



# BINARY MARIONETTE

Evan Huggins, Aaron Nesser and Catlin Sikora



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By Evan Huggins, Aaron Nesser and Catlin Sikora

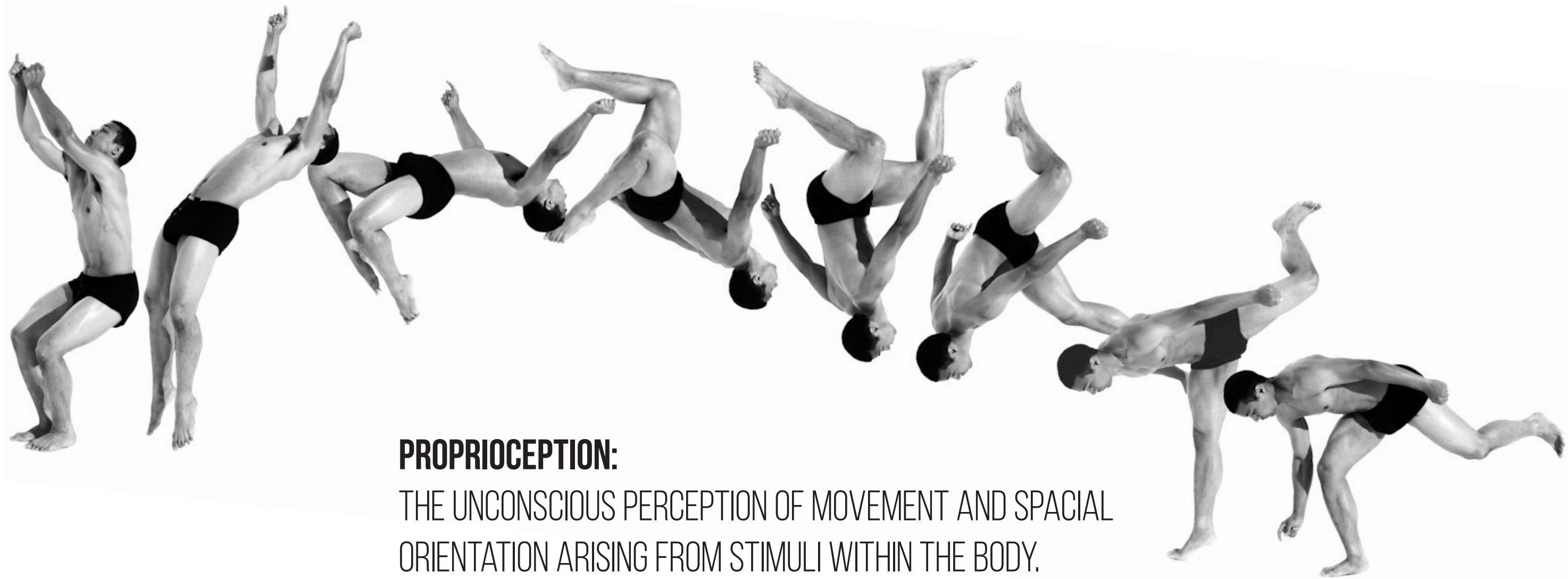
Wearable Technology Prototypes IND 516  
Professor Rebecca Pailes-Friedman  
Chairperson Constantin Boym  
Pratt Institute, Spring 2016

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**PROPRIOCEPTION:**

THE UNCONSCIOUS PERCEPTION OF MOVEMENT AND SPACIAL ORIENTATION ARISING FROM STIMULI WITHIN THE BODY.





**KINESTHETIC INTELLIGENCE:**

THINKING IN MOVEMENTS, INCLUDES THE ABILITY TO USE MOVEMENTS FOR EITHER SELF-EXPRESSION OR PRECISION TO ACHIEVE A GOAL.





