WEARABLE COMPUTING

27 AUG 2014

ERIC PAULOS
www.paulos.net

UNIVERSITY OF CALIFORNIA Berkeley

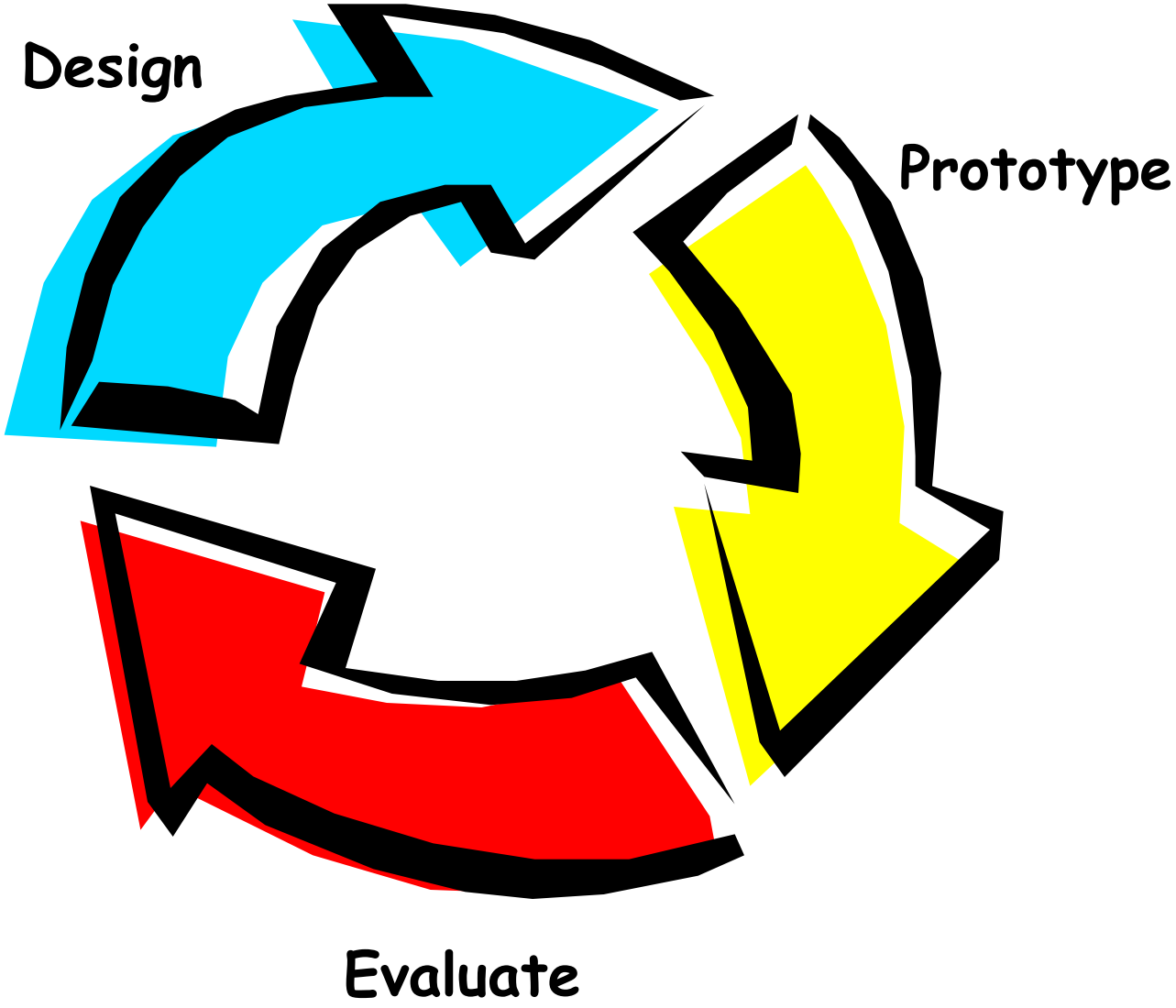
ANNOUNCEMENTS

What Section will you Attend?

