NEURO COOKING

exploring brain and touch

MACIEJ CHMARA / CHMARA.ROSINKE

IDEE

Cooking is one of the most powerful multisensory experiences for our brain. It is a cultural technique with very high therapeutic potential, and from an anthropological perspective, it is remarkable even when considered independently of its outcome – the meal itself.
For 150 years, it has been predominantly non-cooking men who have driven the push to automate and eliminate cooking. Yet working with food could be precisely what helps restore a better balance of the senses and reduce cognitive overload in an increasingly digitized everyday life.
In our project, we connect neuroscience and the therapeutic potential of sensory practices through intuitive haptic feedback.
The development of fine motor skills as well as mental well-being is fostered

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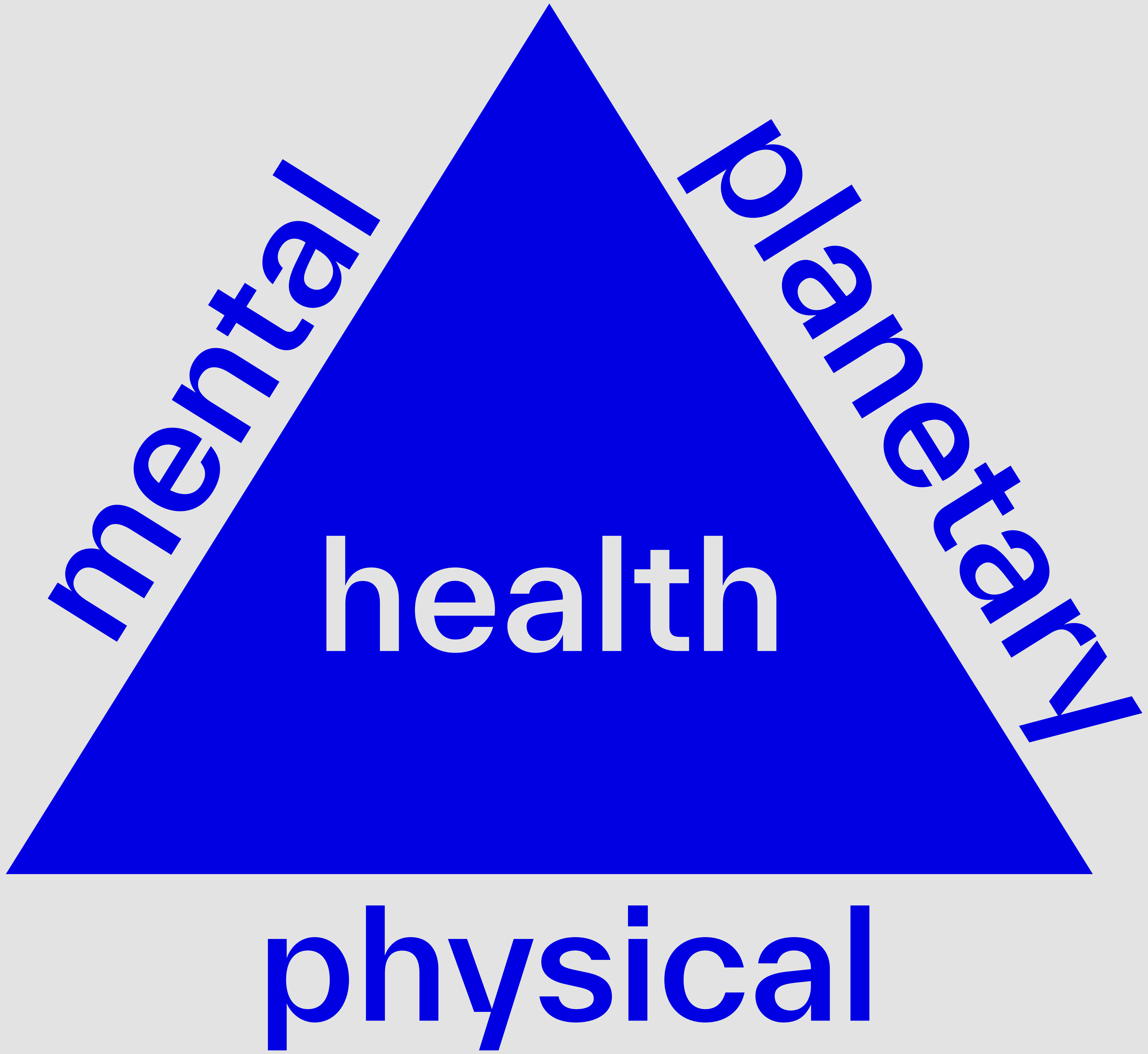
values



1.Concept description - three pillars redefining the umbrella term „food as medicine“

According to a study, cookbooks are a very inefficient method for actually learning to cook. On average, fewer than two recipes are cooked per book. We asked ourselves whether it would be possible to build something like “Rémy,” the cooking rat who controls the human “Linguini” in the Pixar film Ratatouille!?

