

# The Modern Cyborg II

## Biohacking, Body Modification and the “Cyborgian Era”

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# A Brief Overview

- Project Outline
- Psymbiote & Shared Conceptual Designs
- Biohackers/DIY Biology
- Questions & Predictions
- Societal Implications & Contention

# PROJECT

## GOAL

To create a wearable jewelry piece that monitors heart rate through a pulse sensor on the earlobe and conveys it through the flashing of LED bulbs.

## PURPOSE

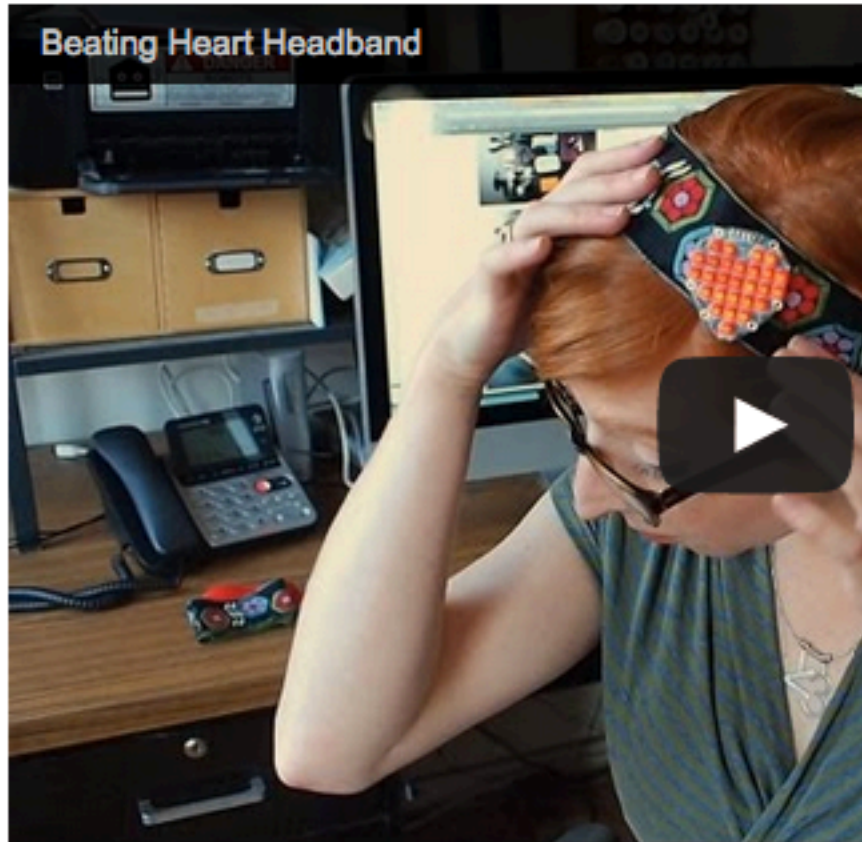
To enable new intimacy and level of connection in human interaction.



<http://www.youtube.com/watch?v=wBys8HgBdrs&feature=youtu.be>

# OTHER PROJECTS

## HeartBeat Headband




Homage to The Hitchhiker's Guide, via Pulse Sensor and Arduino:



# CODE WALKTHROUGH

# PulseSensor

 0 items (\$0.00)

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[Getting Started Video](#)

[Pulse Sensor at TEDx Kids](#)

[Announcing code version 1.1 \( It's out of beta! \)](#)

[Announcing..\(drum roll please\)..Pulse Sensor Amped!](#)

[Emotional Response in Entertainment](#)

[HeartBeat Headband DIY Video](#)

[Article in Make Magazine Vol 29, Jan 2012](#)

[Pulse Sensor Now Available at Maker Shed](#)

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## Pulse Sensor Amped Arduino Code v1.2 Walkthrough

Before we get into the line-by-line stuff, there's some things to know about the signal we are going to process, and the known techniques of doing it. No sense in reinventing the algorithm!

