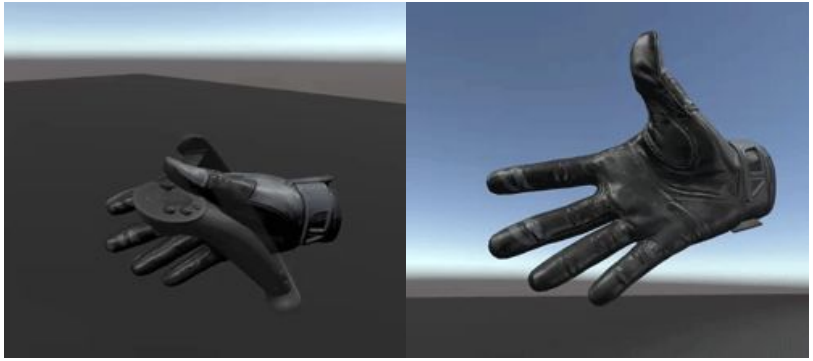

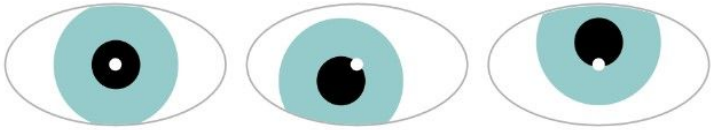

Looking straight at the camera

Looking down and to the right of the camera

Looking directly above the camera

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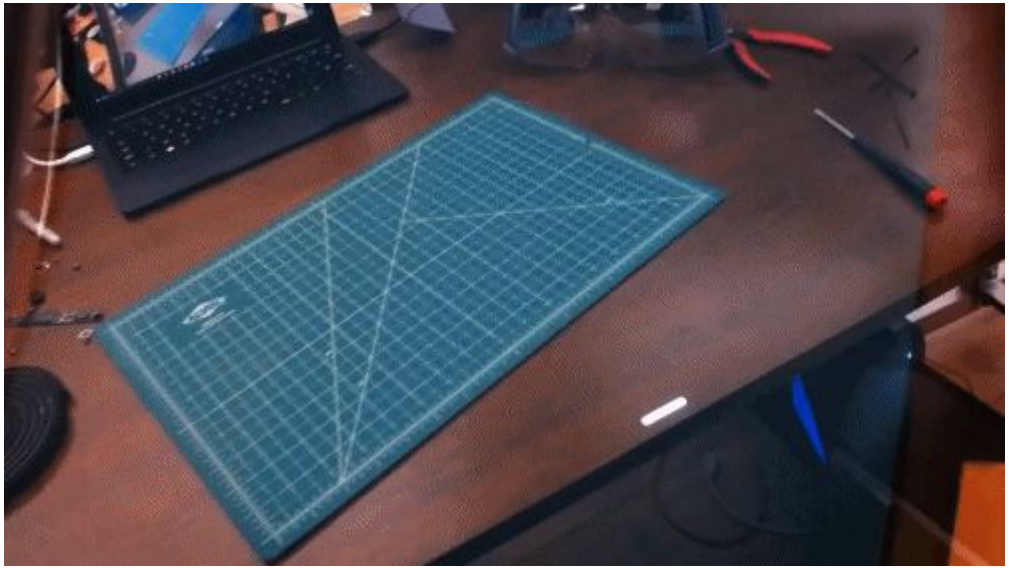

LEAP
MOTION

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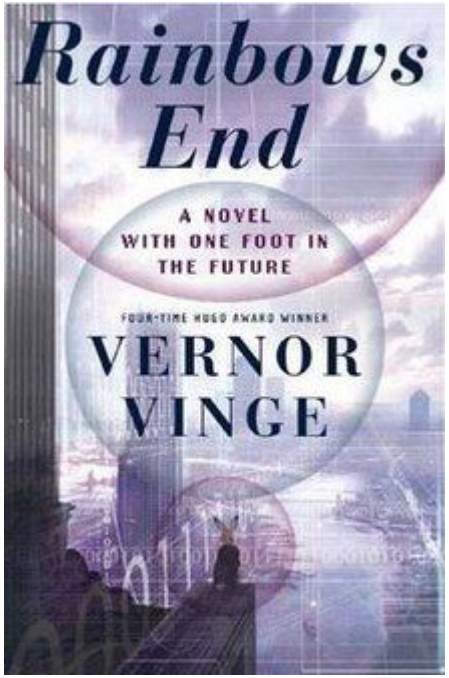

Xiang's gaze dropped from his. He looked at Juan. "I never see *you* tapping your fingers."