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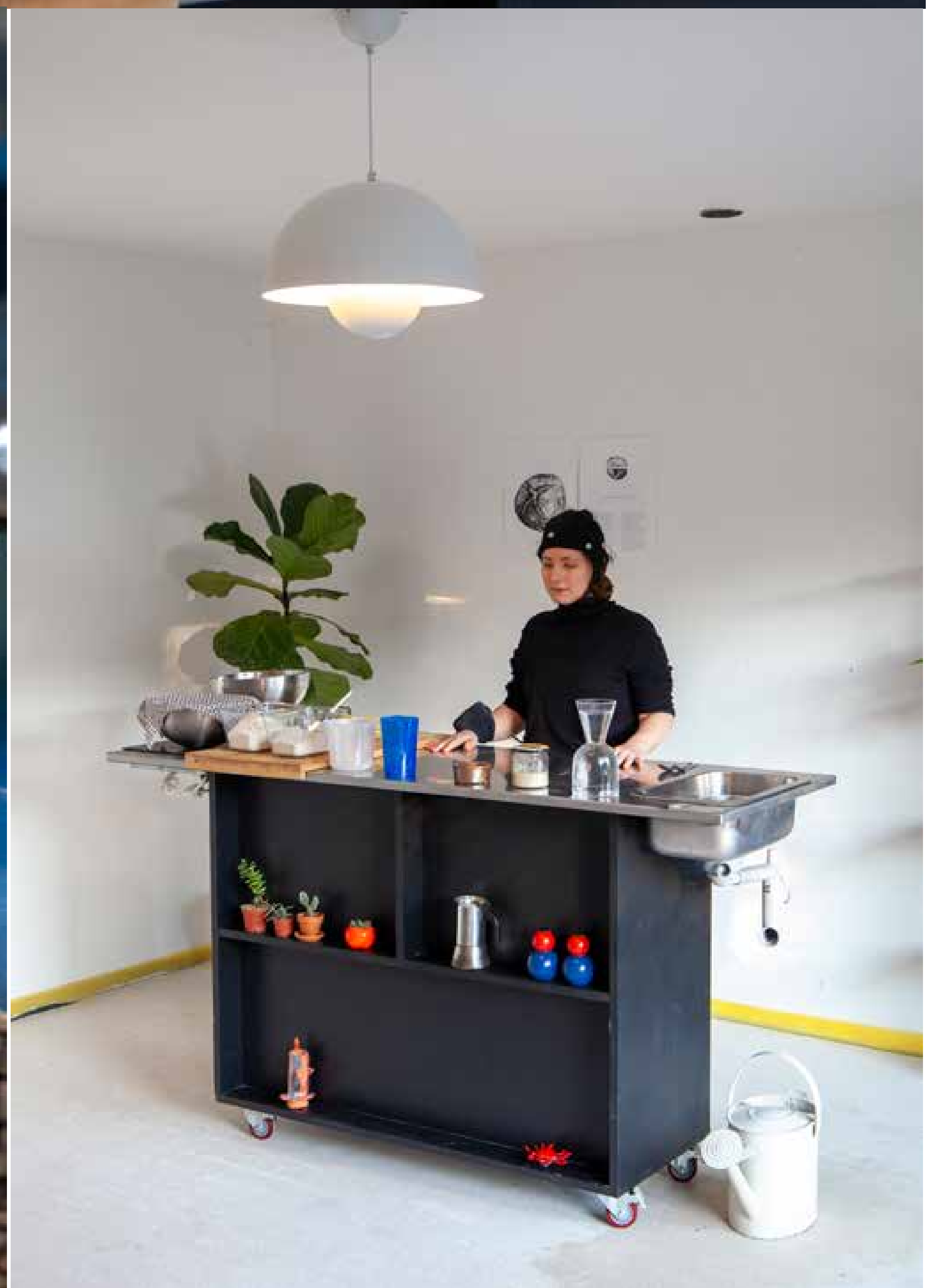
Over the past two years, we have conducted two studies with a total of nearly one hundred participants to demonstrate the benefits of bread baking. Among other outcomes, this work led to the peer-reviewed paper “Eudaimonia in Sourdough: Understanding Well-Being in the Sensory Experiences of Artisanal Activities,” developed in cooperation with the Department of Experimental Psychology and Charles Spence, which explores the therapeutic potential of working with sourdough.



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Design exploration - study

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Based on the first study, we had the foundation to launch a further series of experiments using EEG, ECG, EMG, and gyrometer sensors, in order to gain a more precise understanding of what is happening in the brain and to come one step closer to our “digital cooking rat.”

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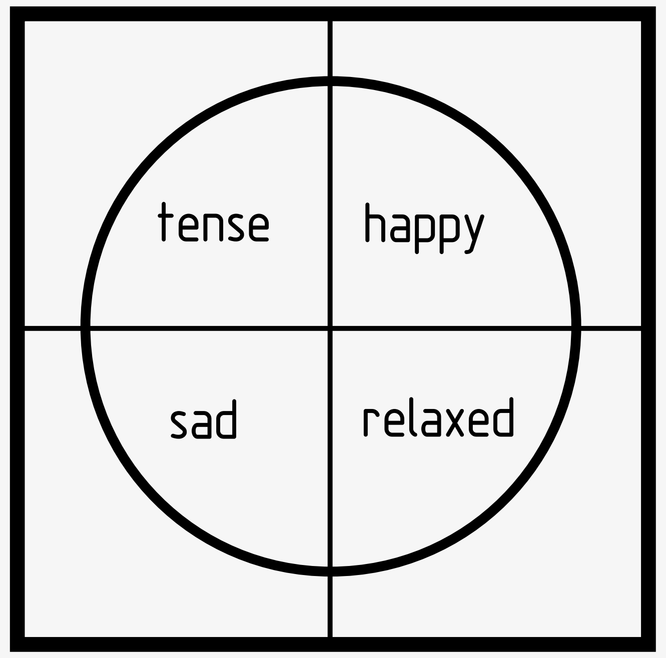
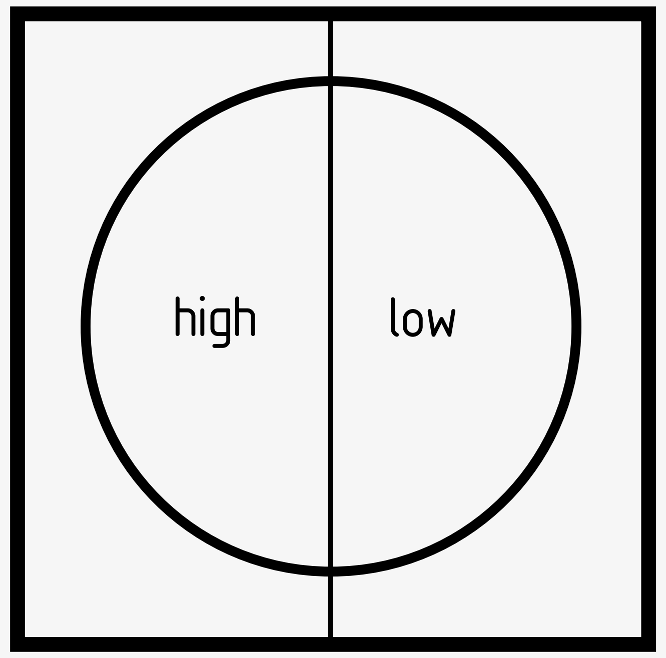
EEG Data
classification
into 4 classes