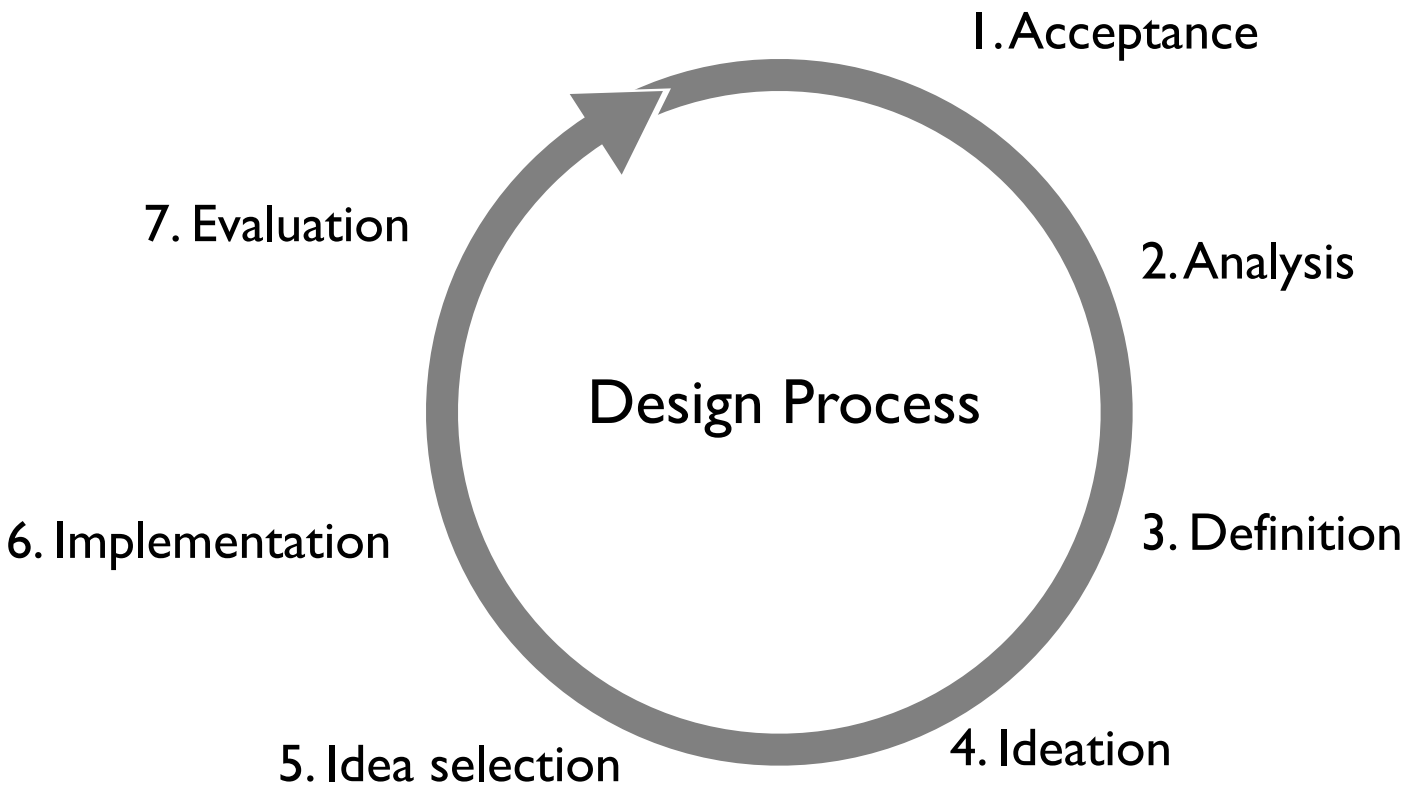
Due Next Thur– Reading Response

Due 10 Sept (before class) – DESIGN 01

Due 11 Sept (Fri) – PROG 01


Design
Prototype
Evaluate

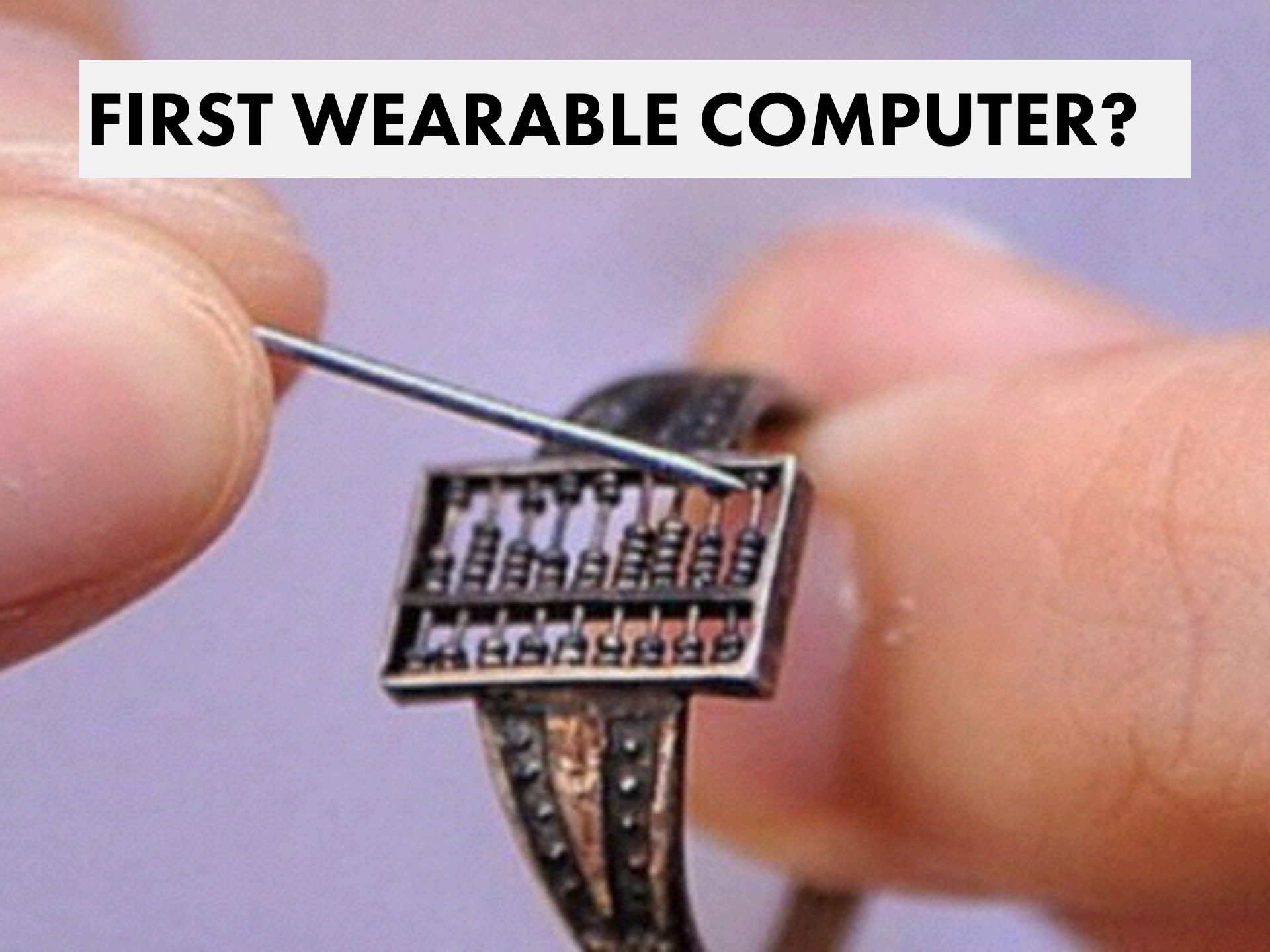
THE DESIGN PROCESS [KOBERG & BAGNALL]



WEARABLE COMPUTING

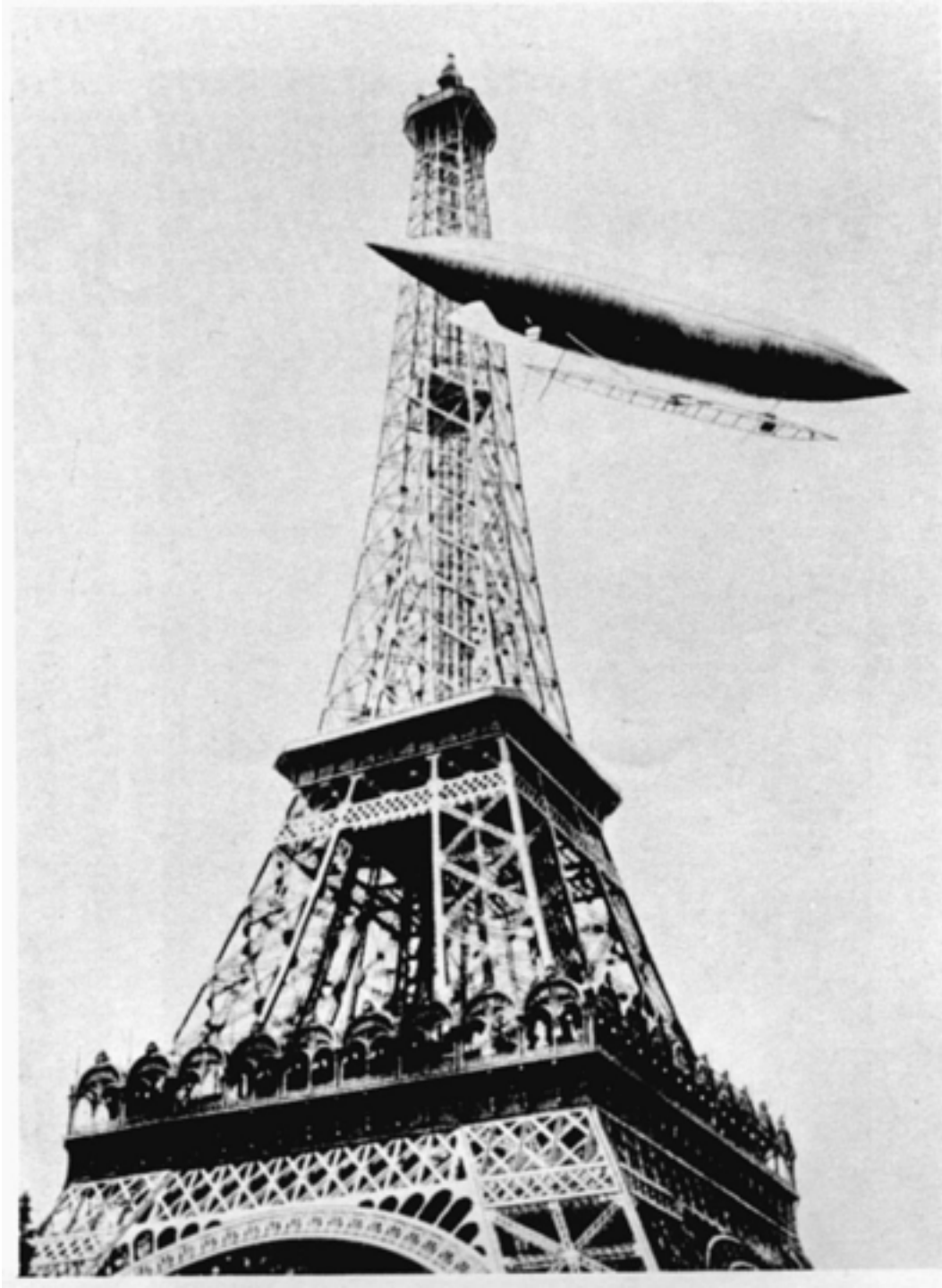
FIRST WEARABLE COMPUTER?

FIRST WEARABLE COMPUTER?

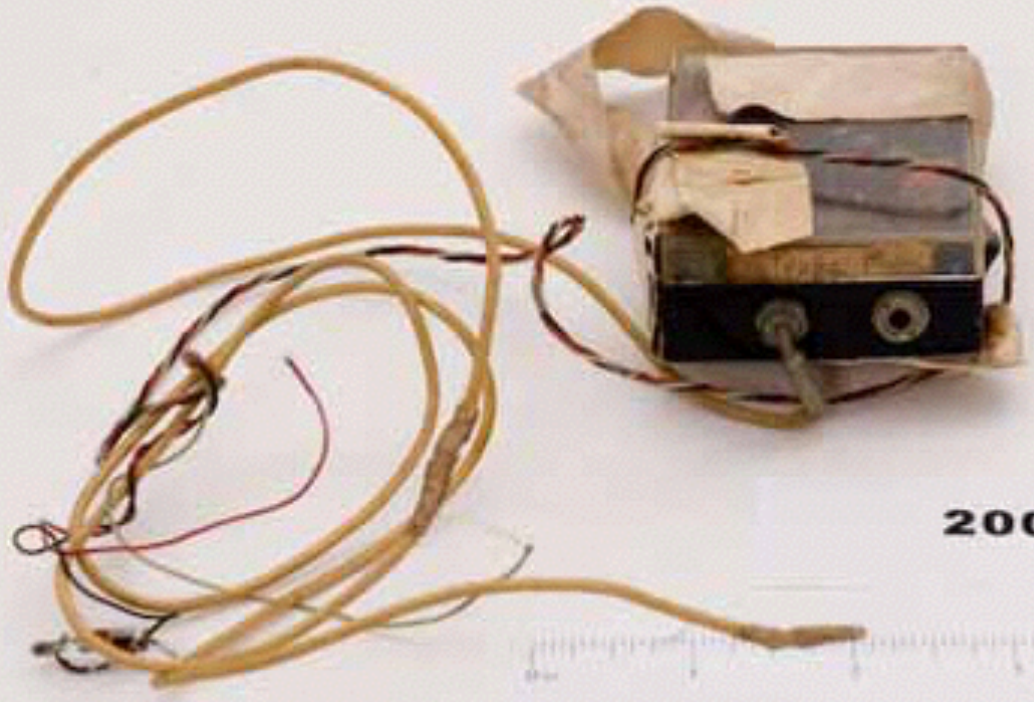



FIRST WEARABLE COMPUTER?