"I'm a kid; I grew up with ensemble coding. Hey, even my mom mostly uses phantom typing."

"Well, Xiu and I are retreads, Juan. We have learning plasticity and all that. Teach us the command gestures or eyeblinks or whatever."

"Okay! But this is not like the standard gestures you've already learned. For the good stuff, everything is custom between you and your wearable. The skin sensors pick muscle twinges that other people can't even see. You teach your Epiphany and it teaches you."

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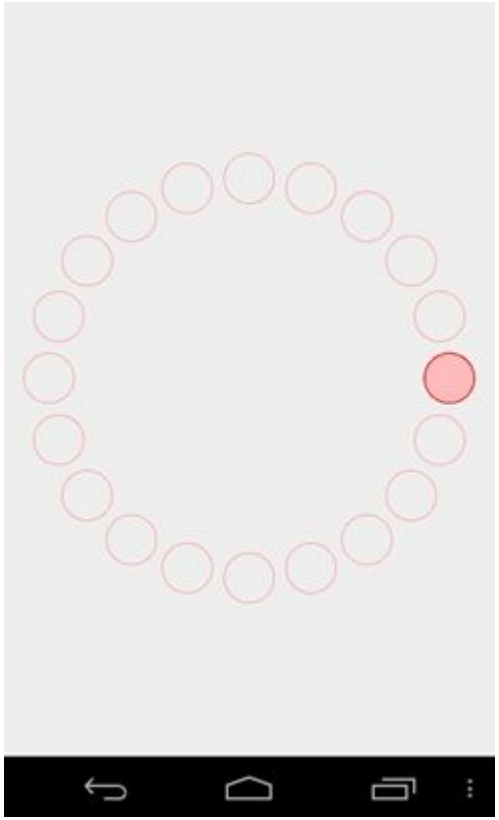
Human input