## **WHAT IF YOUR CLOTHING COULD COMMUNICATE SPECIFIC MOVEMENT CUES IN REAL TIME?**

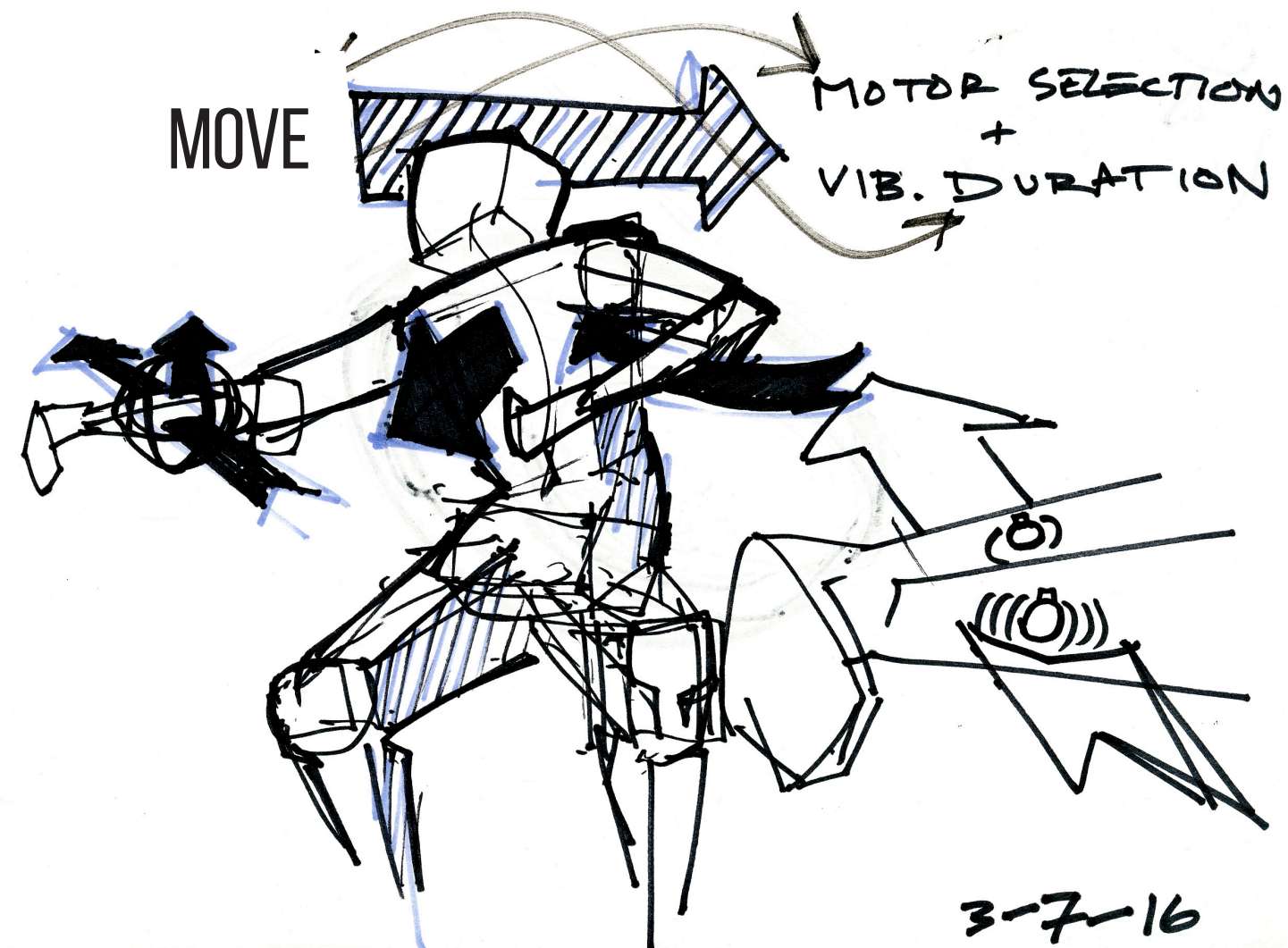
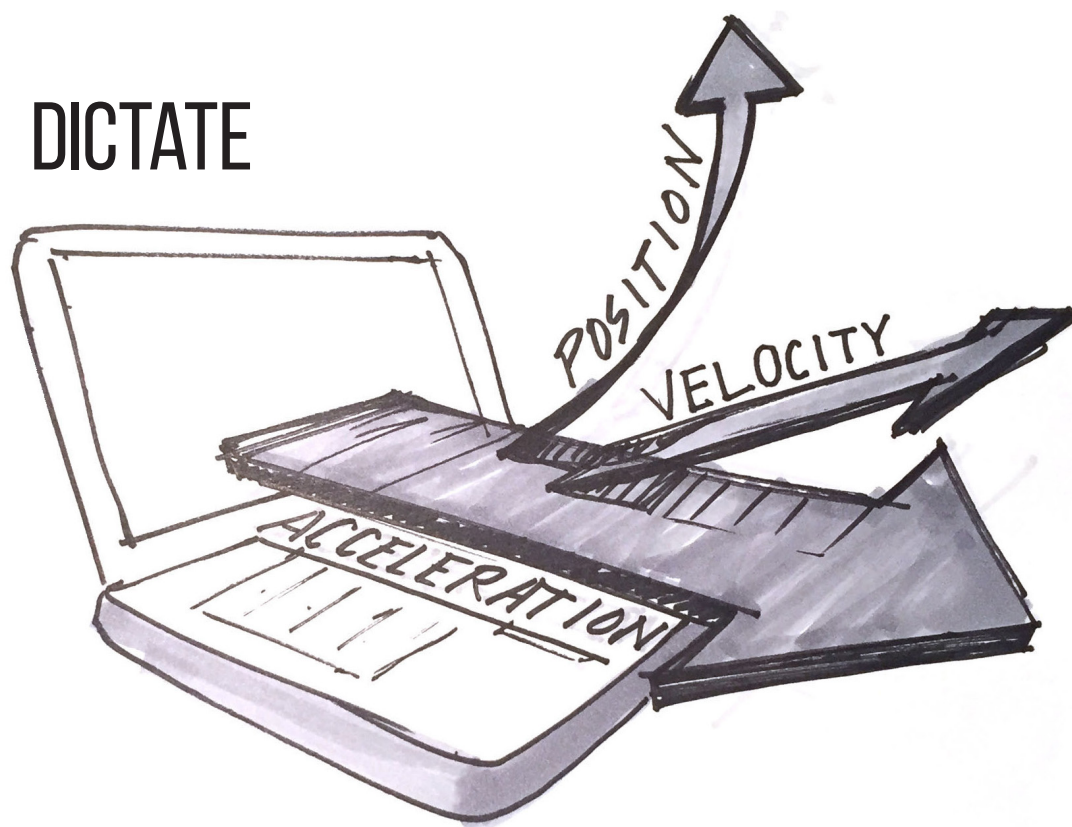
BINARY MARIONETTE IS A WEARABLE DEVICE  
THAT DIRECTS A USER'S BODY TO ACCOMPLISH  
MOVEMENT GOALS DICTATED BY ANOTHER  
PERSON FOR EDUCATION AND ENTERTAINMENT