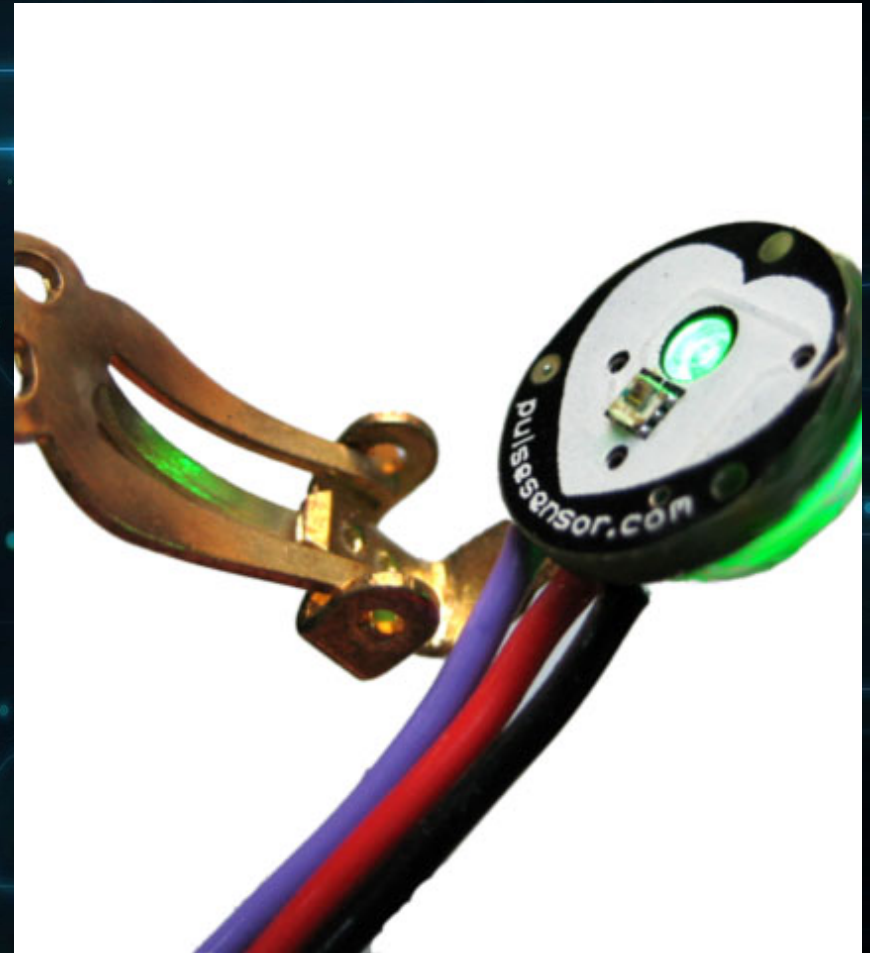
The Pulse Sensor that we make is essentially a photoplethysmograph, which is a well known medical device used for non-invasive heart rate monitoring. Sometimes, photoplethysmographs measure blood-oxygen levels (SpO2), sometimes they don't. The heart pulse signal that comes out of a photoplethysmograph is an analog fluctuation in voltage, and it has a predictable wave shape as shown in figure 1. The depiction of the pulse wave is called a photoplethysmogram, or PPG. Our latest hardware version, Pulse Sensor Amped, amplifies the raw signal of the previous Pulse Sensor, and normalizes the pulse wave around V/2 (midpoint in voltage). Pulse Sensor Amped responds to relative changes in light intensity. If the amount of light incident on the sensor remains constant, the signal value will remain at (or close to) 512 (midpoint of ADC range). More light and the signal goes up. Less light, the opposite. Light from the green LED that is reflected back to the sensor changes during each pulse.

# TECHNOLOGY

## PULSE SENSOR AMPED

“Pulse Sensor Amped is a greatly improved version of the original Pulse Sensor, a plug-and-play heart-rate sensor for Arduino and Arduino compatibles. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heart-rate data into their projects.”

- Ear Clip, perfectly sized to the sensor. It can be hot-glued or epoxied to the back of the sensor to get reading from an ear lobe.