Alberto Santos-Dumont



Alberto Santos-Dumont



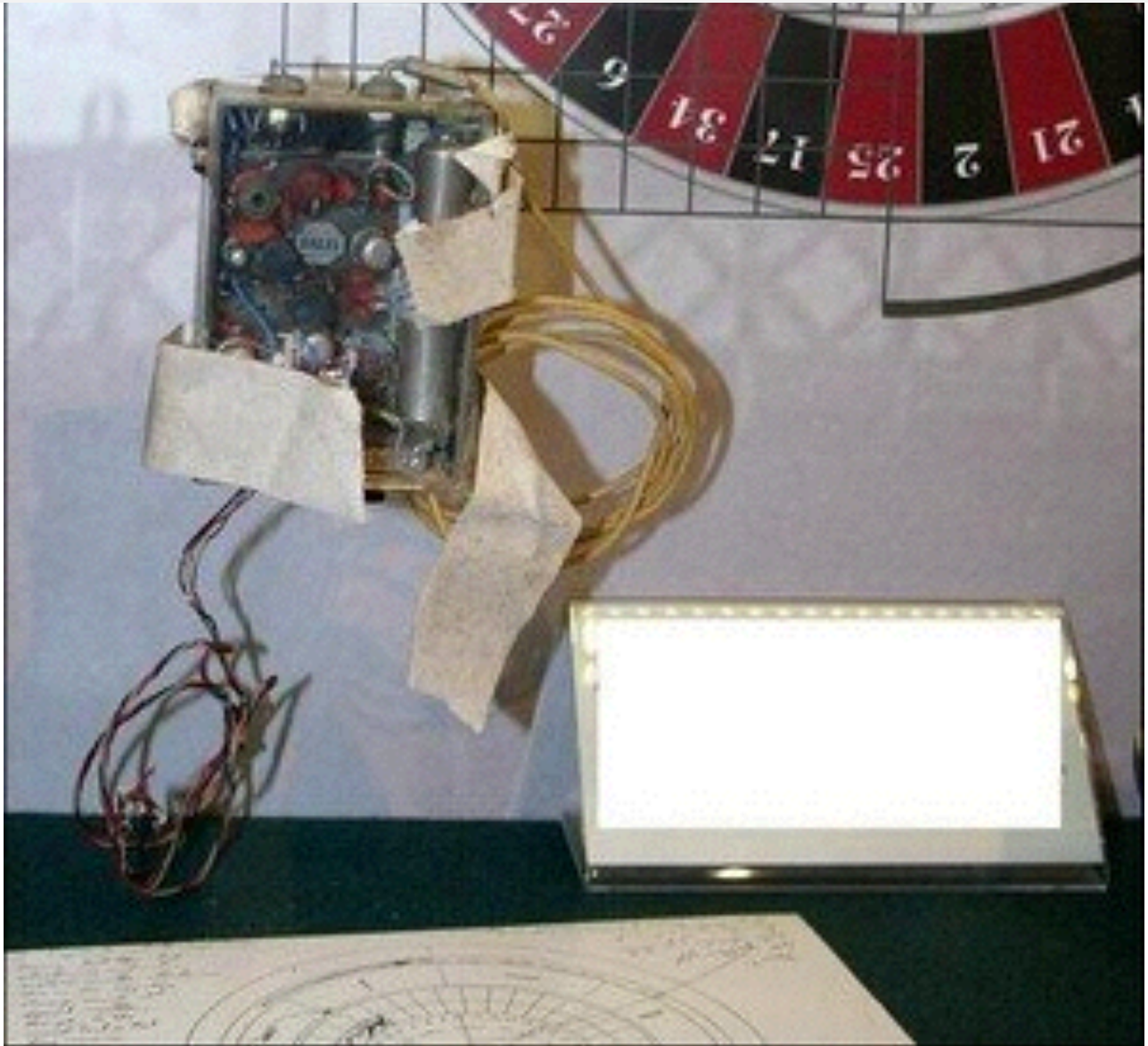
2007.030.014

1961

Edward Thorp
Claude Shannon

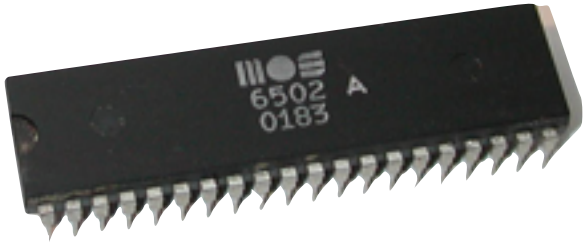
1961

Edward Thorp
Claude Shannon



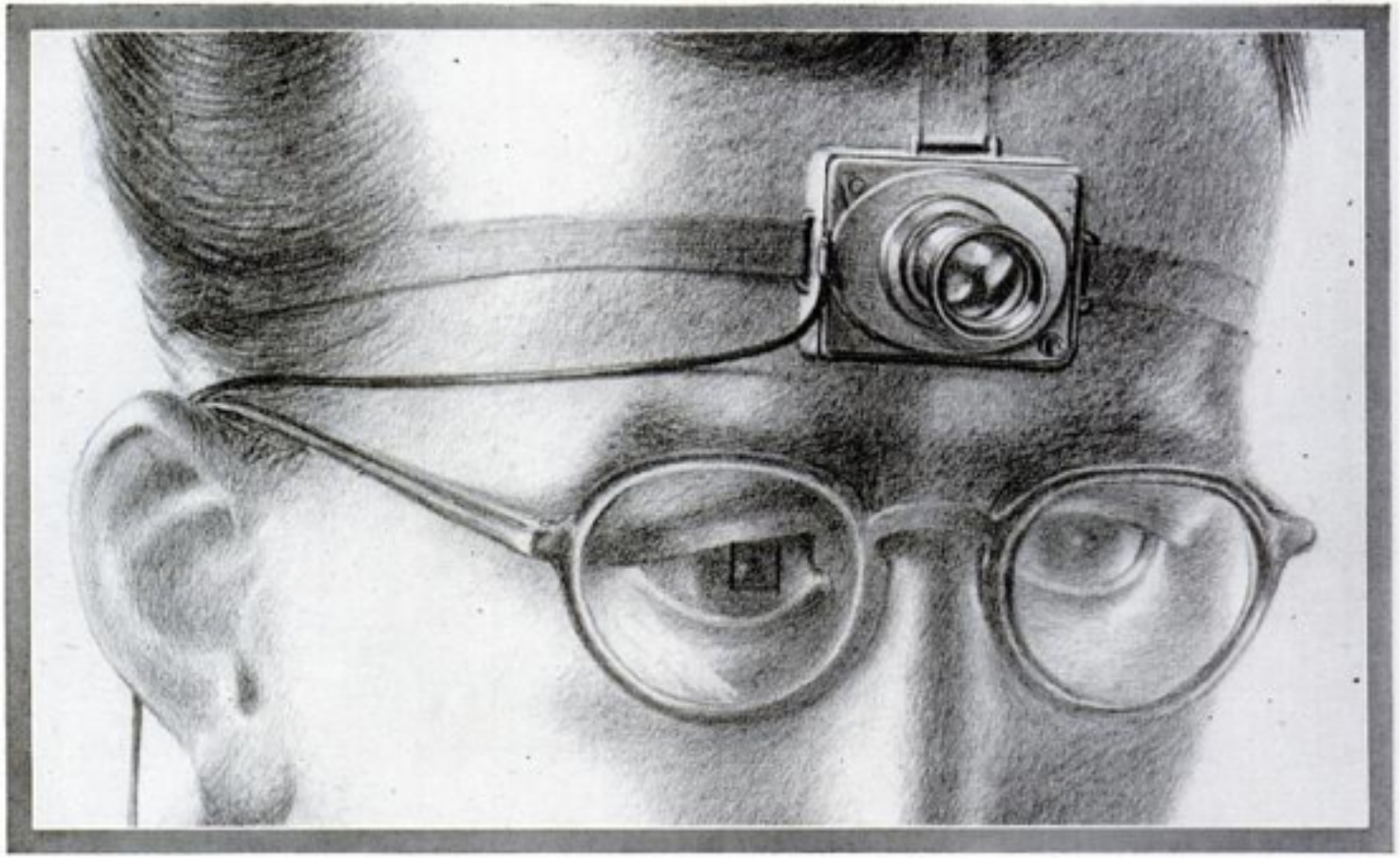
1970

Eudaemons



Electric Dress
Atsuko Tanaka
1956

Electric Dress
Atsuko Tanaka
1956



A SCIENTIST OF THE FUTURE RECORDS EXPERIMENTS WITH A TINY CAMERA FITTED WITH UNIVERSAL-FOCUS LENS. THE SMALL SQUARE IN THE EYEGLASS AT THE LEFT SIGHTS THE OBJECT