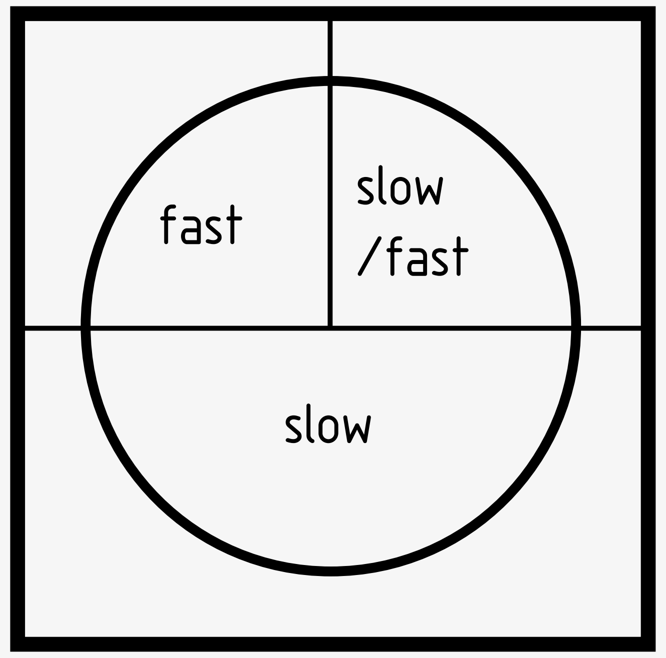
mood/emotion

EMG Data
classification:
into 2 classes



effort

Motion sensor
classification
into 2 classes



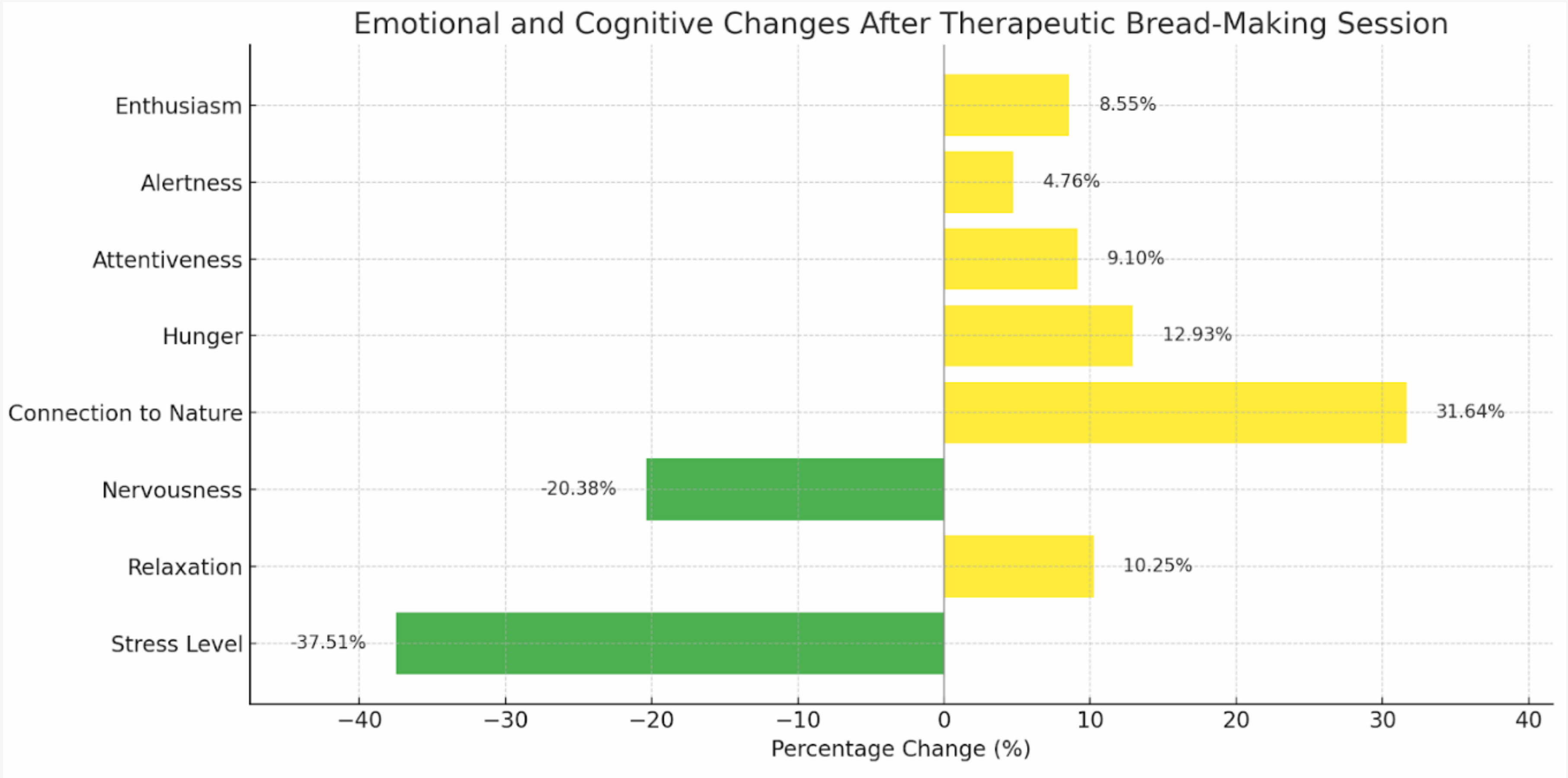
speed

1. Whisking with your hand (sourdugh, salt, water) — a IDEAL: happy+relaxed, low, fast — b OK: happy, high, fast — c BAD: tense/sad
2. kneading (all ingredients) — a IDEAL: relaxed+happy, high, slow — b OK: happy/tense, high, fast — c BAD: sad
3. washing hands — a IDEAL: relaxed/happy, high, slow — b OK: happy/tense, high/low, fast/slow — c BAD: sad, high, fast
4. stretch and fold (folding and shaping the dough) — a IDEAL: relaxed, low, slow — b OK: happy, high, slow — c BAD: tense/sad, high, fast
5. bread yoga (therapeutic folding instructions) — a IDEAL: relaxed+happy, low, slow — b OK: happy, high, fast — c BAD: tense

if a IDEAL, then soothing pulse LED
if 1. b OK, then soothing slow pulse of top vibr. actuator No.4 — if c 1. BAD, then slow rotation illusion top actuator (No.4) plus fron actuators (No. 2+3) actuator triangle