# CONCEPT

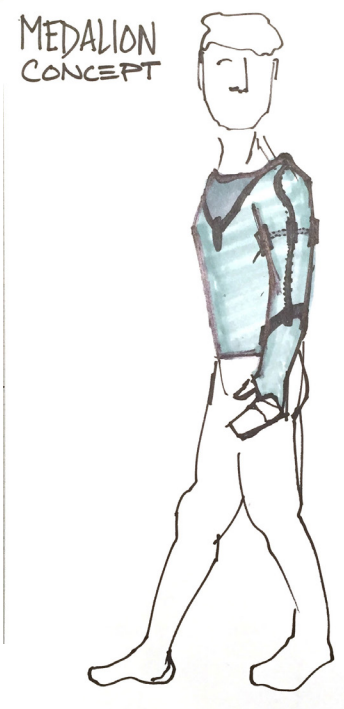
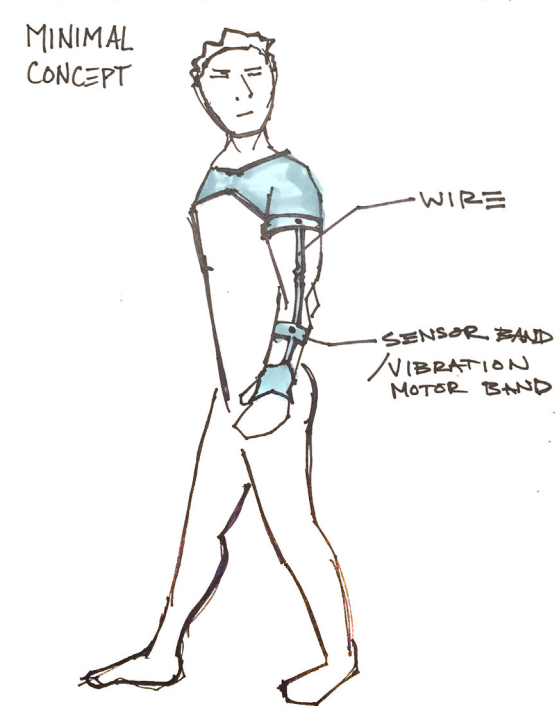
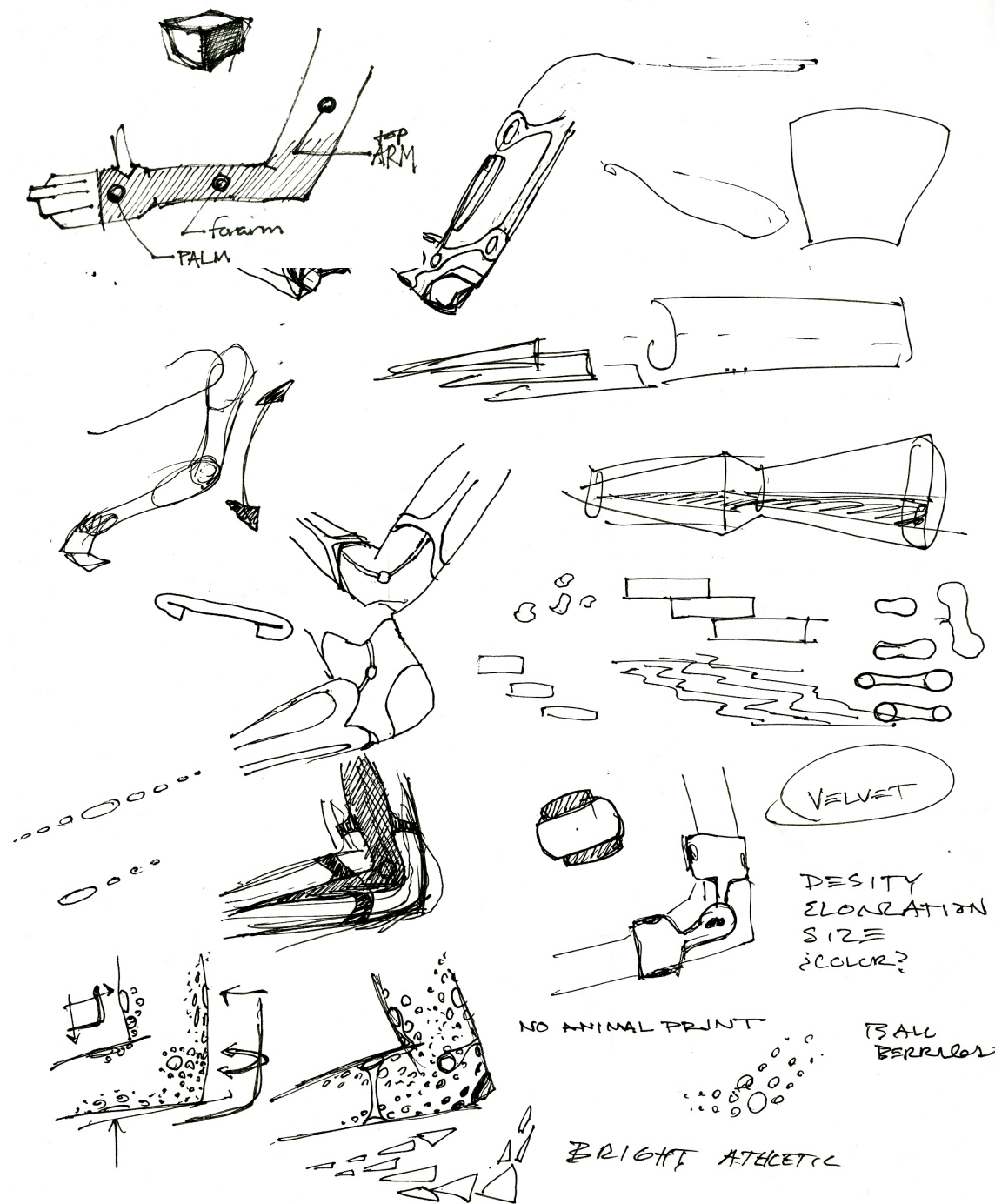
The Artifact requires two people: an operator, and a user. The operator inputs joint movement commands into a computer interface. The commands are

interpreted by the software and sent to the user. Movement data is communicated directly to the skin via haptic signals that invite specific movements by the user.

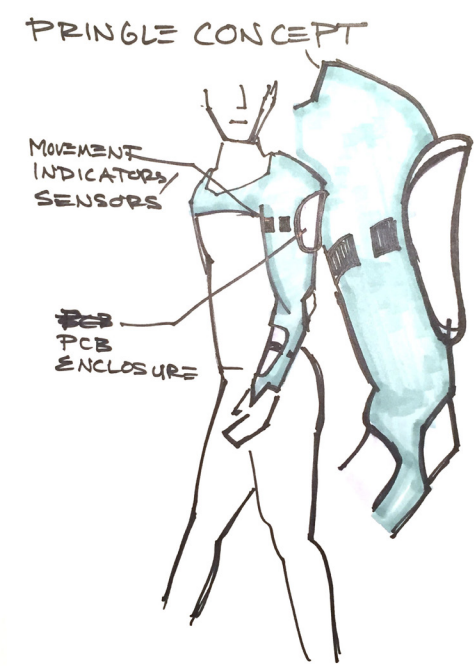
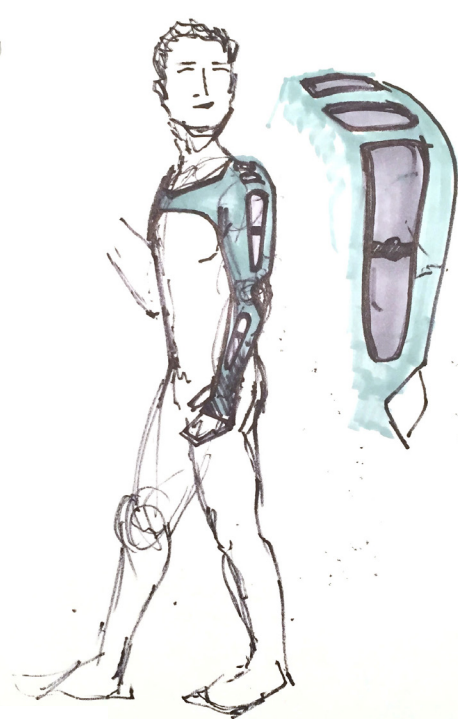




# CONCEPT



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We chose the arm as a starting point for the binary nature of the elbow joint. Various concepts were developed for a short jacket with embedded electronics paired with a long sleeve shirt underneath.