10,000,000 bits/s

Human output

30 bits/s



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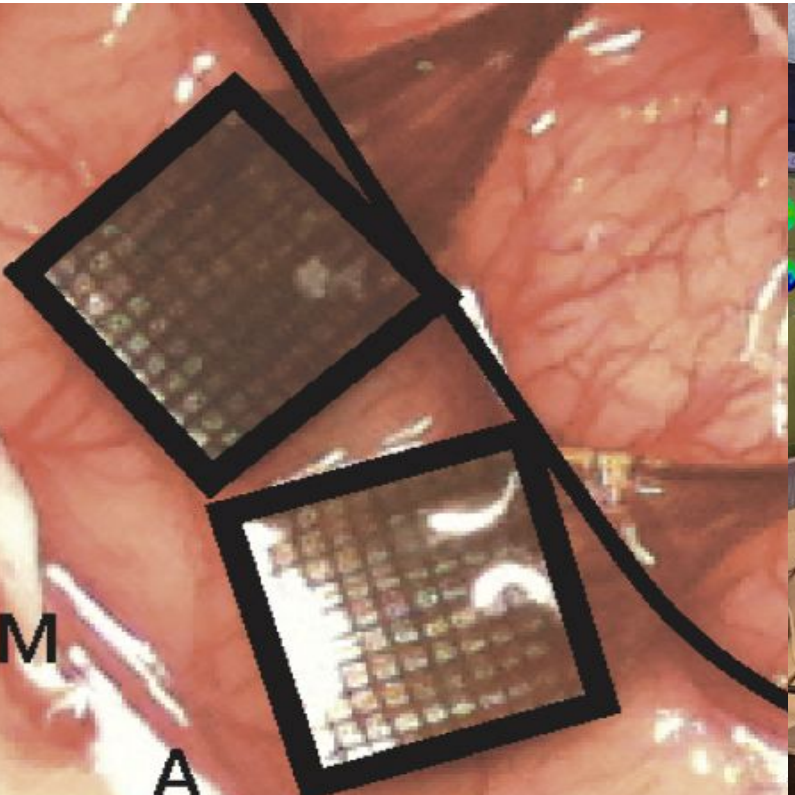
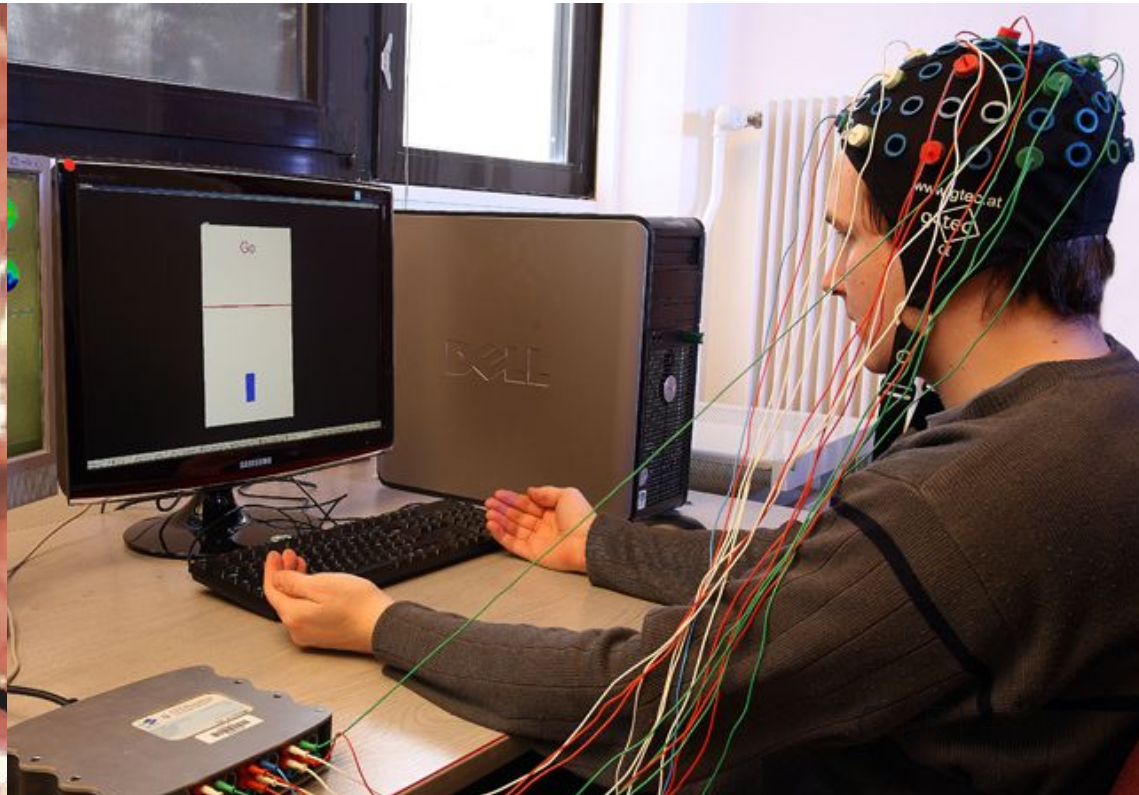
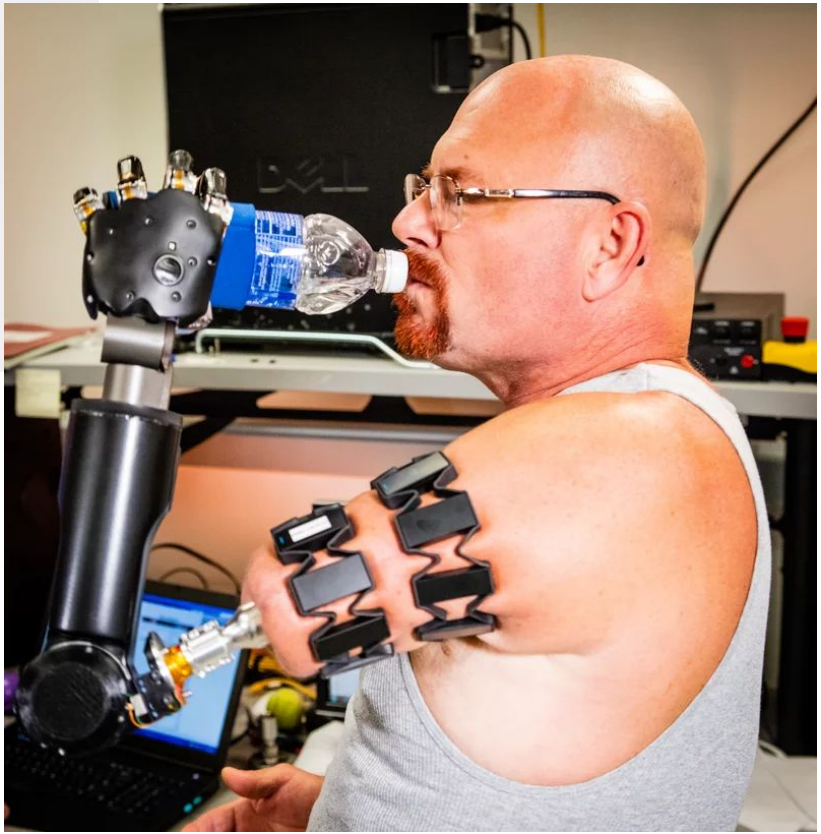
Cortical BMI is hard