if 2. b OK, then slow forward and backward movement No. 1,2,3,2,1 — if 2. c BAD, then Audio: mix the dough with a spoon
...
if 4. b OK, then soothing slow pulse of top vibr. actuator No.4 — if 4. c BAD, then slow rotation illusion of midle actuator (No.2) plus top actuator (No.4)
...

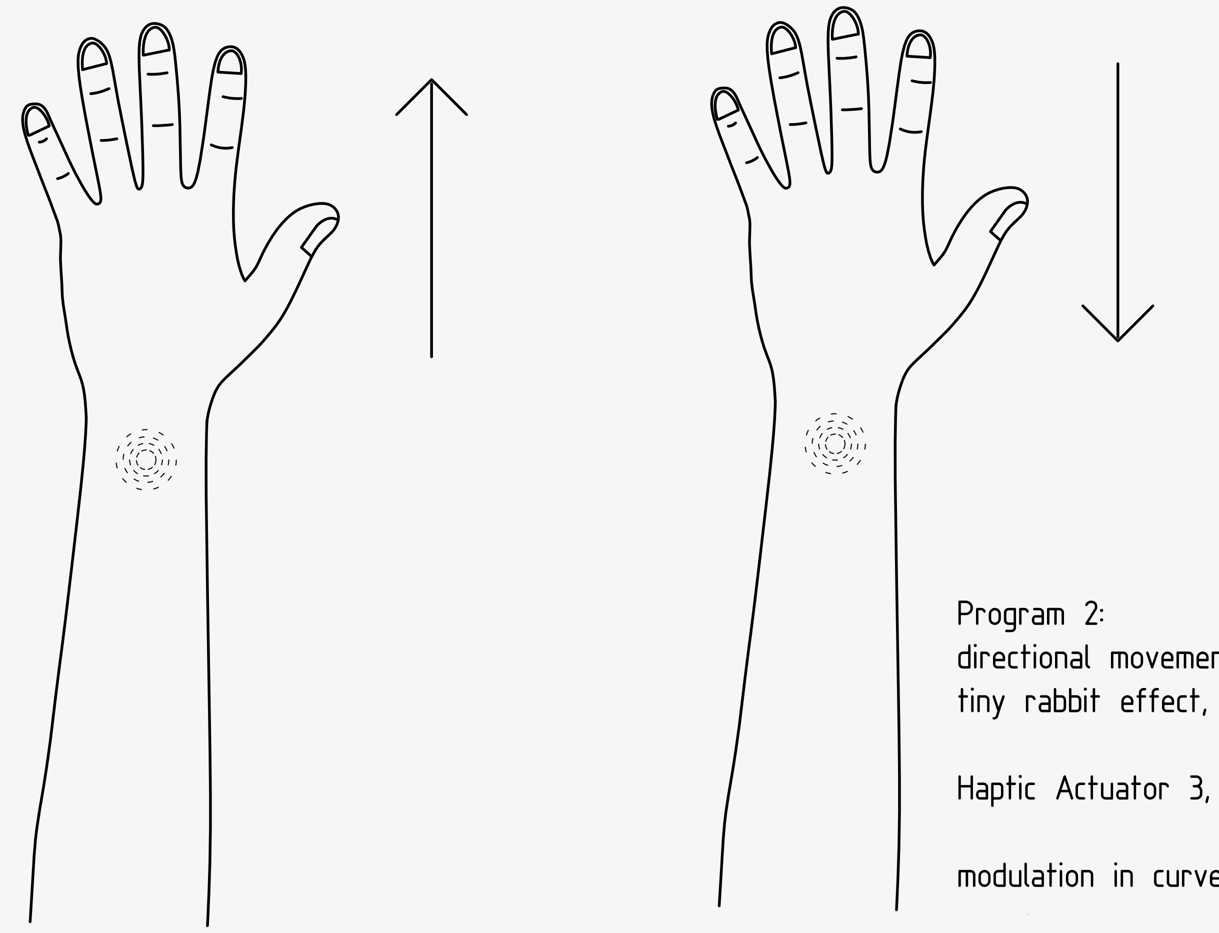
The combination of the study results provided the basis for workflows and conclusions regarding the therapeutic potential of the individual steps and techniques involved in working with dough.
Through live tracking of sensor data and their interpretation via an emotion model, signals can be sent to our wearable on the arm, which intuitively influences the direction of movement, dynamics, and rhythm through various vibration patterns. The idea was to develop something that feels like a second hand – one that holds, calms, and guides you.