# RESEARCH

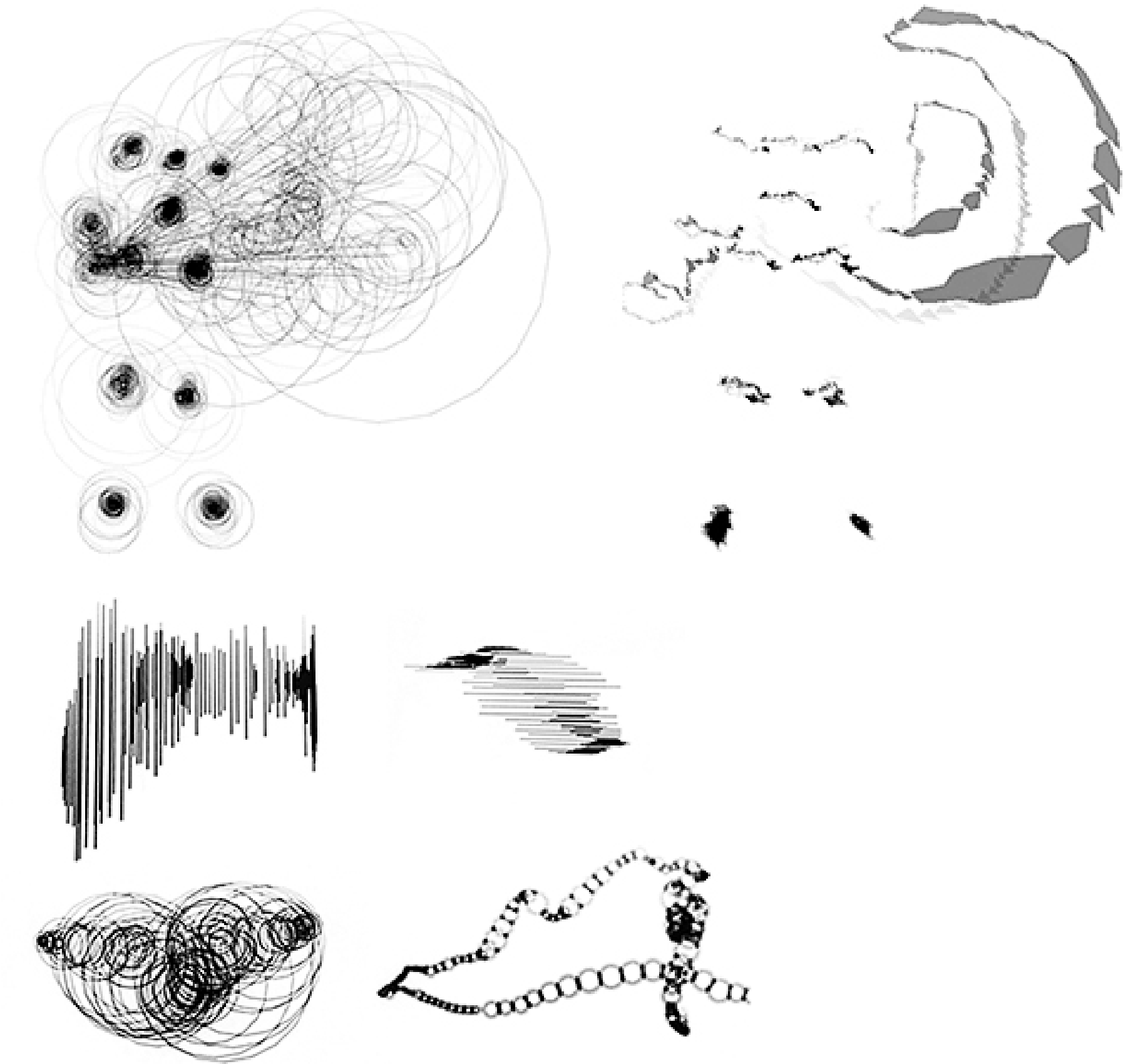
Precedent: Lineform  
Ken Nakagaki, Sean Follmer,  
Hiroshi Ishii  
MIT Media Lab



# RESEARCH

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SEMIOTIC RESOURCE	CORE MODALITIES	SALIENT CHARACTERISTICS	VISUAL DESCRIPTION
COMMUNICATIVE MOVEMENT	VELOCITY	SPEED the rate of change in an x-y-z number	SIZE OF MARK related to the change in velocity
	POSITION	LOCATION of velocity	PLACING OF MARK in the visualised body
	REPETITION	CONTINUATION OF MOVEMENT	RHYTHM in the visual trail
	FREQUENCY	USE OF TIMING	STRUCTURE in the visual trail