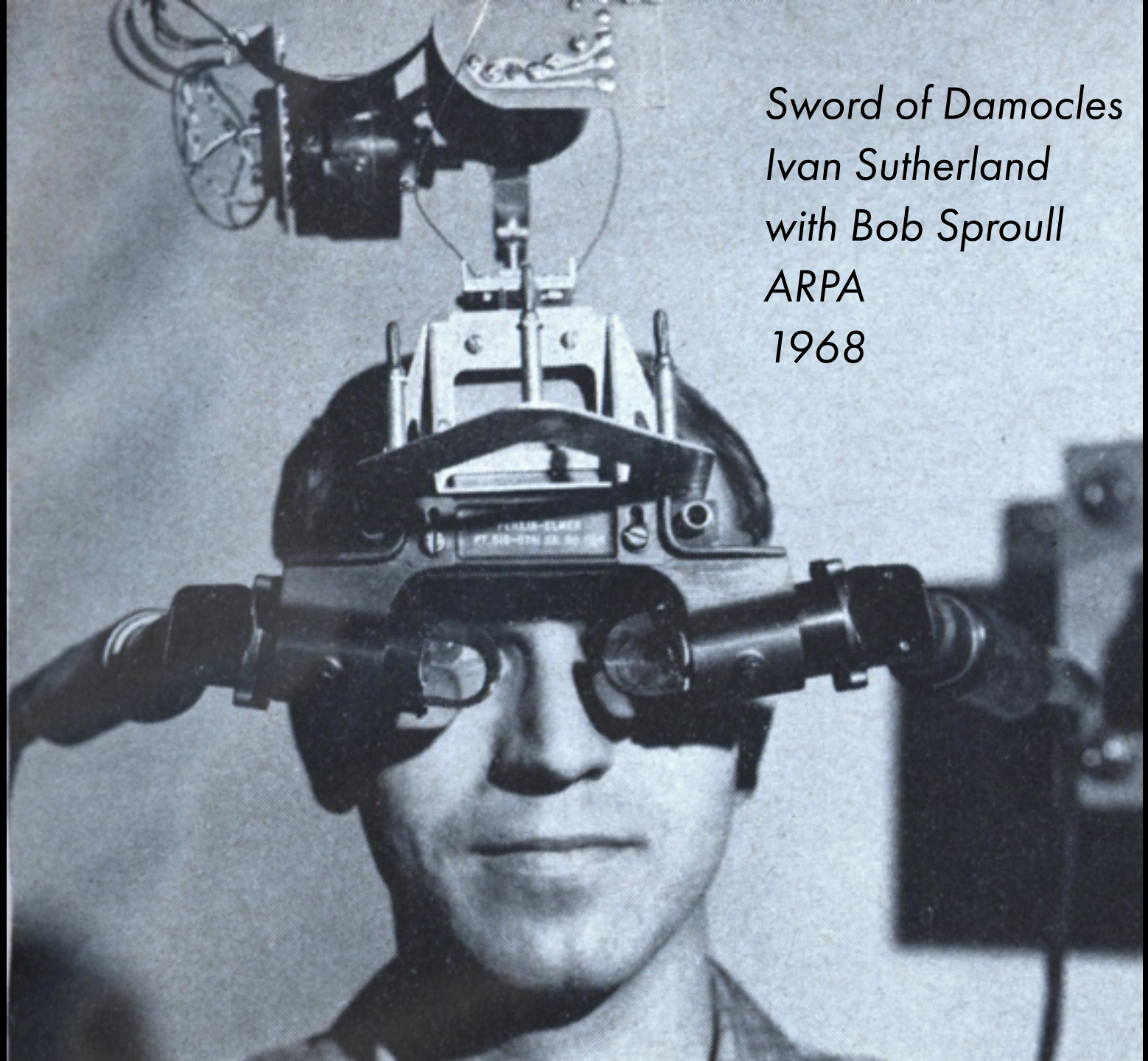
AS WE MAY THINK

A TOP U. S. SCIENTIST FORESEES A POSSIBLE FUTURE WORLD

Vannevar Bush, 1945

The camera hound of the future wears on his forehead a lump a little larger than a walnut. [...] The lens is of universal focus [...]. There is a built-in photocell [...] which automatically adjusts exposure for a wide range of illumination.[...] The cord which trips its shutter may reach down a man's sleeve within easy reach of his fingers. A quick squeeze, and the picture is taken.

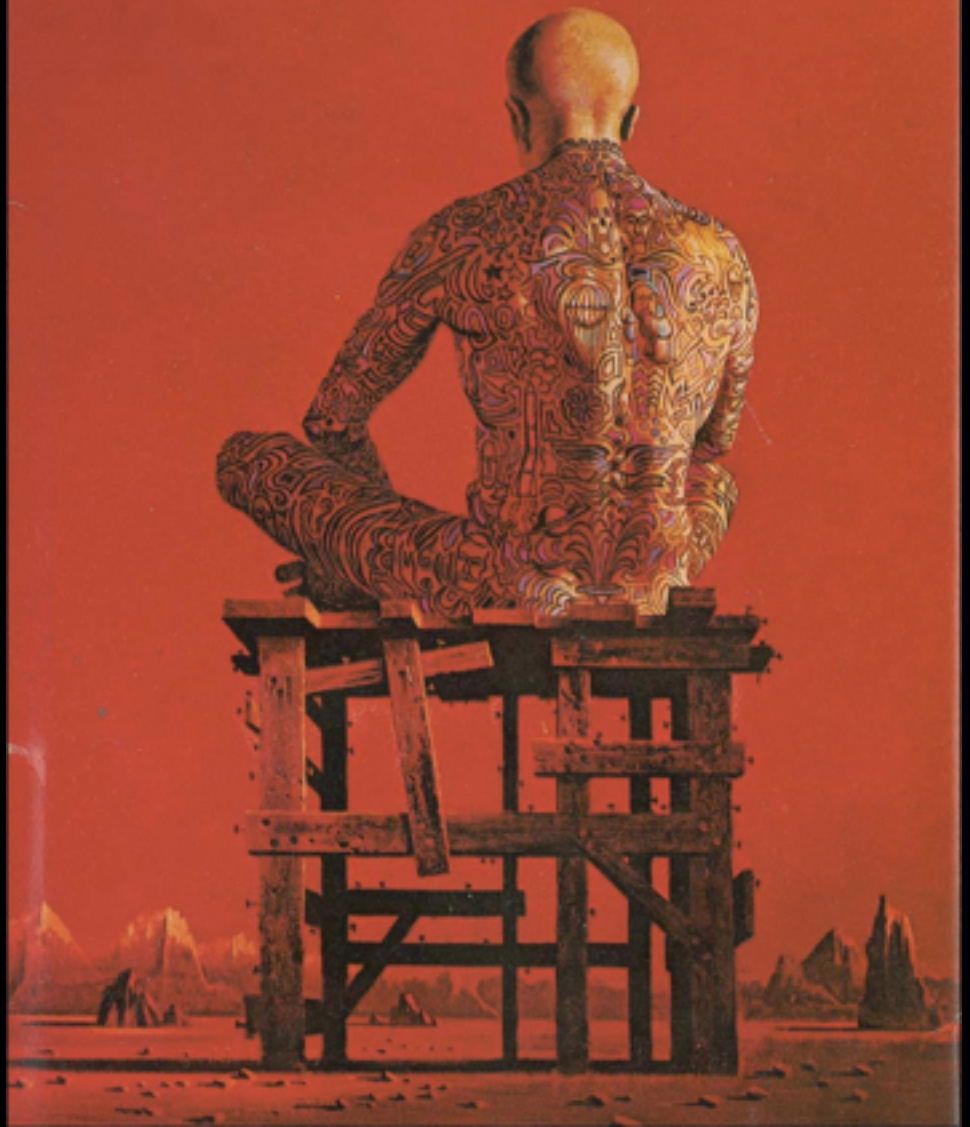
Vannevar Bush, 1945



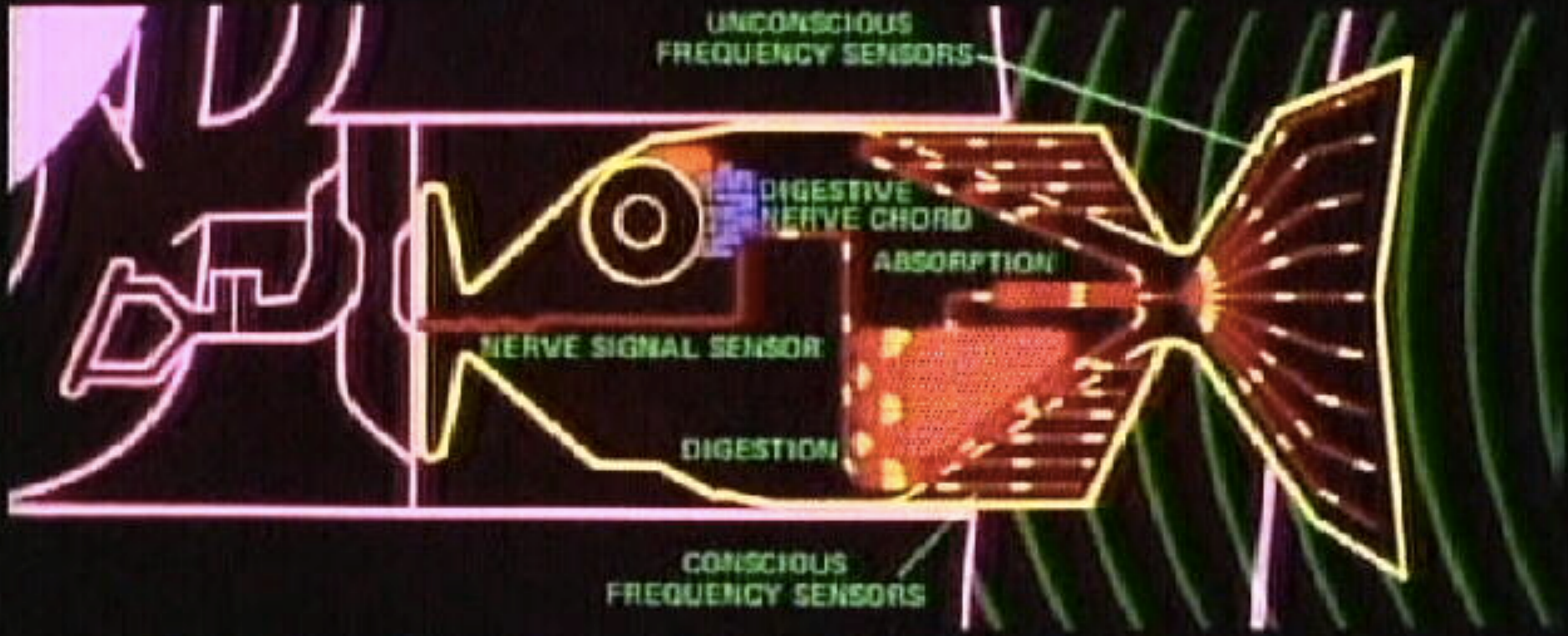
Sword of Damocles
Ivan Sutherland
with Bob Sproull
ARPA
1968

RAY BRADBURY

THE ILLUSTRATED MAN



BABEL FISH



STICK ONE IN YOUR EAR, YOU CAN INSTANTLY UNDERSTAND ANYTHING SAID TO YOU IN ANY FORM OF LANGUAGE: THE SPEECH YOU HEAR DECODES THE BRAIN WAVE MATRIX.

http://gawker.com/5667202/11-things-from-back-to-the-future-ii-that-actually-came-true-and-3-that-havent-yet