psychiatrist from Charité
y as medical tool



audio instructions/programs started manually (or audio by participant, easy command, start, next, repeat) by therapist, and person
1 Whisking
2 kneading
3 washing hands (no long new data)
4 stretch and fold
5 bread yoga
6 tasting (no long new data)

if 1a then M	if 1b then Q	if 1c then W
if 2a then M	if 2b then E	if 2c then R
if 3a then M	if 3b then T	if 3c then Z
if 4a then M	if 4b then U	if 4c then I
if 5a then Y	if 5b then O	if 5c then P
if 6a then Y	if 6b then S	if 6c then D

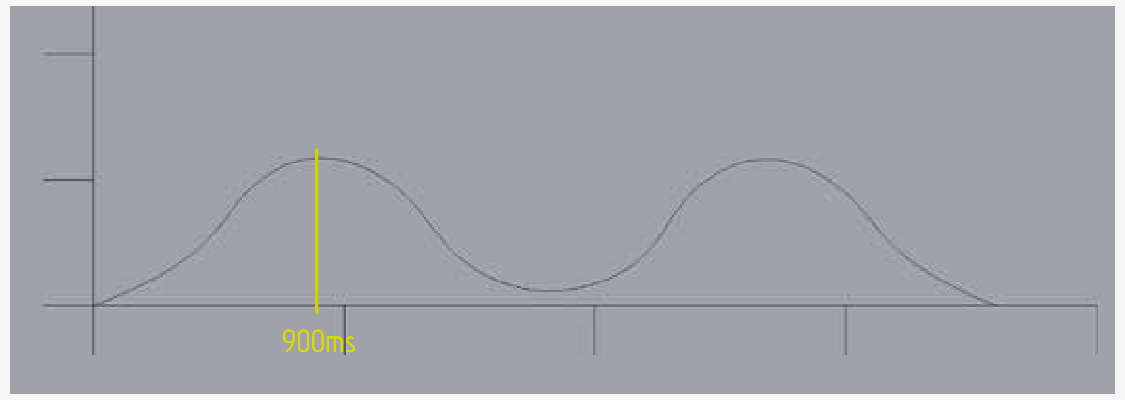


Program 2:
directional movement (tap tap as described oin continous stimuli or
tiny rabbit effect, described a page before, figure 9 right low)

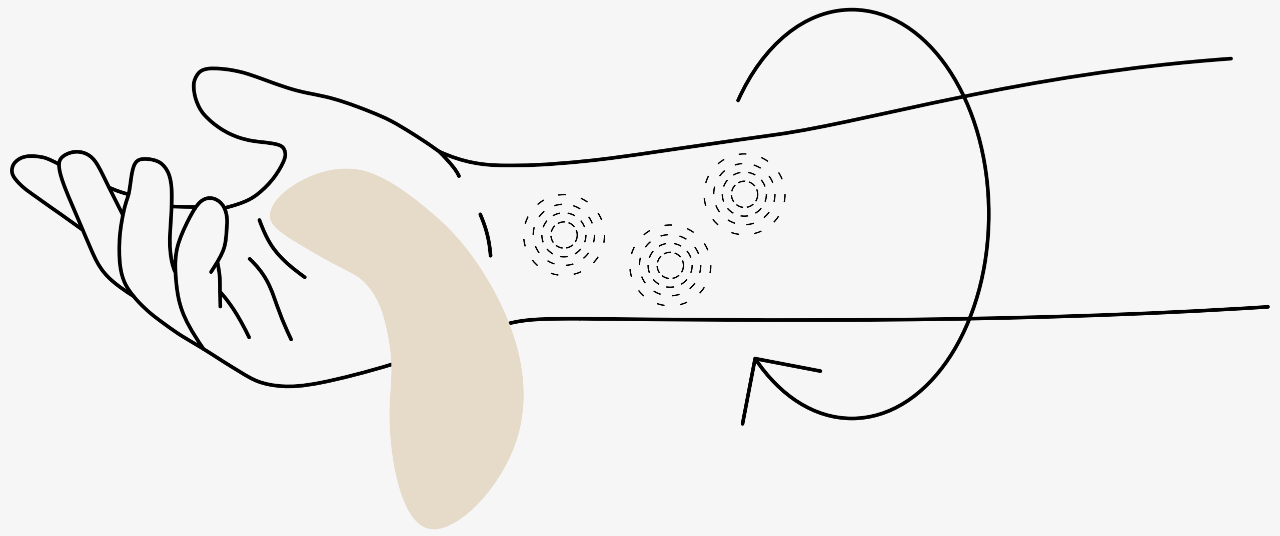
Haptic Actuator 3, then 2, then 1

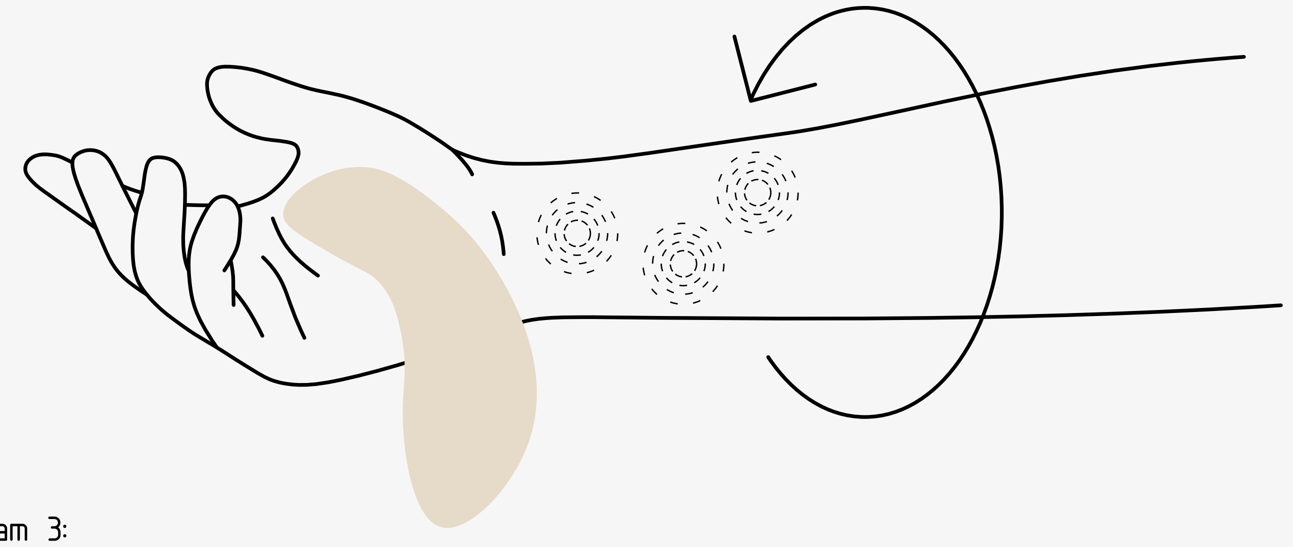
modulation in curve duration and curve geometry (strength)