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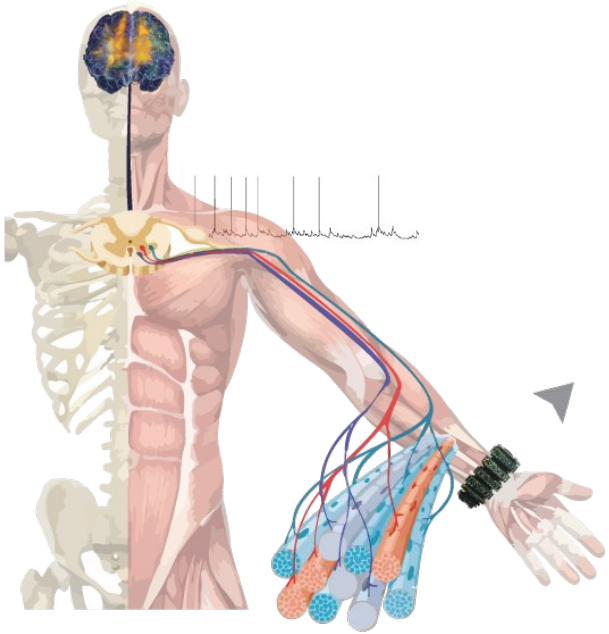
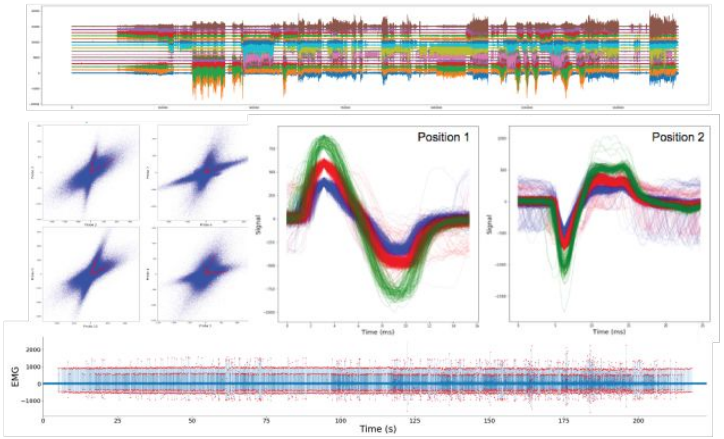
Surface EMG neural interface.

Biophysical signal to control signal.

Neural activity



EMG



Control

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In the future you will connect your nervous system to everything.











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Neural Interaction Design Challenges

1. Robustness & Reliability
2. Novel Interactions
3. Ergonomics
    a. Touchless Control vs. Spatial Computing
4. Learnability & Customization
    a. Fun to learn, and it learns you.
5. Fit to Environment
6. Props

Neural Interaction Design Challenges

1. 3- and 6-DOF navigation
2. Activation, “wake-word” & mode switching
3. Simultaneous continuous & discrete control
4. Hand-object interaction in XR.
5. Text Input!!

Ergonomics & Comfort

1. Smaller is better -- motionless is best?
2. Anatomically informed
3. Variation is essential for comfort.
4. Force: brief or light.

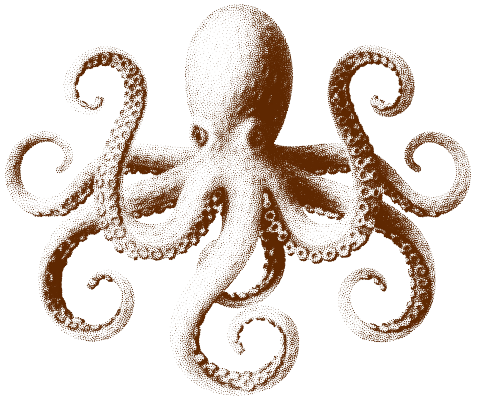
Hand-Object Interaction in XR

1. Grasping, manipulating.
2. Spatial Computing vs. Touchless Control, i.e. direct vs indirect.
3. Haptics & feedback.

Use your arm, or use The Force?

Novel Interactions

Co-evolution of software and controllers.



Control these with an xbox controller… or your hand?

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Novel Interactions

Co-evolution of software and controllers.

Control these with an xbox controller… or your hand?