Jurassic Park


FLIR
82.6°
Hot & Cold
Iron
White Hot
Black
CES 30
FLIR

VuMan 1
CMU
1991

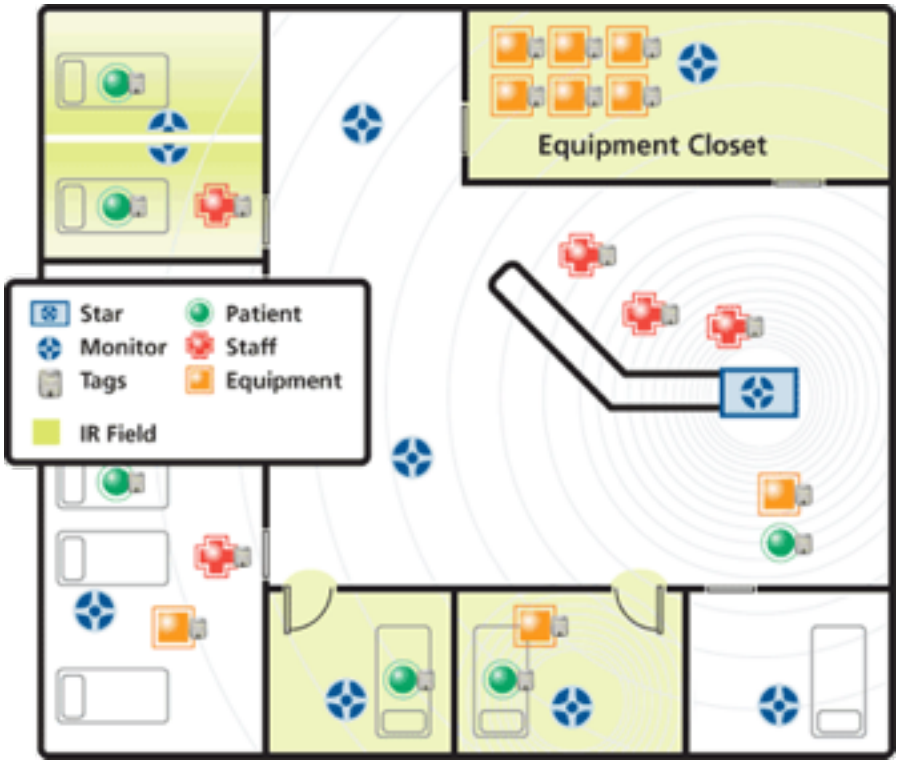
CONTEXT AWARE COMPUTING

any information that can be used to characterize the situation of an entity - Anind Dey

Olivetti Active Badge
1990

Olivetti Active
Badge
1990

Olivetti Active Badge
1990



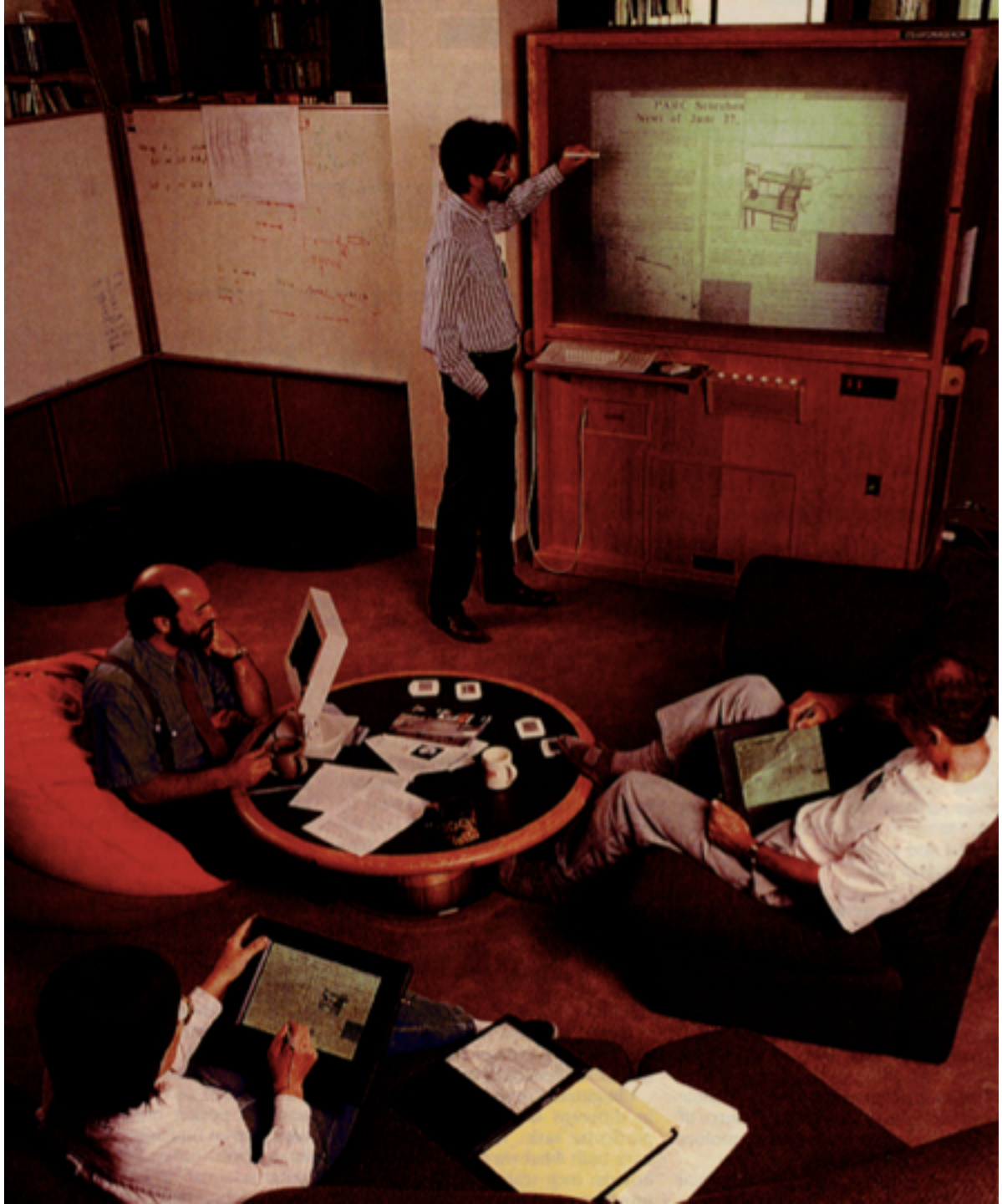

Ubiquitous Computing
Mark Weiser 1991

Pads

Tabs

Boards

1991



Wearable Computing
MIT 1993

WEARABLE CHARACTERISTICS

- Portable while remaining operational, thereby allowing a user to move and still operate the device.
- Allow for hands free use and allow for non-obstructive access.
- Integrate sensors such as wireless communications, cameras, GPS, microphones and accelerometers as input devices to provide information about the close environment.
- Communicate information to the user in a proactive way, thus conveying information to the user even when not being actively used. An example would be alerting the user when a new email has arrived
- Always being on and continuously receiving information about the surrounding environment.

Brad Rhodes (1997)

1980 -

Steve Mann's "wearable computer" and "reality mediator" inventions of the 1970s have evolved into what looks like ordinary eyeglasses.

Google Glass 2013

Google Glass 2013

amazon Prime

Bjoern's Amazon.com | Today's Deals | Gift Cards | Sell | Help

Father's Day Is June 15
Sponsored by DeWalt › Shop now

Shop by Department | Search | Wearable Technology | Go | Hello, Bjoern Your Account | Your Prime | 0 Cart | Wish List

All Electronics | Best Sellers | Electronics Accessories | Audio & Home Theater | Camera & Photo | Car Electronics & GPS | Cell Phones & Accessories | Computers