Program 1:
Only vibration motor 4,
soothing / relaxiong vibration repetition, 18 seconds (5x the graphic)



Peak curve 0.9seconds.

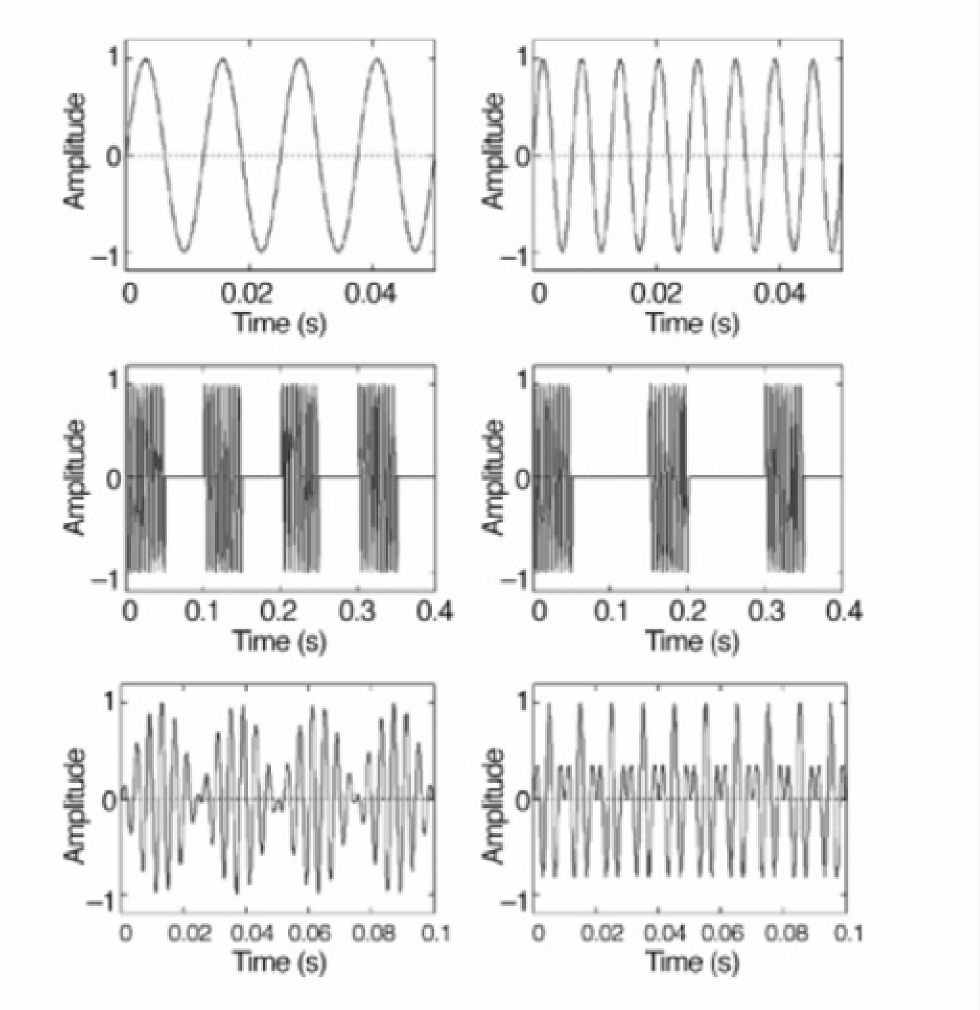




Program 3:
rotational movement (tap tap as desicribed oin continous stimuli or
tiny rabbit effect, described a page before, figure 9 right low)