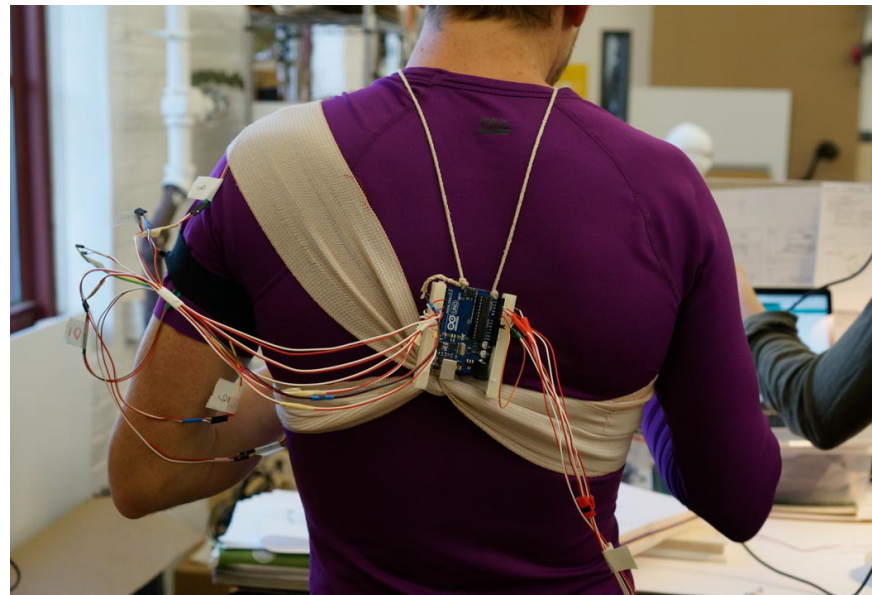


# PROTOTYPES: ELECTRONIC

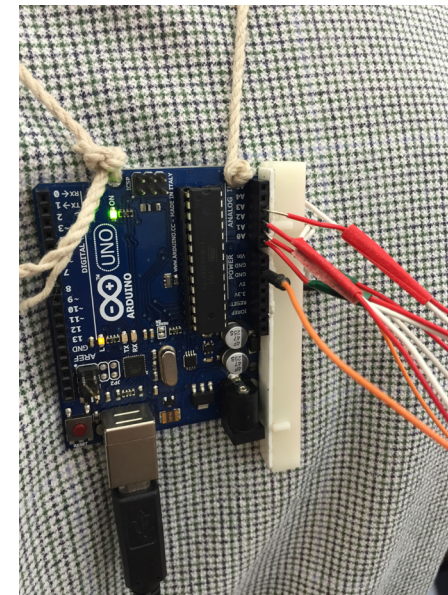
We proved our concept by calling and texting two smartphones tied to the body. We found that the vibration generated a movement cue.



Our second functional prototype was a set of 8 vibration motors, attached to an arm with Velcro straps and controlled by an Arduino.



Our third prototype was built into a system of Velcro straps with movable motors, that connected to a long sleeve compression shirt.



Our final prototype was built into a short jacket and used sliding buckles to adjust to the user. It was powered by an x-OSC board.



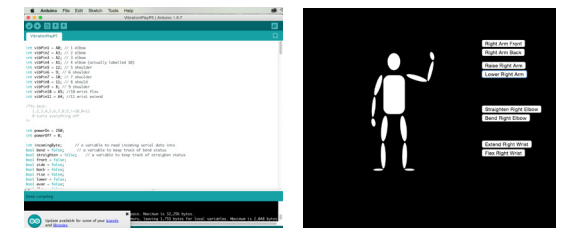
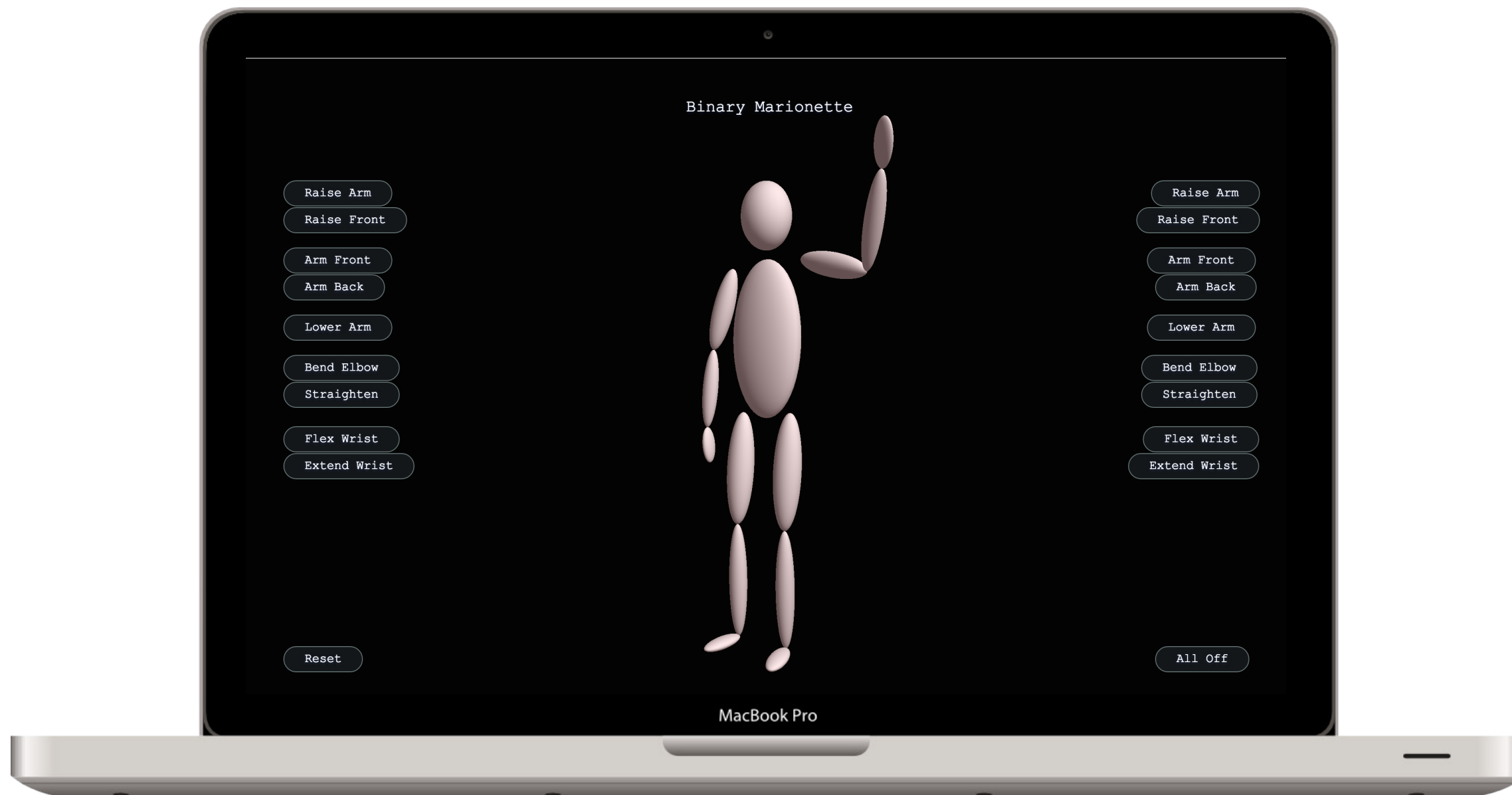


# PROTOTYPES: INTERFACE

The interface was first realized as a command interface within the Arduino IDE.

Using P5 software we developed a GUI with buttons that controlled a on-screen figure and the body control suit in concert.

The interface was refined to include a 3D-rotatable figure, and expanded to include both arms.