Wearable Technology

EXPLORE WEARABLE TECHNOLOGY

Fitness & Wellness

Healthcare Devices

Wearable Cameras

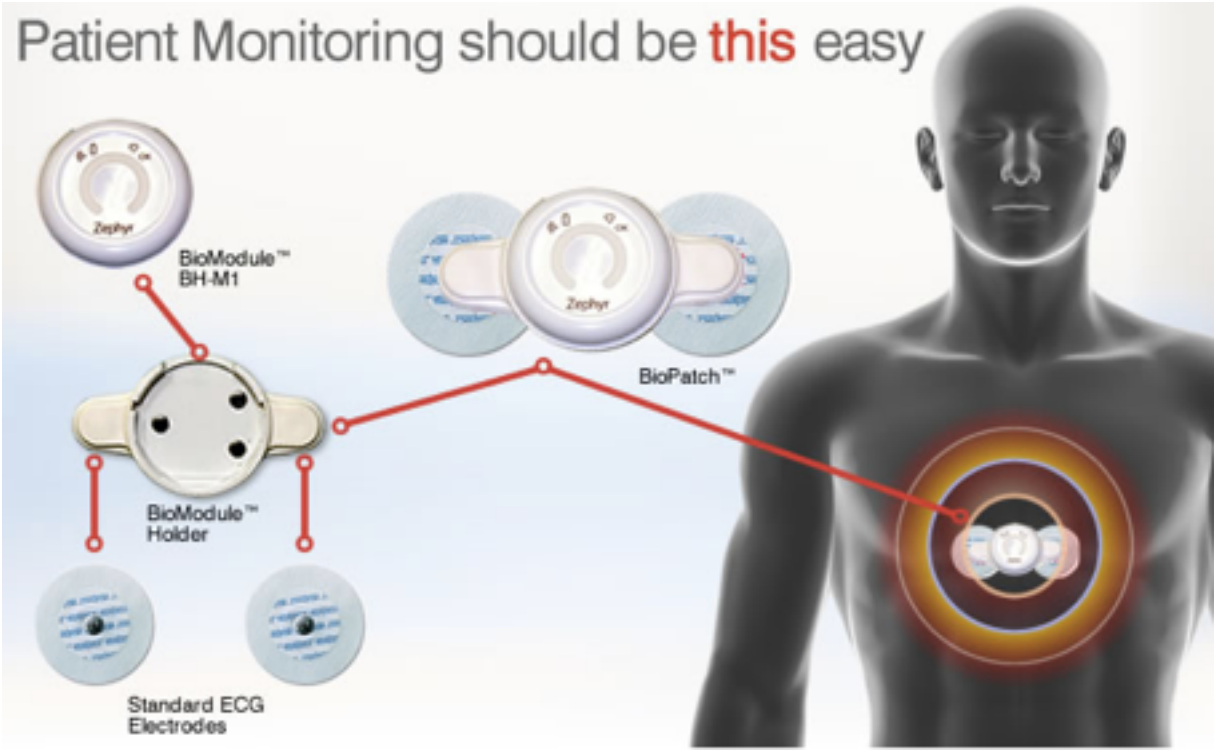
Smart Watches

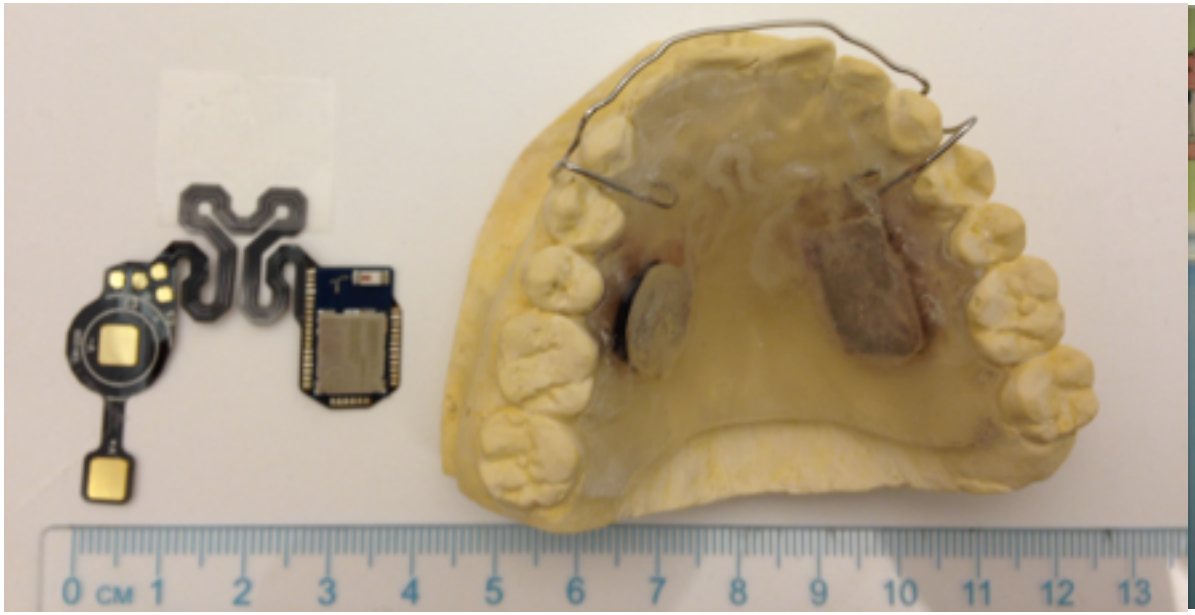
Family, Kids & Pets

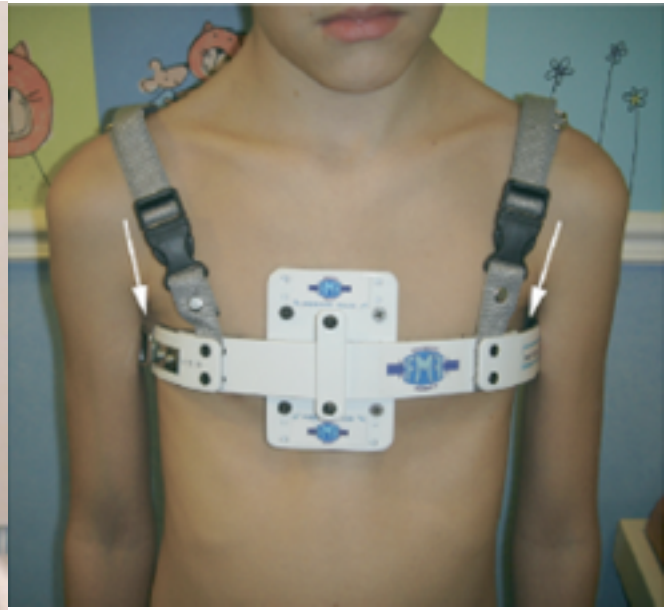
The New Generation III Alcohol and Marijuana Sensing House Arrest Ankle Bracelet With Active GPS Is Now Available for only $3.50 per day!

AP Photo/The Cincinnati Enquirer, CARRIE COCHRAN

housearrestbracelet.com


Patient Monitoring should be this easy
BioModule™
BH-M1
BioPatch™
BioModule™
Holder
Standard ECG
Electrodes





UCSF BioDesign, Roy Lab

Smart Retainer

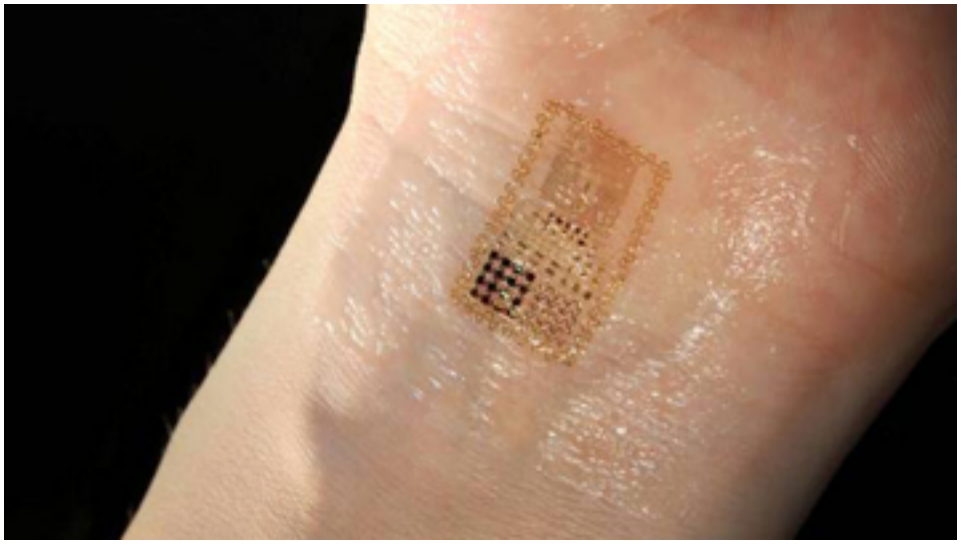
Dynamic Compressor for Pectus Carinatum

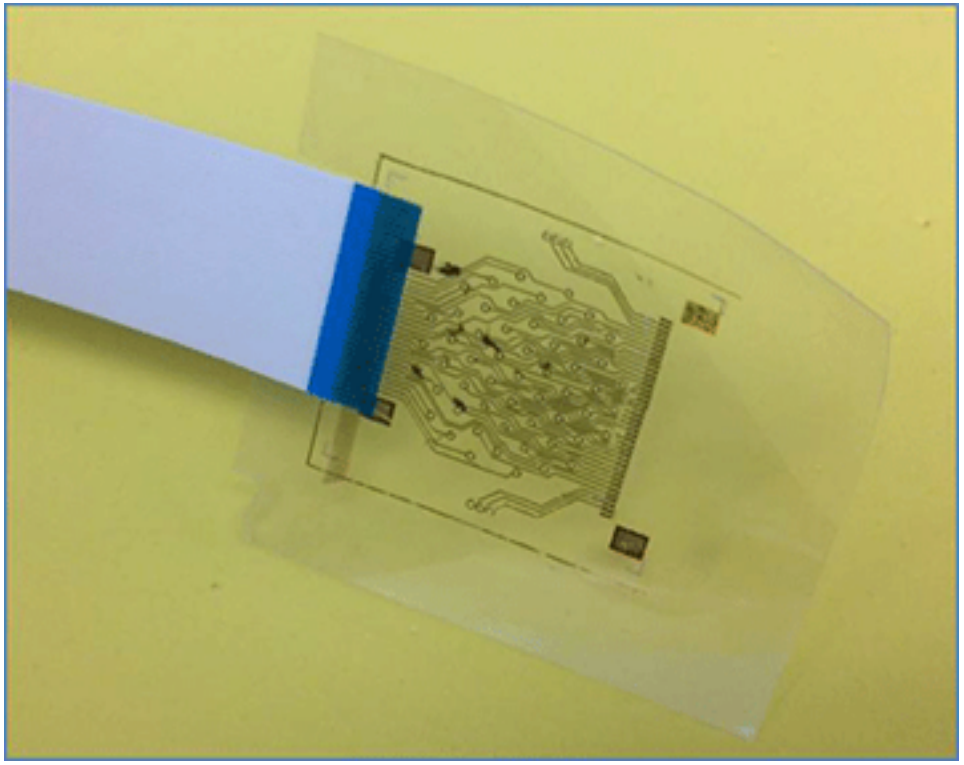
How The Platform Works

proteus DIGITAL HEALTH

The ingestible sensor is technology you swallow. It's made entirely of ingredients found in food and activated upon ingestion. You take it alongside your medications, capturing the exact time of ingestion.