Haptic Actuator 4, then 1, then 2

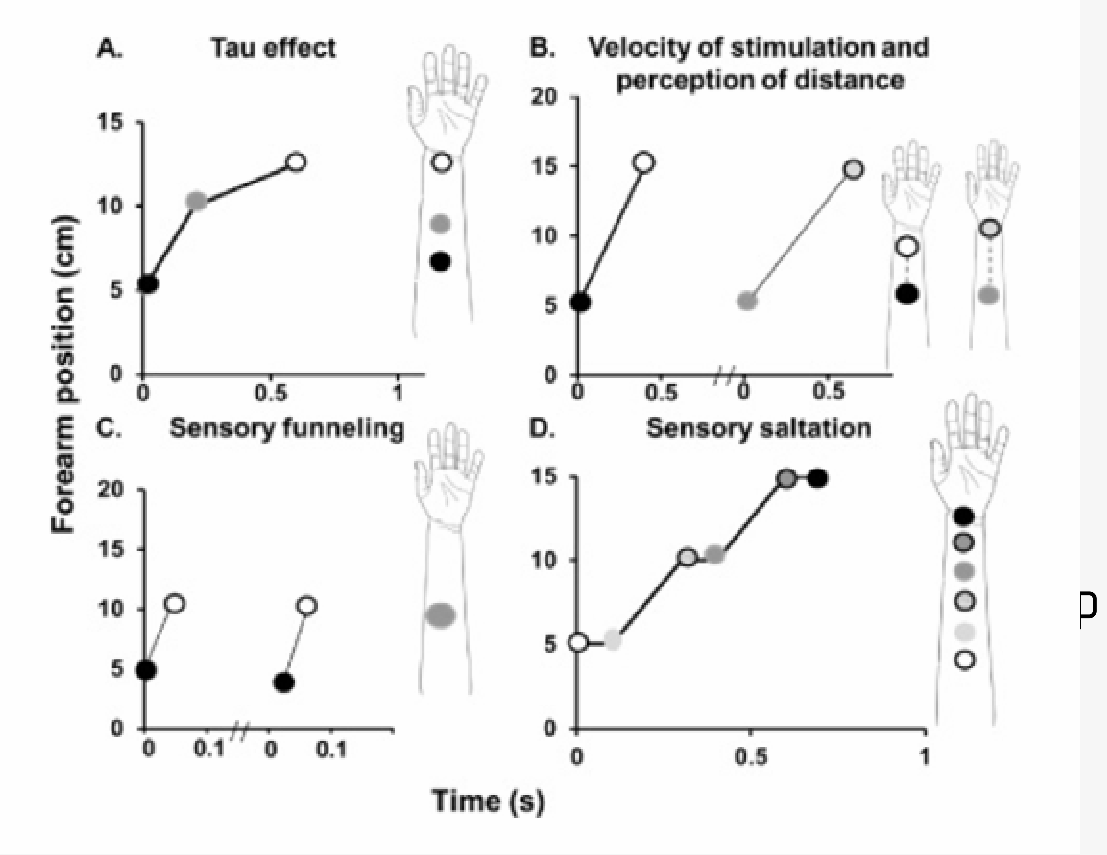
The foundation for the first steps toward an intuitive haptic language emerged from research on vibration motors conducted at MIT and Oxford. In particular, we drew on so-called “haptic illusions” and studies investigating when, for example, vibrations feel like a caress, when they feel like a gentle tap, and when they feel scratchy — enabling us to calibrate the vibration motors in code and model their frequencies. Simple “on and off” switching of actuators does not stimulate much in our brain. Currently, the wearable is capable of sending simple directional cues, rotations, rhythms, and calming pulsations to the user. We are working on expanding our intuitive language.



Rules:
3point
- if interval of vibration on the skin is very short (100-300ms) stimuli appear nearer to each other (smaller dista
- if interval of vibration on the skin is bigger than 300ms, distance of stimuli appears bigger

Taps or continuous stimuli!?
Contiuous stimul (gentle stroke)i:

tap (100ms) | stop (70ms) | tap (100ms) | stop (20-250ms) | tap (100ms) | stop (70ms) | tap (100ms) | p (100ms)



Tiny Rabbit (taps):

tap (100ms) | stop (70ms) | tap (100ms) | stop (300-400ms) | tap (100ms) | stop (70ms) | tap (100ms) | stop (300-400ms)| tap (100ms) | stop (70ms) | tap (100ms)

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The prototypes were printed from mono-material and partly biodegradable materials. For the hardware, commonly available microcontrollers, drivers, and LRAs were used. From a design perspective, the goal was to achieve flexibility and individualization of the wearable through mechanical solutions rather than non-recyclable high-tech compound materials.

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In the medium and long term, the project is to be further developed into an open platform in the fields of research and art.

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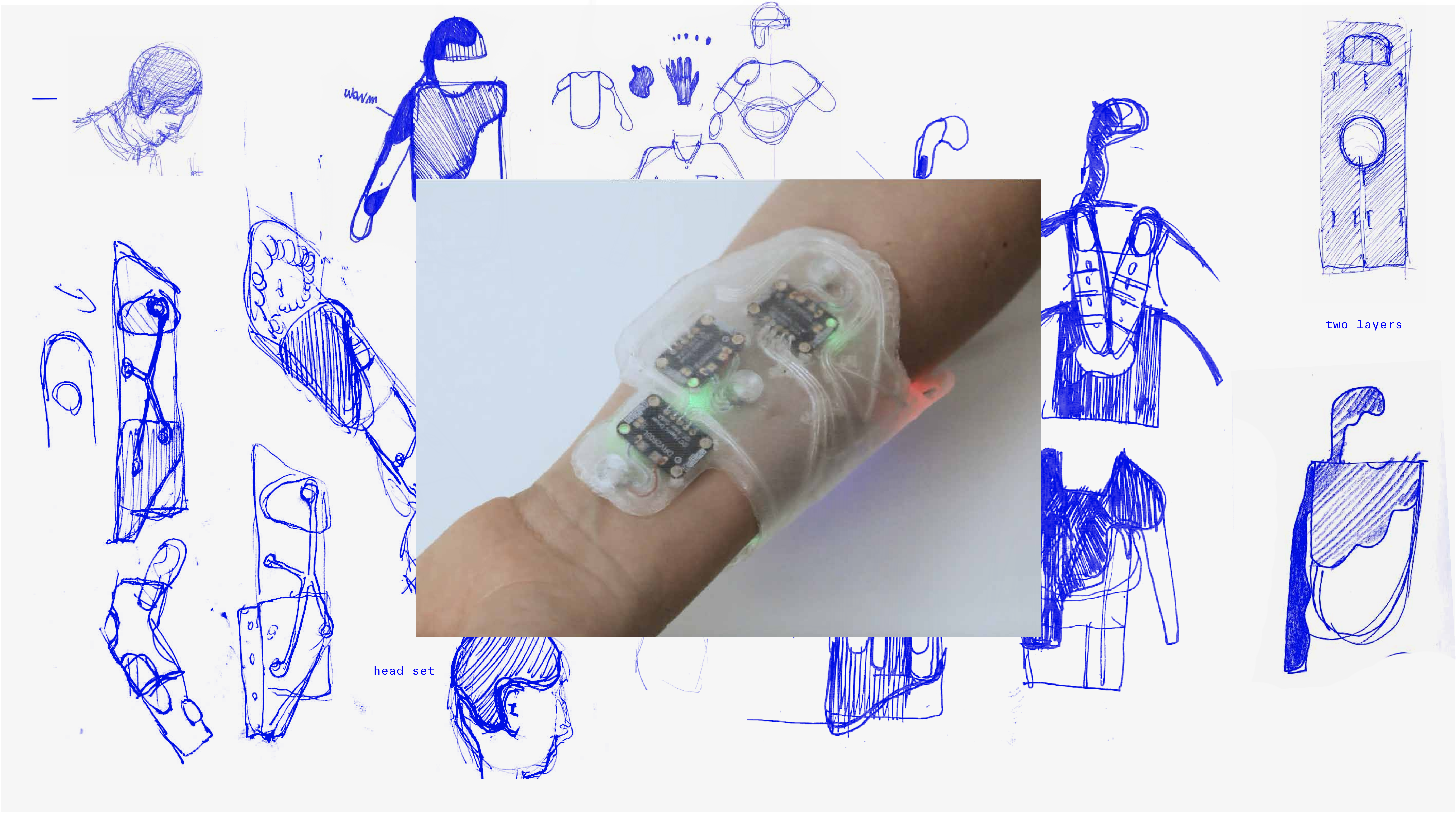