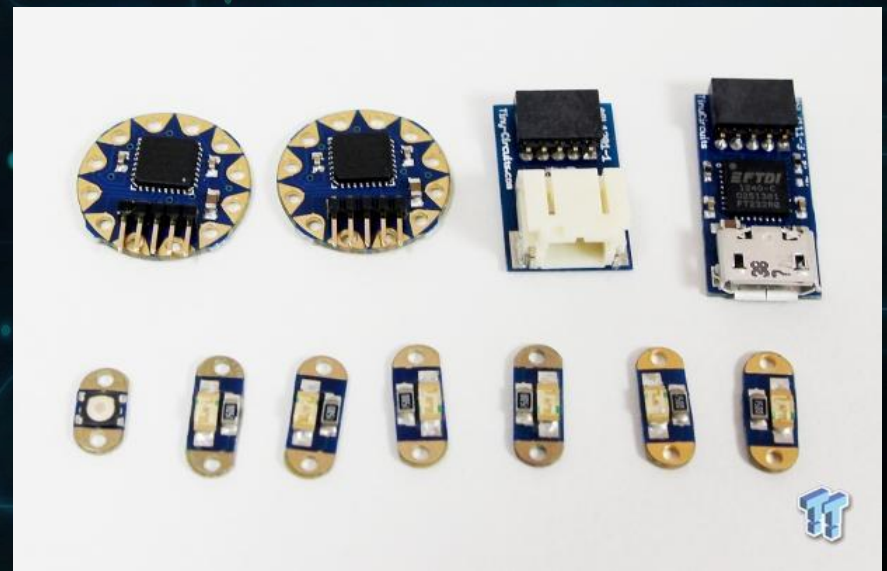


# TECHNOLOGY

## TINYCIRCUITS “TINYLILY”

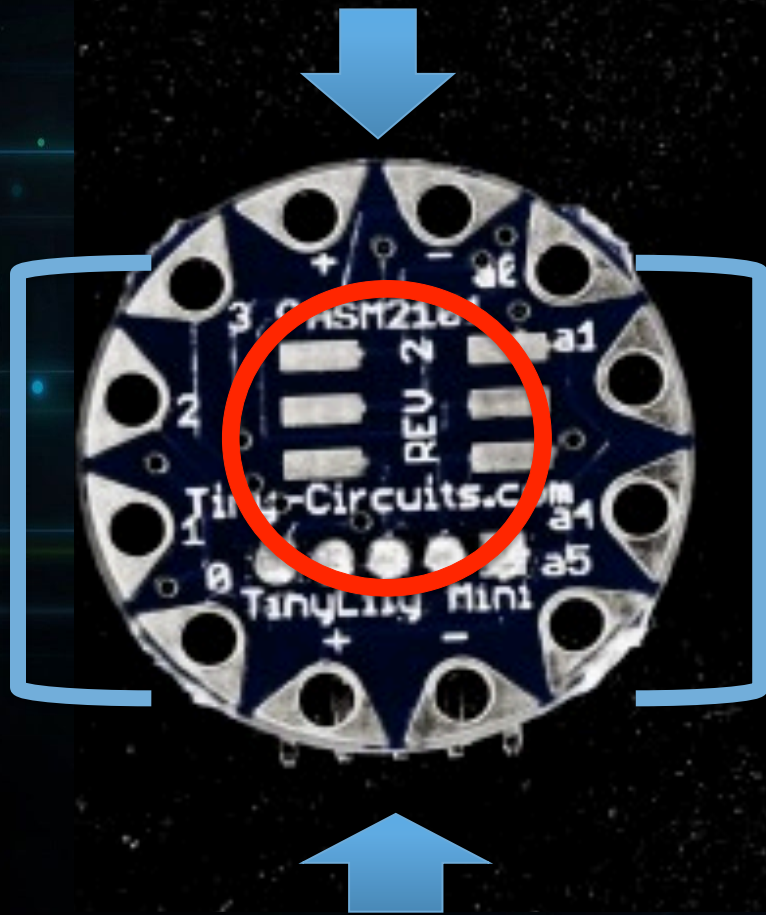
“Arduino compatible module in an ultra compact package. Designed to be used in e-textile and wearable applications, the TinyLily Mini is very similar to the Arduino LilyPad, with the same processing power and Arduino software compatibility – but at 1/12th the size!”

- Atmel Atmega328P processor Washable
- Sewtabs for 8 I/O (4 Digital, 4 Analog / Digital) and 4 Power Sewtabs (2 for power, 2 for ground)





# THE BRAIN



## PulseSensorAmped\_Arduino\_1dot1 §

```

volatile int rate[10];           // used to hold last ten IBI values
volatile unsigned long sampleCounter = 0;      // used to determine pulse timing
volatile unsigned long lastBeatTime = 0;      // used to find the inter beat interval
volatile int P =512;            // used to find peak in pulse wave
volatile int T = 512;          // used to find trough in pulse wave
volatile int thresh = 512;     // used to find instant moment of heart beat
volatile int amp = 100;        // used to hold amplitude of pulse waveform
volatile boolean firstBeat = true; // used to seed rate array so we startup with reasonable BPM
volatile boolean secondBeat = true; // used to seed rate array so we startup with reasonable BPM