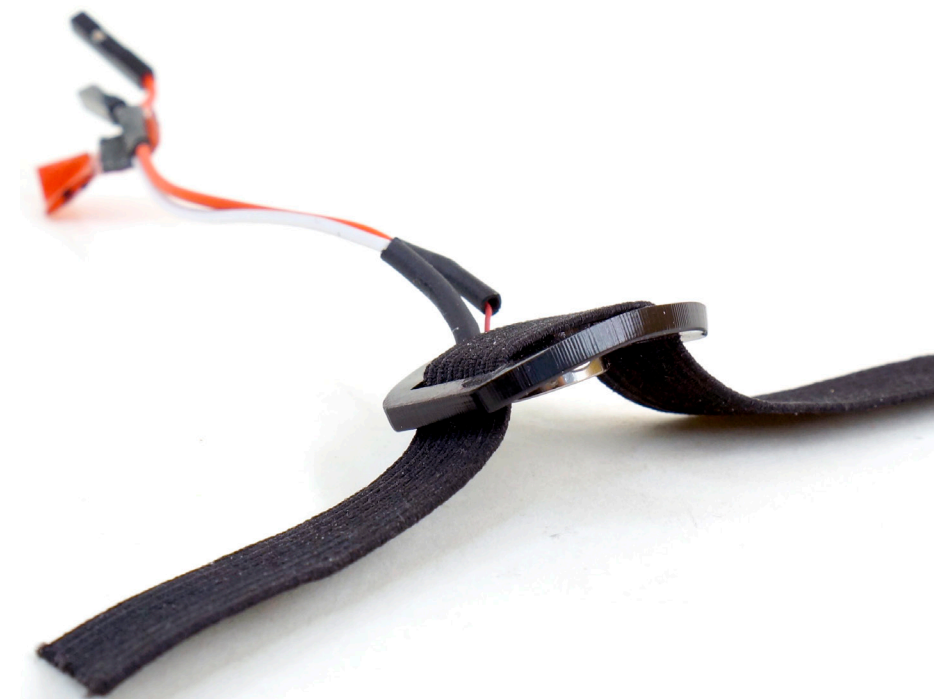
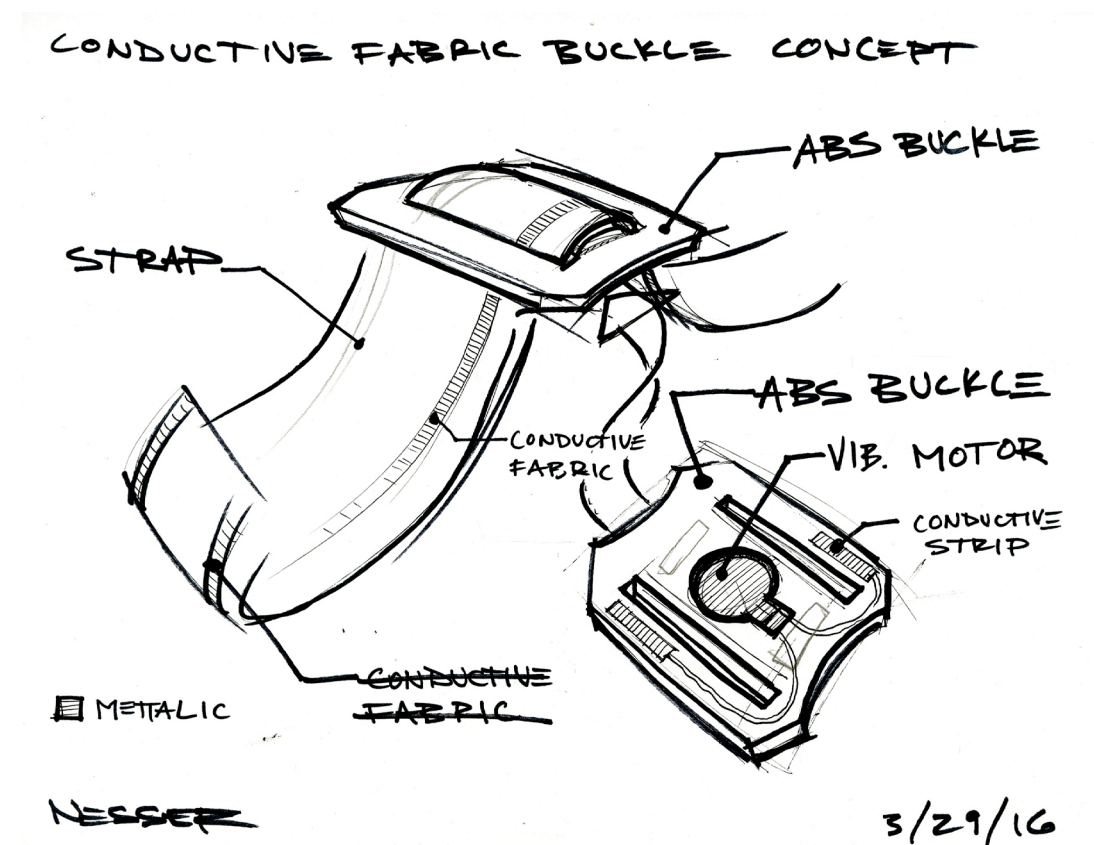


# PROTOTYPES: SLIDES



Custom slides were developed to house the vibration motors and slide along the bands.

The final slide was optimized for motor contact and user comfort. It's smaller size also minimized visibility through the garment.