Your body powers the ingestible sensor. With no battery and no antenna, your stomach fluids complete the power source and your body transmits the unique number generated by the sensor.



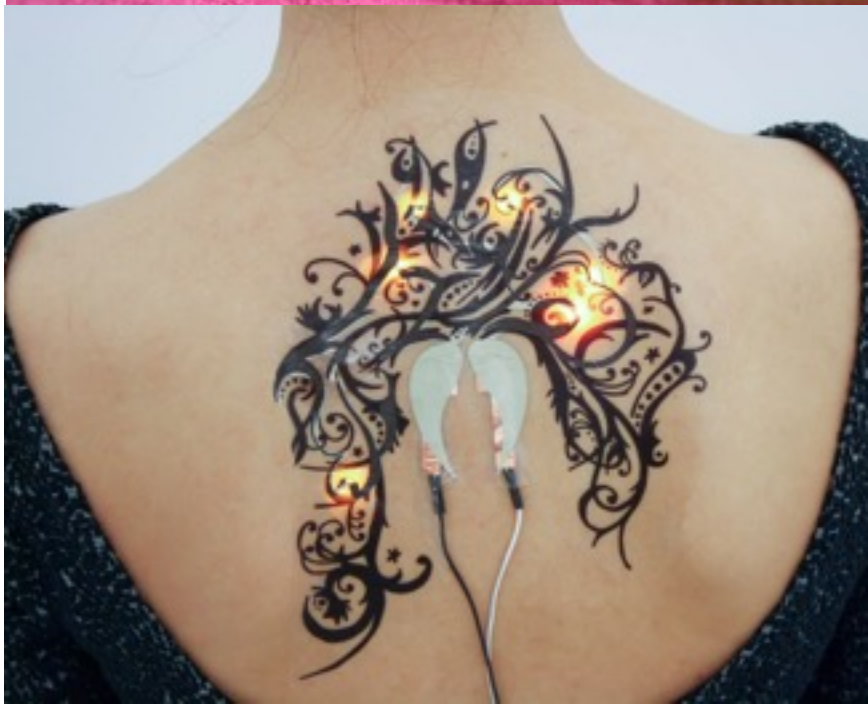


skin and epidural computing

SKINTILLATES

Joanne Lo

epidermis electronics



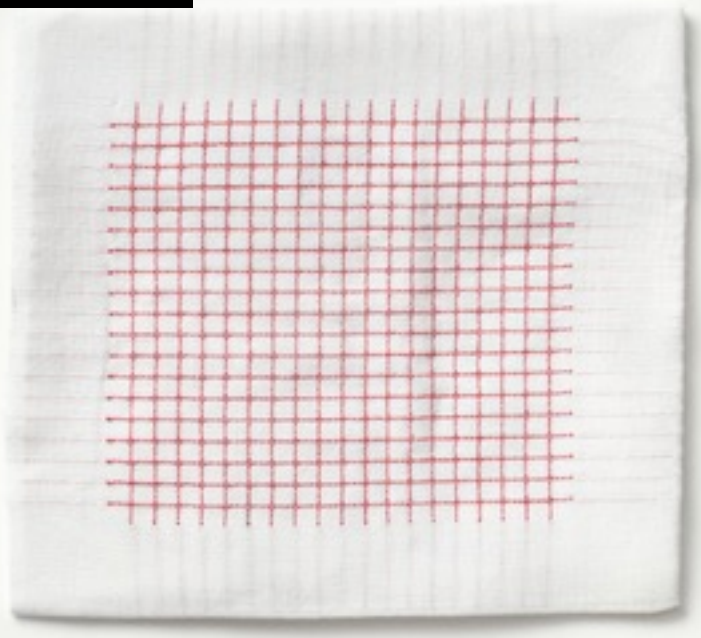
cosmetic computing

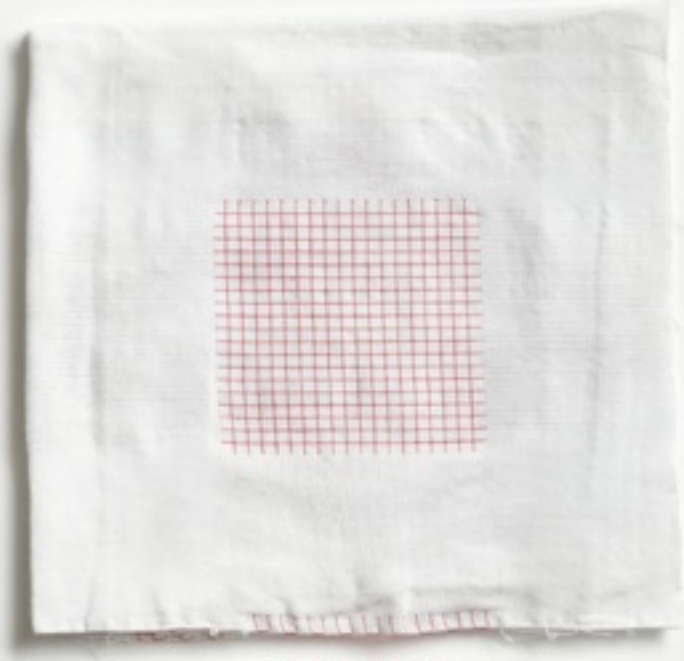
NEO-WEARABLES

Joanne Lo

PROJECT JACQUARD

Google ATAP





Third Ear, Stelarc, 2008

Hugh Herr, MIT Media Lab

Photo by SparkFun, Maker Faire 2014

EyeWriter

Hövding

EVOLUTION OF SMART WATCHES

Pulsar P1
by Hamilton 1972

Casio C-80
1980

Pulsar NL C01
by Seiko 1982

24 bytes RAM

Seiko Data 2000
from 1983

Seiko RC-1000
1984

2 KB RAM

Casio TC-600-1
1984

Casio AT-550-7
1984

Casio AT-550-7

1984

NOW... THE INVISIBLE CASIO CALCULATOR WATCH

Finger-write your figures on the watch face.

Introducing the timepiece that adds another dimension to watch technology. This new CASIO combines state-of-the-art micro-computer technology with the latest styling to give you an elegant timepiece with a multitude of functions.

And the most remarkable function of all is this... The watch face actually reads and computes math problems you trace on its face.

And there's more, much more... for less than $100.00.

ELECTRO-TOUCH TECHNOLOGY.

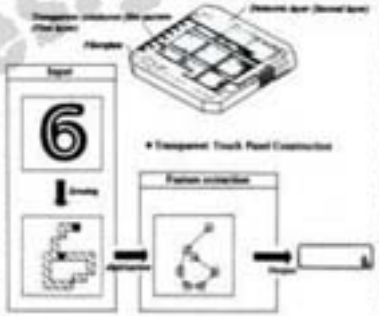
This handsome and superbly stylish timepiece has a transparent crystal that reads finger-strokes you trace across its face. Each figure and math symbol you outline appears on the background digital display. Take your finger across twice (in) and the answer presents itself like magic.

No keys, no keyboards, no need to use stylus or pen! Even the broadest fingers will work. Add, subtract, multiply, divide — perform chain and mixed calculations to eight places, plus decimal. There's even an indicator telling you which function is being performed.

DIGITAL PRECISION, ANALOG STYLE.

This handsome CASIO was created exclusively for the man who recognizes exceptional styling. And that's what you get in 12-hour or 24-hour digital time. A pre-programmed calendar is set until the year 2019. It's a handsome and functional way to wear time with accuracy to 1/2 second per day.

HERE'S HOW THIS MARVEL WORKS



PRECISION ALARM AND STOPWATCH.

You can program this multi-talented wrist alarm for daily events. To wake you up.

WE INTRODUCE IT AND WE GUARANTEE IT.

When we first heard the engineers at CASIO were on the brink of perfecting a finger-trace recognition calculator watch, we had hopes of being the first to offer it. And now that's a reality.

Because this innovative timepiece is now available only through On The Run, to be assured earliest delivery, please order yours now. Chrome and stainless model **AT-550** is only **$99.95** and gold-plated model **AT-550G** is **$119.95.**

See how this handsome accessory can be worn anytime, anywhere. Discover the convenience of finger-trace calculation and all the other special features of this talented timepiece. Once you see this handsome and functional timepiece, you're sure to want to keep it. If not, we guarantee your satisfaction. Simply return it in new condition within 30 days for a full and courteous refund. One-year warranty included.

CREDIT CARD HOLDERS ORDER TOLL-FREE TODAY.

To order, call toll-free number below, or send a check or money order for the total amount **plus $2.50** for the first watch, $1.00 for each additional watch for shipping and insurance. Add an additional $2.00 for UPS air delivery. MD residents add 4% tax.