```

```

void interruptSetup(){
  // Initializes Timer2 to throw an interrupt every 2mS.
  TCCR2A = 0x02; // DISABLE PWM ON DIGITAL PINS 3 AND 11, AND GO INTO CTC MODE
  TCCR2B = 0x05; // DON'T FORCE COMPARE, 256 PRESCALER
  OCR2A = 0X7C; // SET THE TOP OF THE COUNT TO 124 FOR 500Hz SAMPLE RATE
  TIMSK2 = 0x02; // ENABLE INTERRUPT ON MATCH BETWEEN TIMER2 AND OCR2A
  sei(); // MAKE SURE GLOBAL INTERRUPTS ARE ENABLED
}

// THIS IS THE TIMER 2 INTERRUPT SERVICE ROUTINE.
// Timer 2 makes sure that we take a reading every 2 milliseconds
ISR(TIMER2_COMPA_vect){
  cli(); // disable interrupts while we do this
  Signal = analogRead(pulsePin); // read the Pulse Sensor
  sampleCounter += 2; // keep track of the time in mS with this variable
  int N = sampleCounter - lastBeatTime; // monitor the time since the last beat to avoid noise

```

```

// find the peak and trough of the pulse wave

```

Done compiling.

Binary sketch size: 4,462 bytes (of a 30,720 byte maximum)



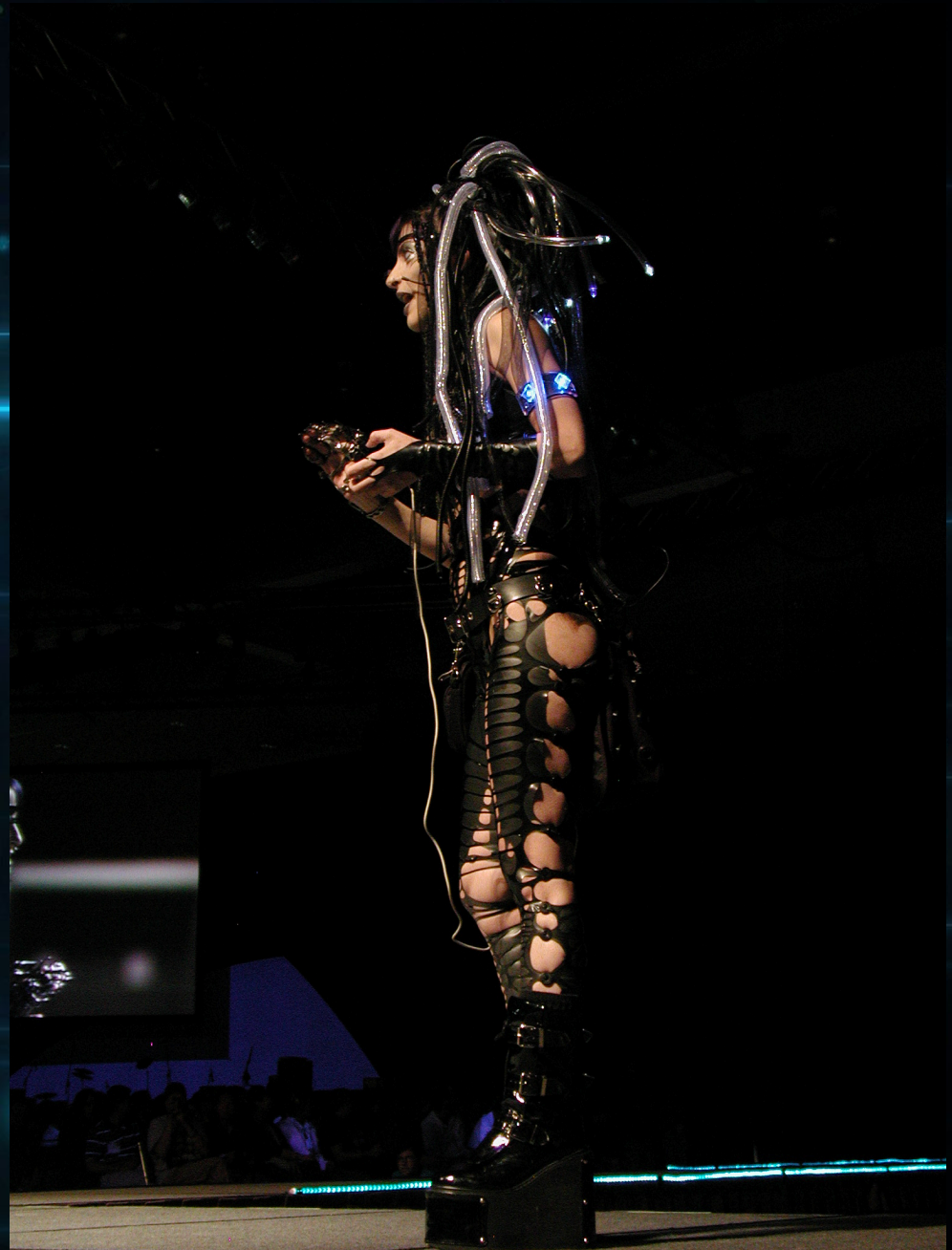
# PYSMBIOTE

Isa Gordan & Jesse Jarrell

“Effort to place myself at that conceptual terrain—that collision of bodies and machines”