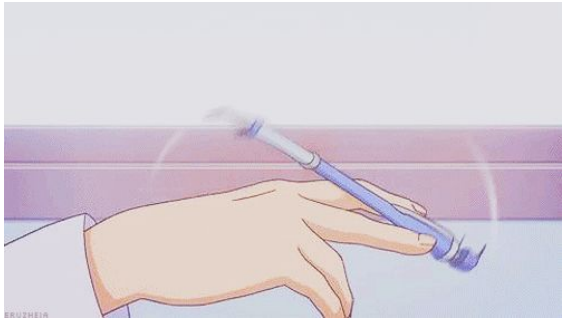
Text Input!!

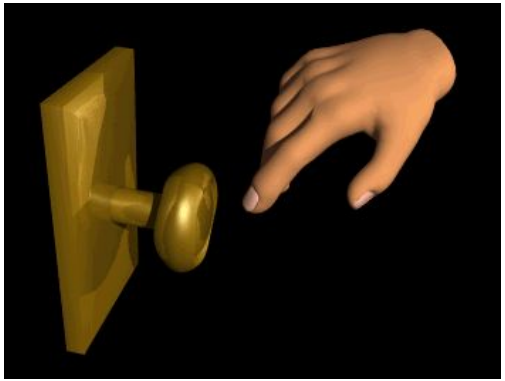
1. One-handed vs two
2. QWERTY-or-not
3. Visual, audio feedback
4. Swipe, chords, …?

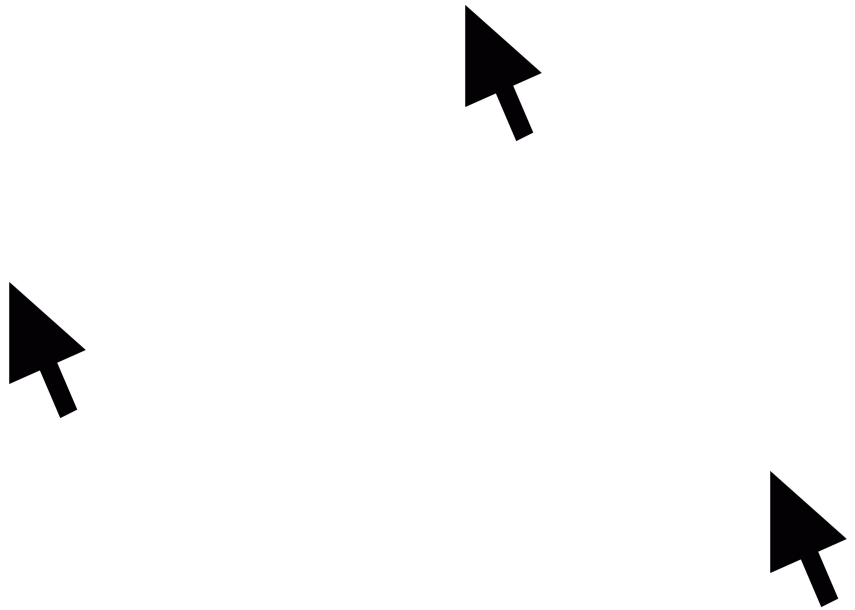
We can do better than this...

Props

1. Constrain hand shape & muscle activation
2. Something to push against
3. Feels cool
4. Optional scaffolding?







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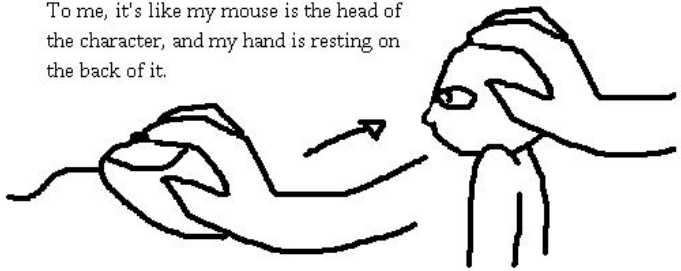
Some people think inverting the y-axis on games doesn't make any sense, but it does to me.

☒ Invert 'Y'-Mouselook

To me, it's like my mouse is the head of the character, and my hand is resting on the back of it.



To make them look down, I push the mouse forward, like I'm tilting their head down to look.

And to make them look up, I pull the mouse back, again as though I were craning their necks upward.