800-437-4385

Casio AT-550-7
1984

Seiko Receptor
1990

OnHand PC
1998

128 KB RAM
16 bit CPU
102x64 mono screen
Apps in C

IBM + Citizen Linux
Smartwtch , 2002

Microsoft SPOT
Watch
2004

Samsung S9110
Watch Phone, 2009

Apple iPod Nano
2011

Motorola's
Motoactv, 2011


109H


JAWBONE


FUEL


RUN


12:45
Mon, 24 Feb


7500

Pebble, 2013

ARM Cortex-M3
Pebble OS (FreeRTOS)
Processing on watch

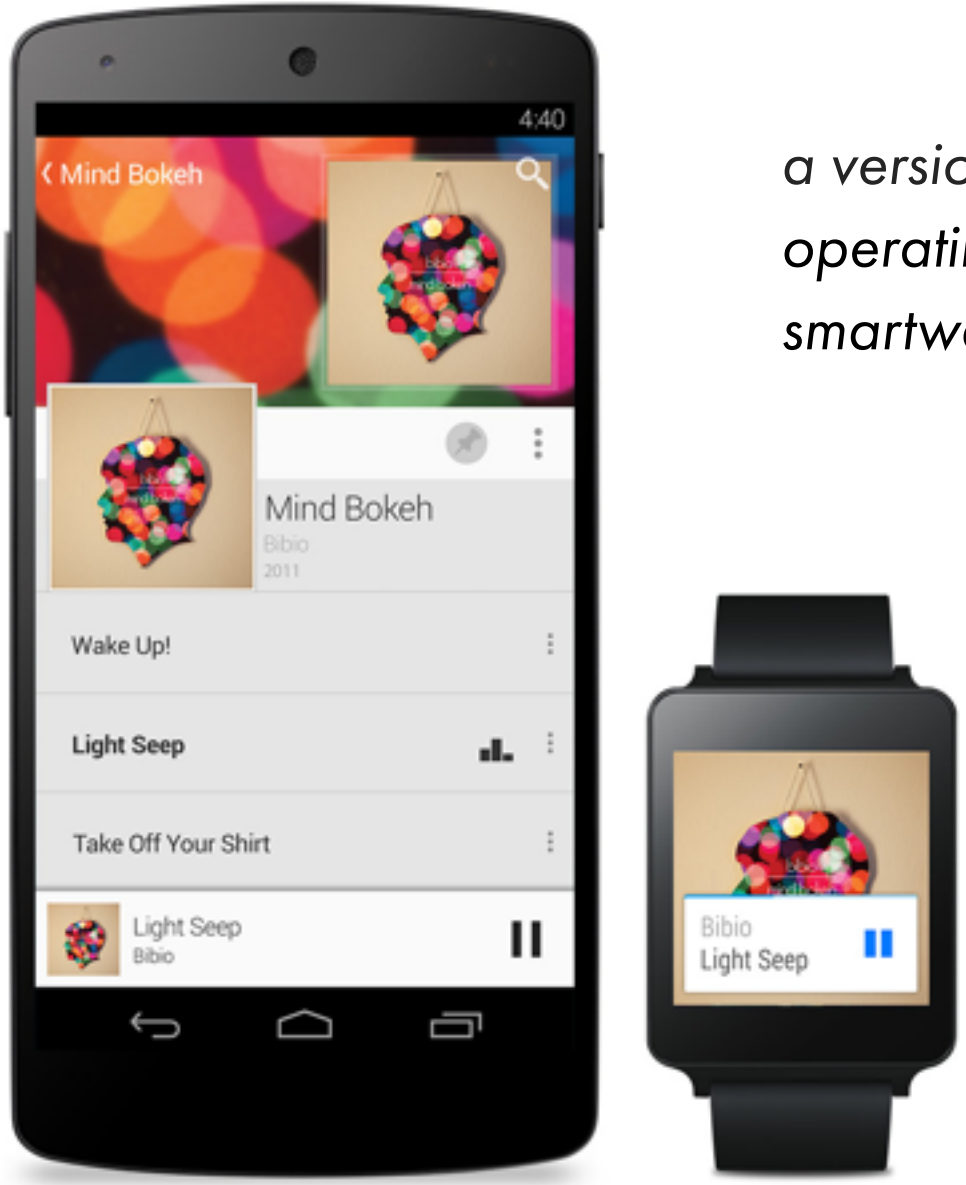
e-Ink 144x168 pixels
vibrating motor
magnetometer
ambient light
accelerometer

Samsung Galaxy Gear, 2013

800 MHz CPU
320 x 320 pixel square touchsceen
1.9 MPixel camera
4 GB memory
512 MB RAM

accelerometer
gyroscope
BLE
Phone calls

Android Wear, 2014



a version of Google's Android operating system designed for smartwatches and other wearables

Asus ZenWatch, 3 Sep 2014

Apple Watch 2015

iWatch

Because style is timeless


8:20


12:00
Fri, Jan 31
6:30
Fri, Jan 31
Rise and Shine
12:00
Fri, Jan 31
Healthbook
12:00
Fri, Jan 31

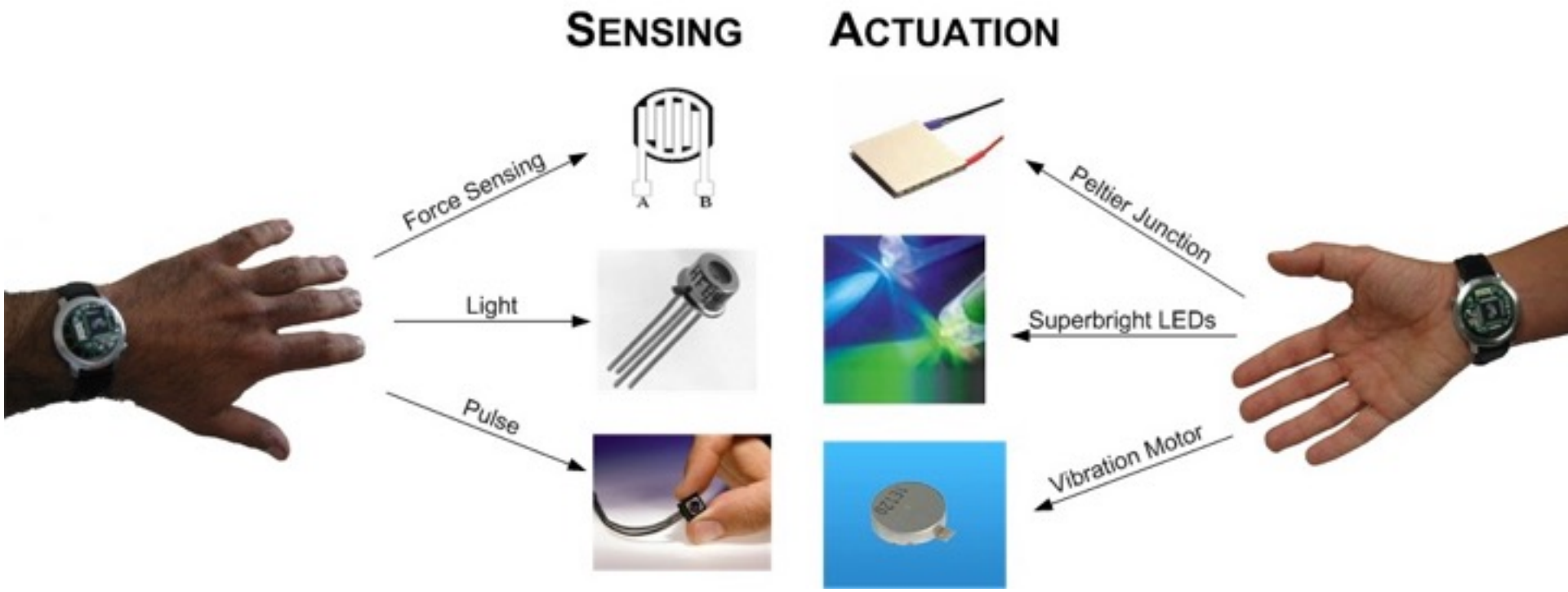

12:50

Connexus

eric paulos (2002)


4.00M
ATMEL

CONNEXUS SENSING AND ACTUATION



Real Touch, Apple 2015

Tap. Let friends or loved ones know you're thinking of them with a silent, gentle tap they'll feel on the wrist. You can even customize taps for different people.

Heartbeat. When you press two fingers on the screen, the built-in heart rate sensor records and sends your heartbeat. It's a simple and intimate way to tell someone how you feel.

OPPORTUNITIES

- Experience of retrieving information was the key principle driving information access through a device
- User experience was affected by how users could control their personal flow of information
- Sensor data based on user context and information accessibility
- Smartwatches that satisfy user requirements most adequately will survive
- Smartwatch interface has been predicted to replace the smart phone for simple tasks (i.e. viewing short text and accessing sensory data)
- UI with watch involving flexible input and rapid text entry are vital

SMARTWATCH APPLICATIONS

- notifications for emails, calls, text messages & social media activity
- stock prices
- activity tracking (movement, sleep, estimates of calories burned)
- remote controls for smartphones, cameras & home appliances
- turn-by-turn directions (using the GPS receiver in a smartphone or tablet)
- display of RSS and JSON feeds
- custom watch faces

SMARTWATCH APPLICATIONS

- cycling app to measure speed, distance & pace through GPS
- golf rangefinder app supporting more than 25,000 courses
- IFTTT integration for notifications
- listen to music
- To do lists (groceries, errands, etc.)
- Calendars and appointments
- Health
- .....

SMARTWATCH UI INSIGHTS

- flick on
- talk to watch
- interface with phone lock
- touch gestures and shortcuts
- new on body sensing
- emergency contact
- messages


would be an even function
of the lag τ = s − t. This
gives the more familiar form
$$R(\tau) = \frac{\mathrm{E}[(X_t - \mu)(X_{t+\tau} - \mu)]}{\sigma^2},$$
and the fact that this is an
even function can be stated

SMARTWATCH CHALLENGES

- screen size, shape, and legibility
- power
- connectivity
- context awareness
- sensing
- I/O O=haptic, aural, vibration, shape…
- familiar interfaces or novel interaction models
- social acceptance

Moto 360

1.56″ 320x290 at 205 ppi Display

Mic + Speech Recognition via Google Voice

Backlight

TI OMAP 3 Processor with 4GB storage

BLE with Android Phone (4.3 or higher really 5.0)

Pedometer

Optical heart rate

Single Physical Button

Vibration Motor

Wireless Charging