- Exploration in creative cybernetics and cyborg performance persona

“Why would you want to wear your heart on your sleeve? Using your biometric data, projecting it out in the world, enables people to understand you on a new level”



# CONTENTION WITHIN

## **Cyborg Community: Debates**

- Wearable Tech vs. Integrated Tech
- Mainstream Centralization vs. Hacker Mentality
- Capitalizing on Individuality

## **Health & Safety**

- Individual Safety Issues
- Potential for Bioterrorism
- Regulation vs. Limiting Innovation
- Regulation vs. Forced Dependency

# CONTENTION OUTSIDE

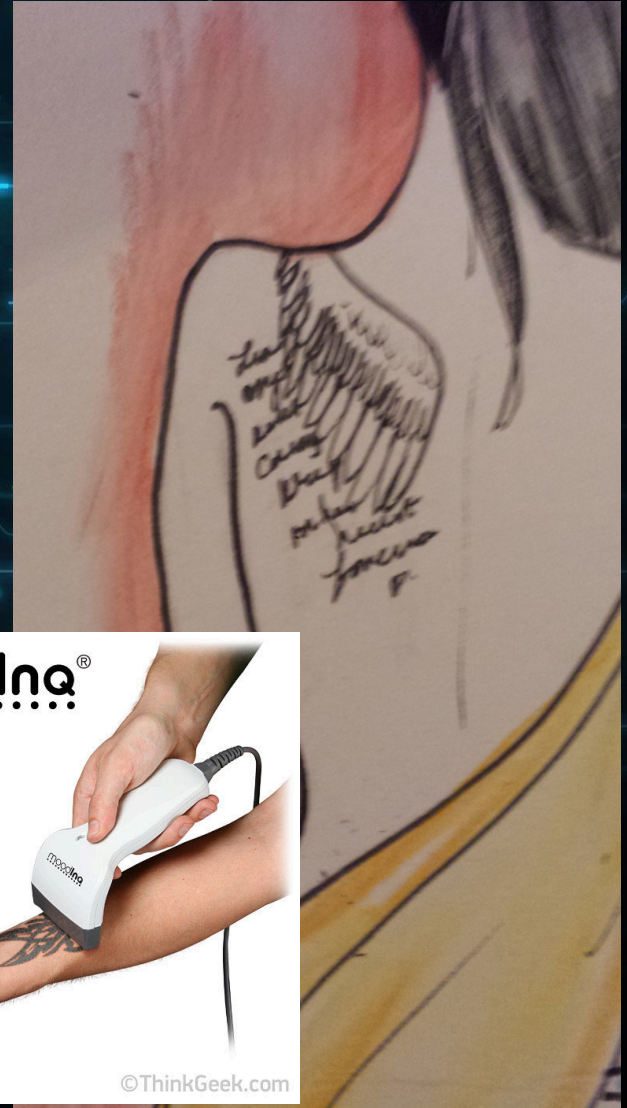
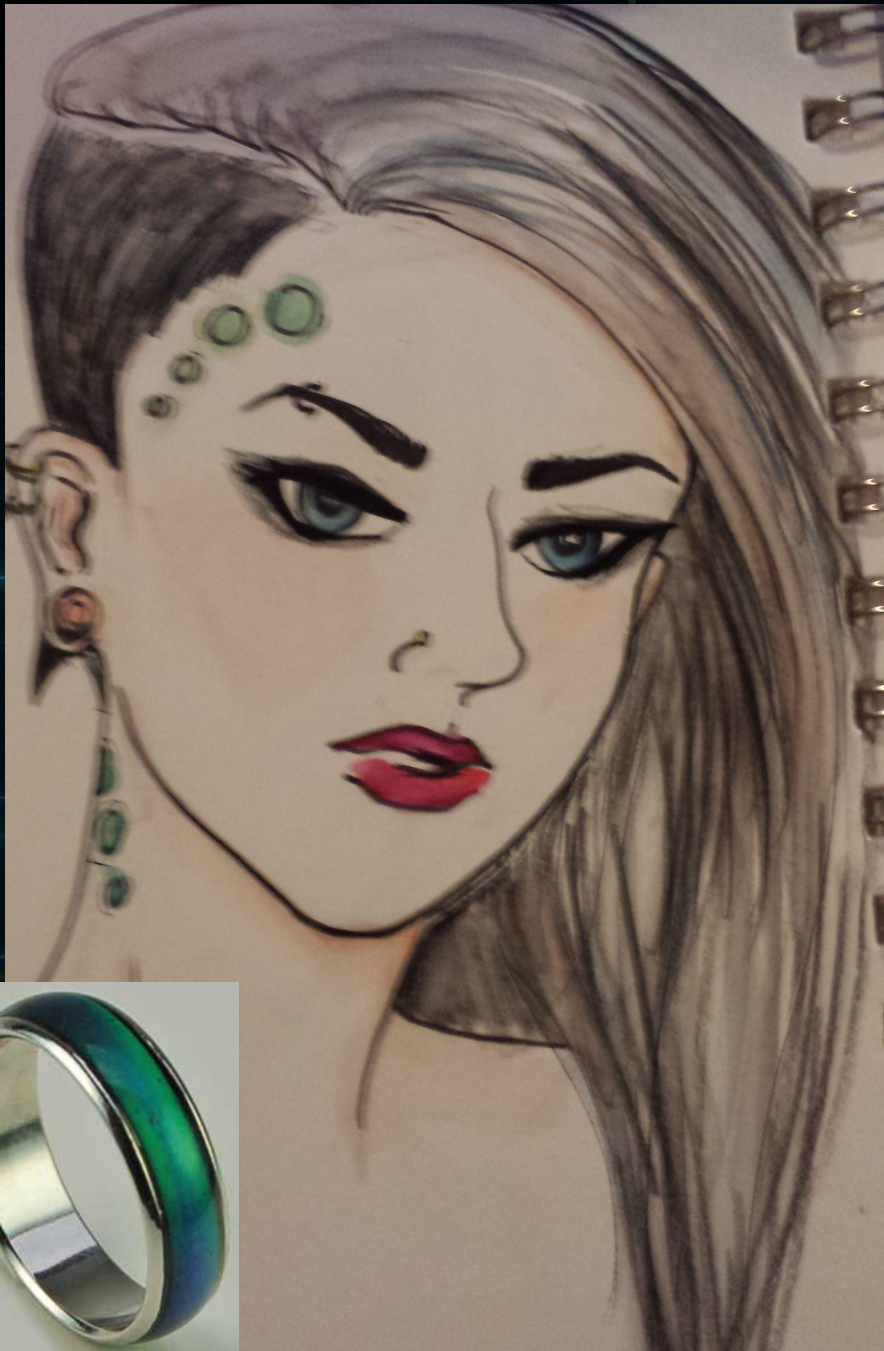
## Security & Commercialism