I know not everyone sees it this way

but that's how it makes sense to me.

this man's head is really soft

https://www.reddit.com/r/gaming/comments/84wjsk/inverted_mouse/


THIS ITEM IS NO LONGER AVAILABLE FOR SALE. PLEASE CONTACT US FOR A SUITABLE ALTERNATIVE.
Soft Dome
Classic Dome
Soft Rim


Untitled
Dirty Saw
Dance Bass
FX Synth
Lite Melody
Pad
FX Sample
Drums
24 Syn
Drums in
Lead Syn
27 Ins
Master
Transfer Curve
Graphical representation of Compressor's Threshold, Ratio and Knee. The horizontal axis shows input level and the vertical axis represents output level. Drag the dot in the display to adjust Ratio and Threshold simultaneously.
Compressor
Drop an Instrument or Sample Here

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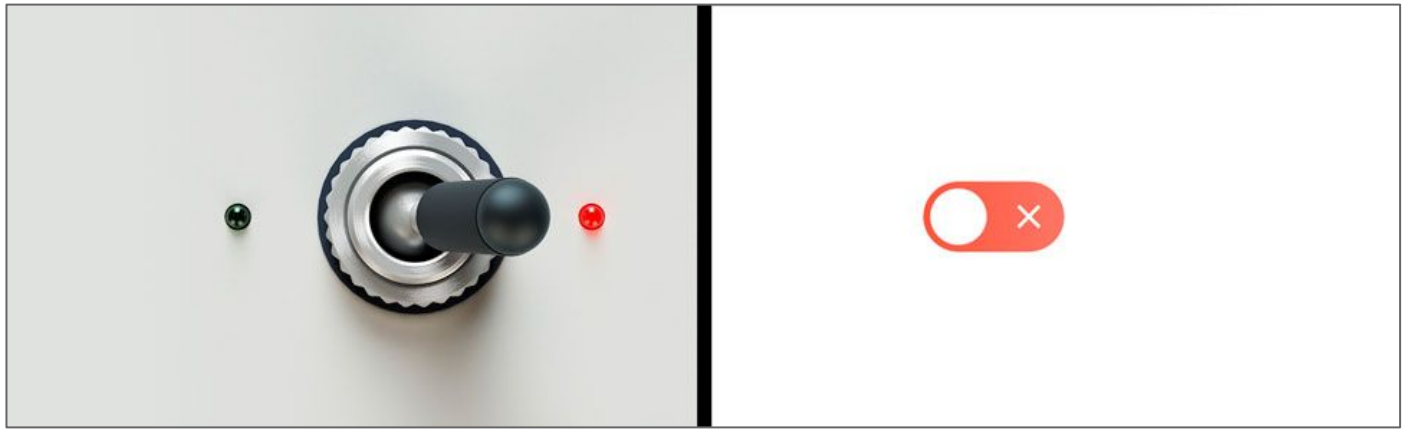