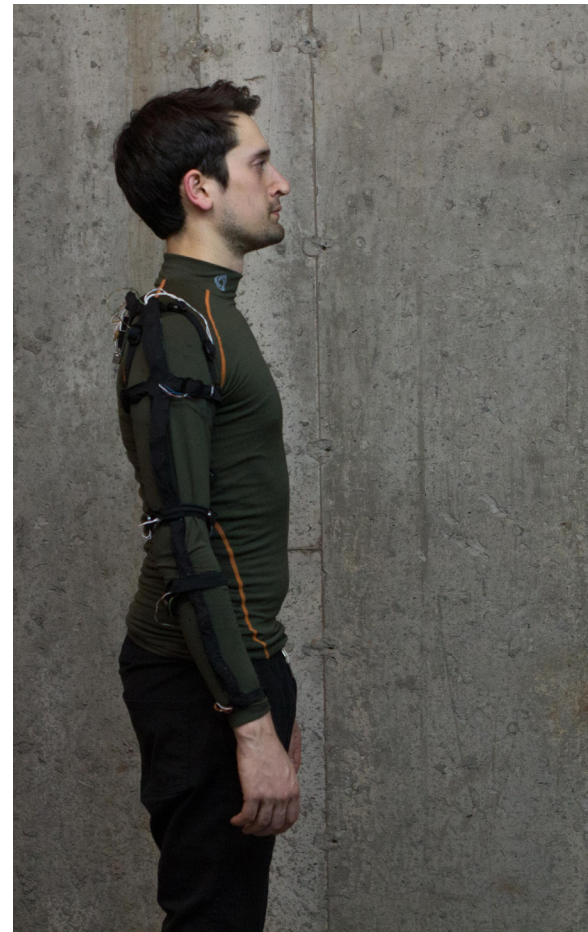
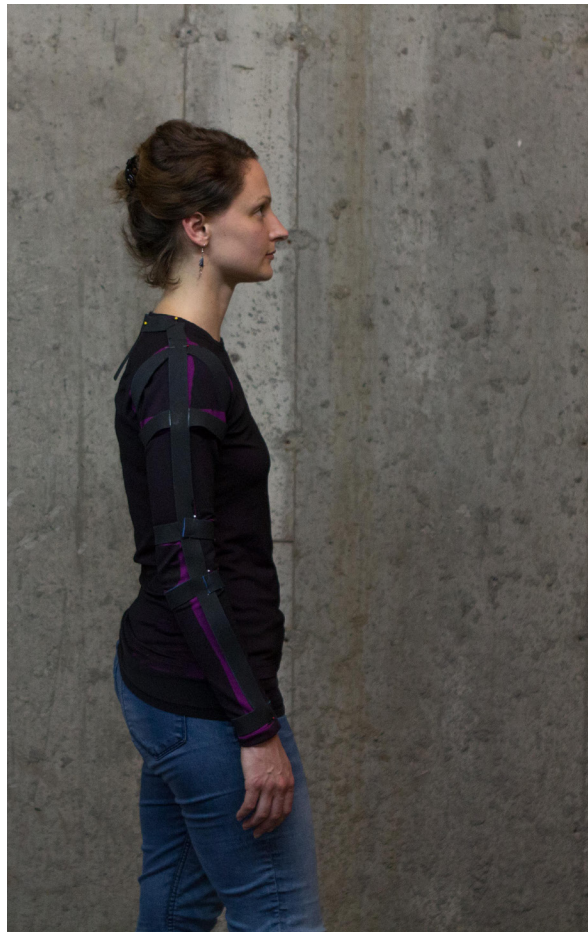




# PROTOTYPES: GARMENT



Patterns were developed initially as a collection of straps for maximum adjustability and sizability, and eventually as a jacket to house all of the electronics.





# USER TESTING

## THE SENSATION

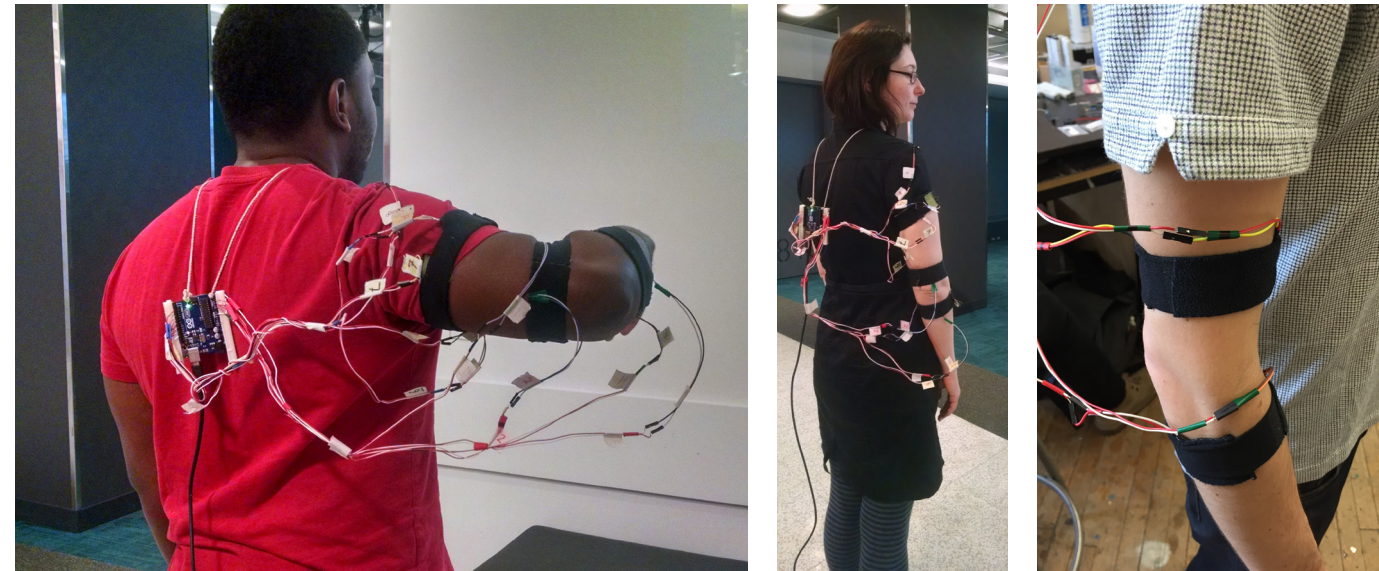
“buzzing like a bee” (3 people)  
“like a spa/massage” (3 people)  
“relaxing” (2 people)  
“not intrusive” (5 people)  
“uncomfortable” (3 people)  
“tickle” (2 people)

## THE EXPERIENCE

“control” (2 people)  
“space suit” (2 people)  
“movement initiation”  
“confusing with 1+ function” (4 people)