- Privacy & Security Issues
- Big Brother & Surveillance
- Commodification of Modification
- Generational and Inter-modification Competition →  
New “Racism”
- Wealth Gap: more money, better MODS

## Religion & Ethics

- Human body sacred
- New class systems and force social exclusion
- “Techno-Doping” as it has been termed
- Destruction of gender roles
- Will new modifications make society less gendered, less racist, and more socially minded?

# PREDICTIONS



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# BIOHACKERS

[http://  
www.tubechop.com/  
watch/4258650](http://www.tubechop.com/watch/4258650)





# ++ SOCIETAL IMPLICATIONS ++

TECH → INDUSTRY → FASHION → PERCEPTION →  
INDIVIDUALITY → NEW SOCIETY

- “The boundary between science fiction and social reality is an optical illusion” (Latham 409)
- “Cyberpunk aesthetic often hails the modified body as a range of, and vehicle for, individual freedoms” (Pitts 155)
- “Participant Evolution” → better lives, create new industry, new jobs, spark invention and advance technology
- Open Source platforms → global collaboration and community
- “Man vs. Machine” to “Man & Machine”

The background is a dark blue gradient with a complex pattern of glowing blue and green lines and particles. The lines are horizontal and have a stepped, circuit-like appearance, with some segments being thicker and more prominent. Small, bright blue and green dots are scattered throughout the scene, some appearing to be part of the circuit lines. The overall effect is a futuristic, digital aesthetic.

Thank You