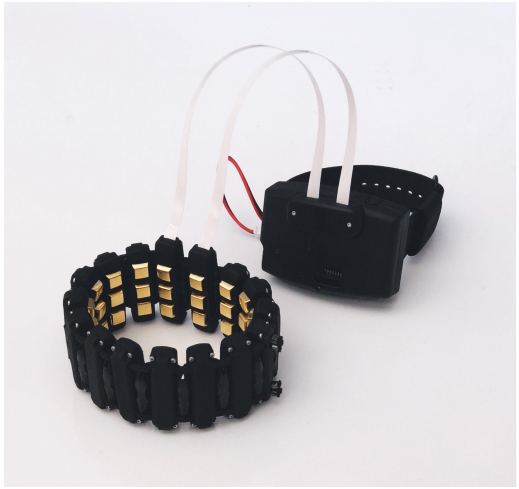

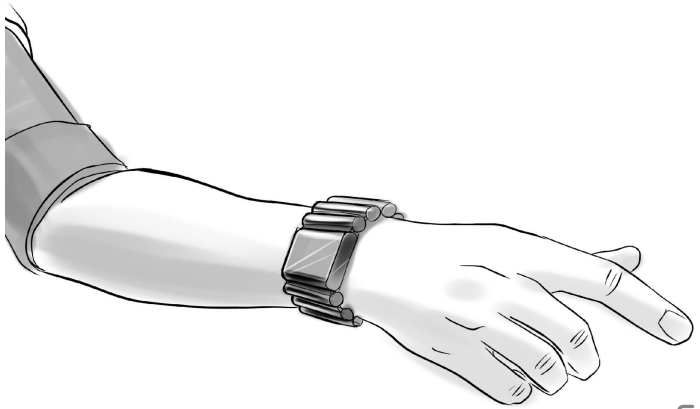

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2019

2020

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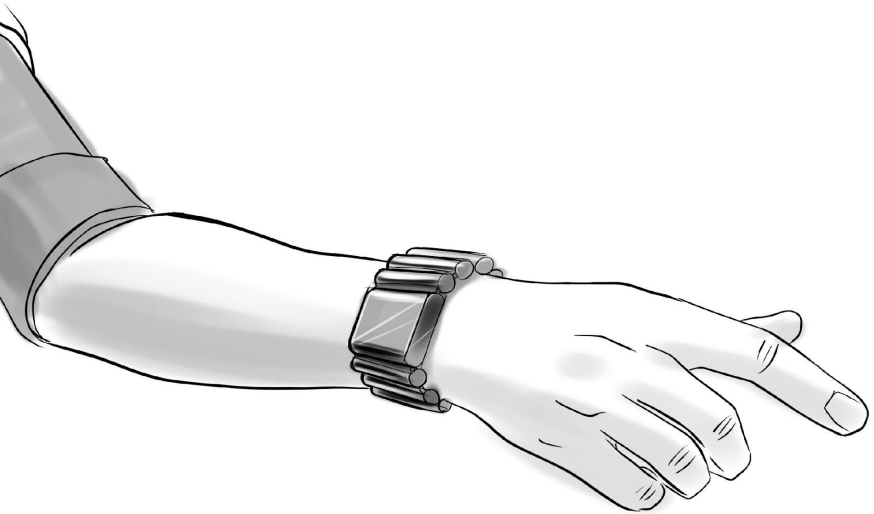
CTRL-kit developer platform.



Hardware

SDK & API

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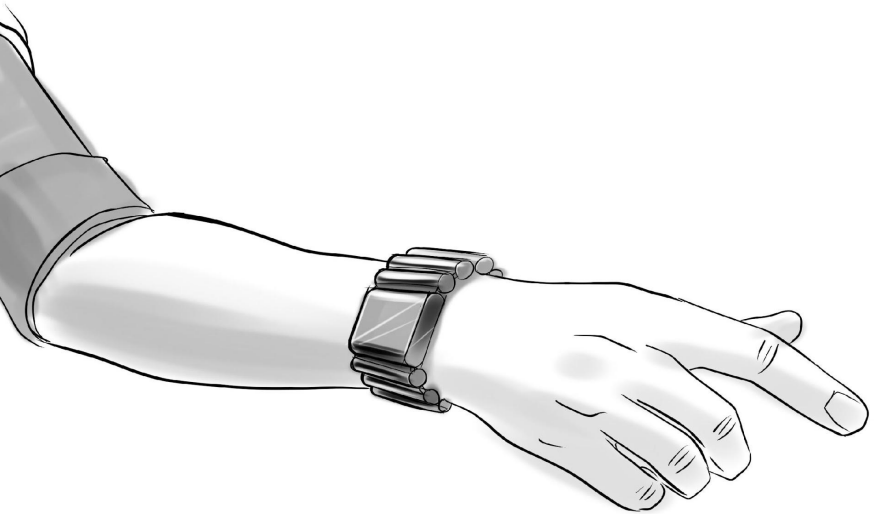
Questions?



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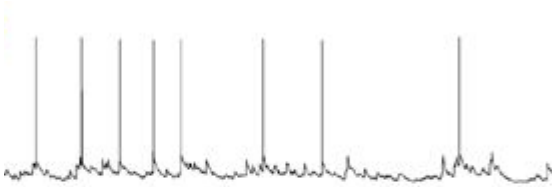
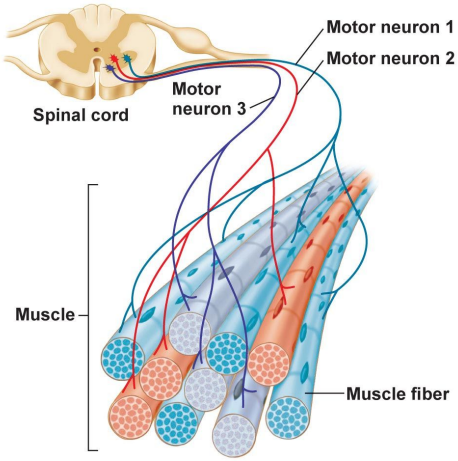
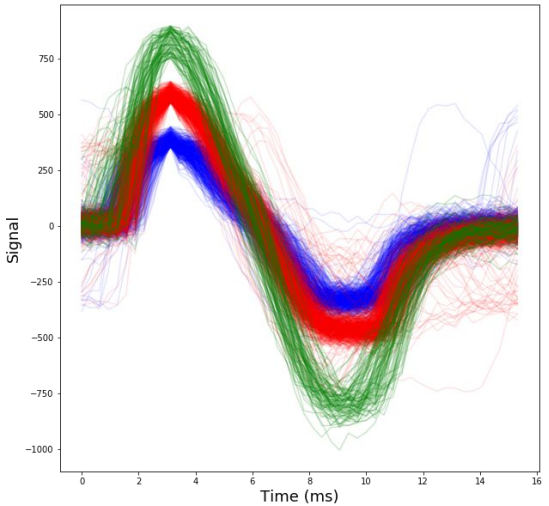
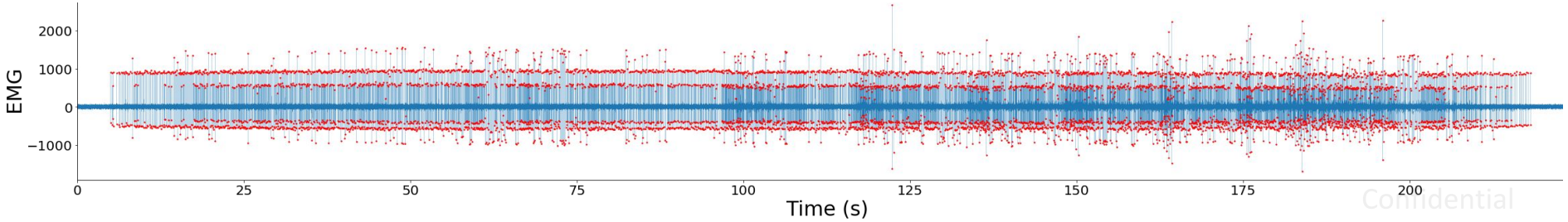
[Extra slides]