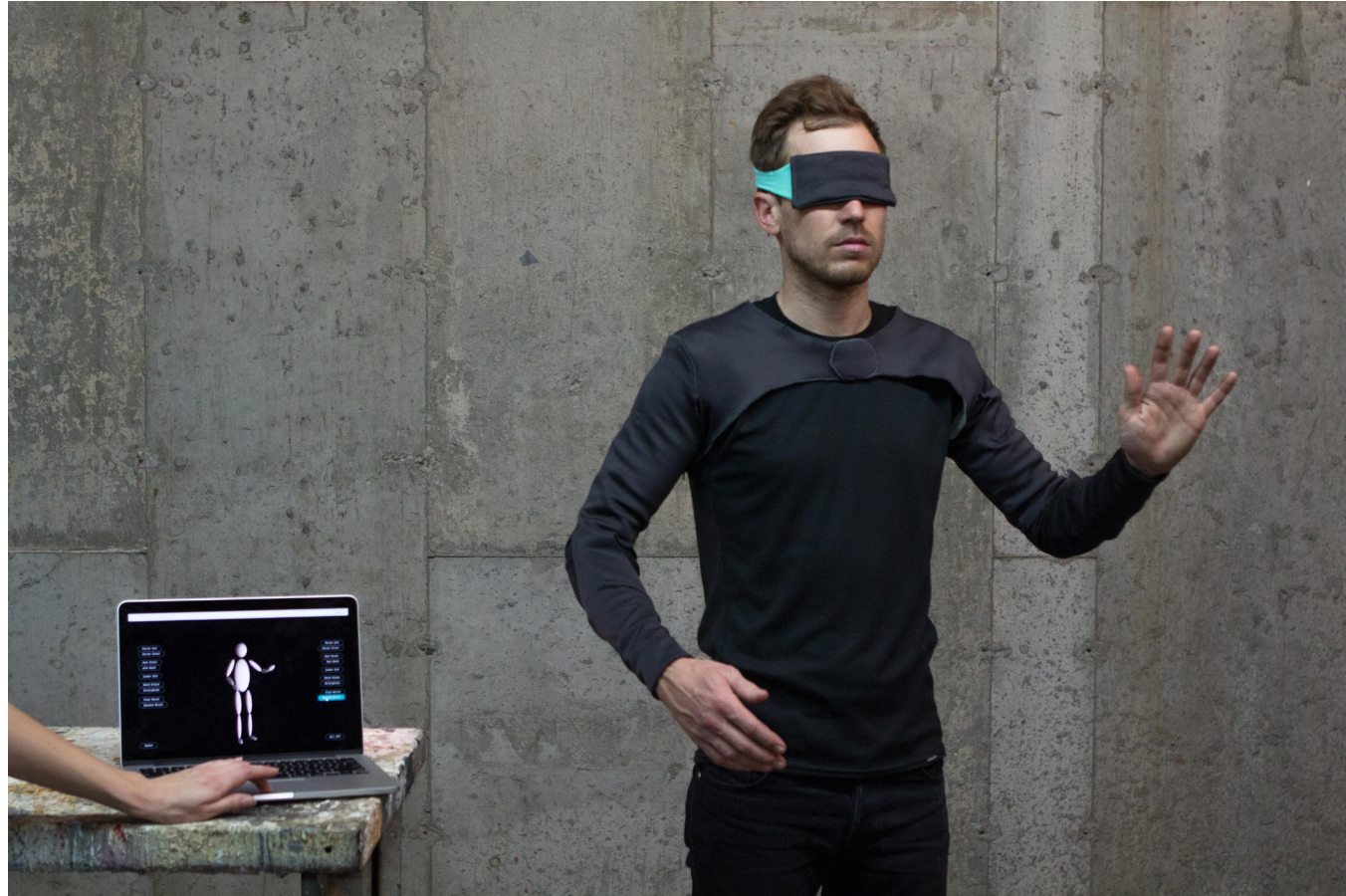
## POTENTIAL USES

“physical therapy/medical applications”  
“teach movement”  
“vision/proprioceptive assistive tech”





# PRODUCT



The functional prototype is made from stretch neoprene bonded to jersey for mobility and comfort.

Vibration motors are held in place with custom sliding buckles on elastic bands sewn into the garment.



The vibration motors are wired to an x-OSC I/O board, which receives signals from the interface over its own wifi network.

The garment is pictured inside-out at right to display electronics.





# APPLICATION: INSTANT LEARNING

**IMAGINE...**

YOUR FIRST TIME SNOWBOARDING... THE BITE OF  
THE COLD SNOW AND ICE EVERY TIME YOU FELL...

**WHAT IF YOUR BOOTS TAUGHT YOU HOW TO  
TURN, BALANCE AND MASTER THE SLOPES?**





# APPLICATION: DISTANCE

A photograph of a young couple embracing in a field at sunset. The woman, with long dark hair, is wearing a white t-shirt and has her arms around the man. The man, with dark hair, is wearing a red and white plaid shirt and is looking down. They are standing in a field of tall grass, with trees in the background. The sky is a mix of orange, yellow, and blue, suggesting the time is either sunrise or sunset.

## IMAGINE...

YOUR SIGNIFICANT OTHER IS ON AN EXTENDED DEPLOYMENT. YOU HAVE SENT EVERY EMOJI, BUT NOTHING SEEMS TO QUITE CAPTURE WHAT YOU WANT TO EXPRESS.

**WHAT IF YOU COULD SEND YOUR A HUG OR A GESTURE OF CONNECTION ACROSS THE WORLD?**



# APPLICATION: INSTANT HELP

**IMAGINE...**

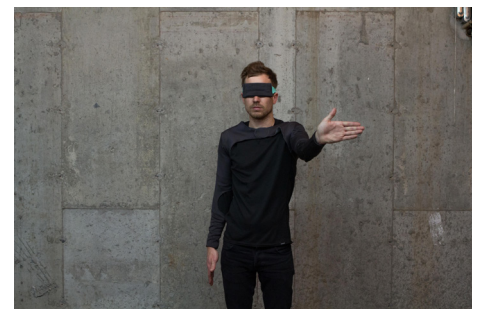
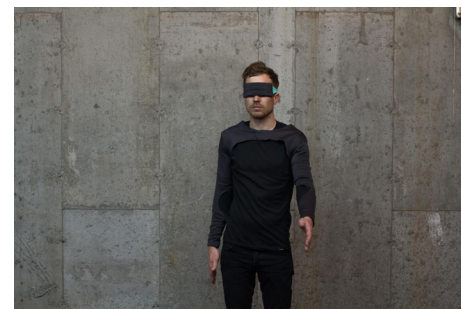
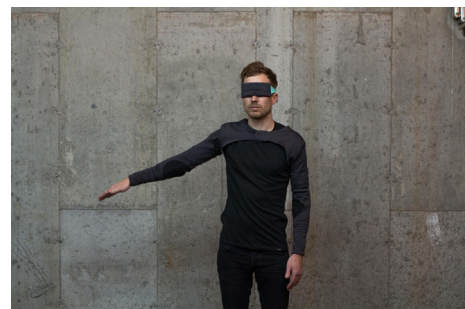
YOUR CAR HAS BROKEN DOWN ON THE SIDE OF A  
REMOTE ROAD

**WHAT IF A MECHANIC COULD INSTANTLY START  
REPAIRING YOUR CAR BY CONTROLLING YOUR  
HANDS. GETTING YOU ON YOUR WAY QUICKLY.**





# PROTOTYPES: FINAL









# ACKNOWLEDGMENTS