Neurocontrol: EMG → motor neuron activity



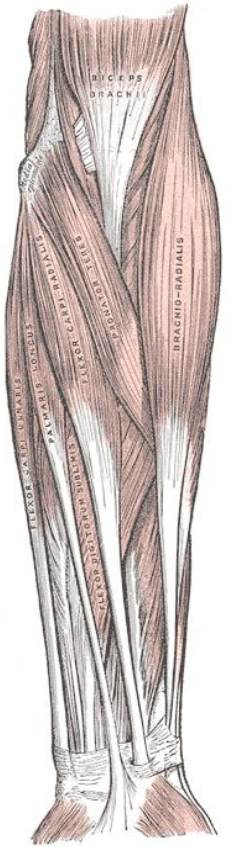


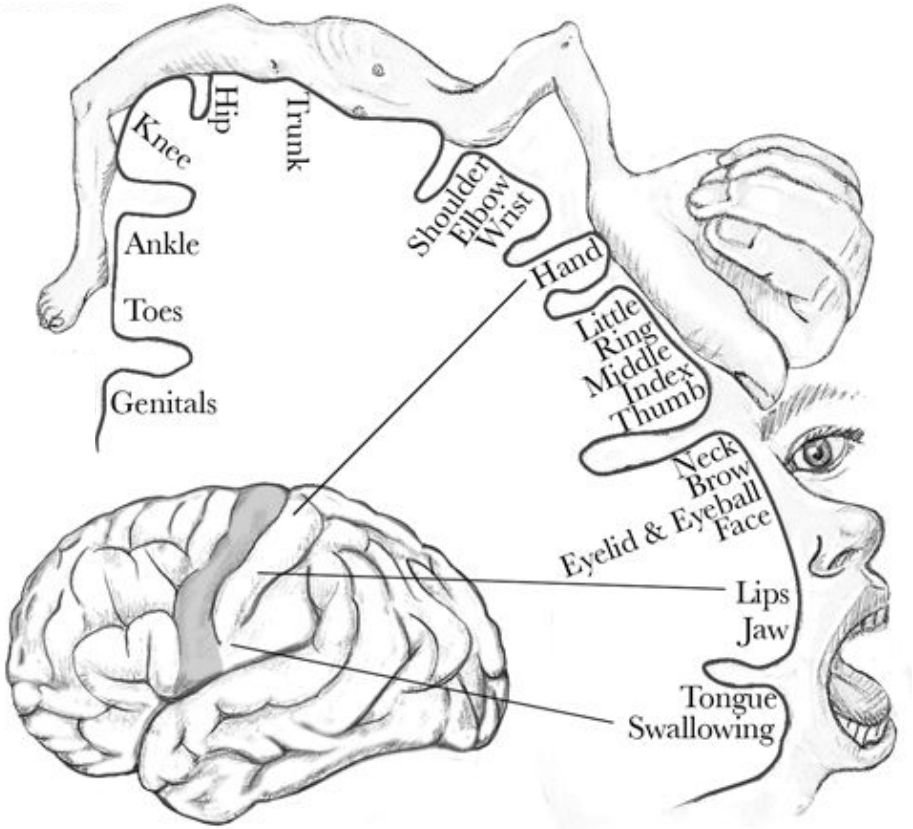




Confidential

The richest signals are at the forearm.





Tool / object control

Spoken language