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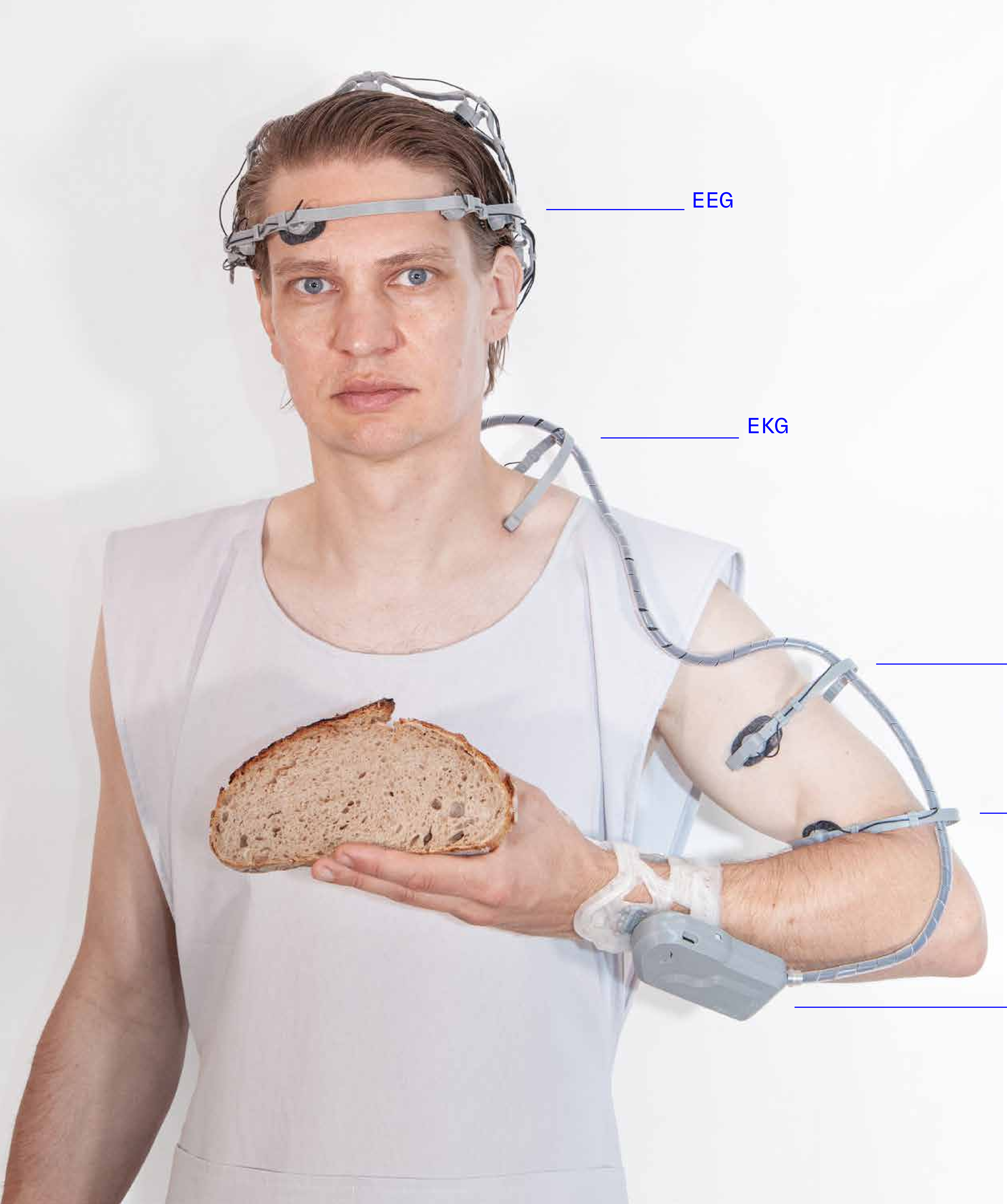

The design of the wearable, with its cable routing, dry and textile sensors, mechanical springs, and other features, also has the advantage of being much faster to put on than a conventional EEG and is geared toward mobile use.

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On the underside of the forearm, three vibration motors are installed at specific distances and angles relative to one another, and on the upper side, one actuator is mounted. Intensity, wave structure, and frequency amplitude are modeled.

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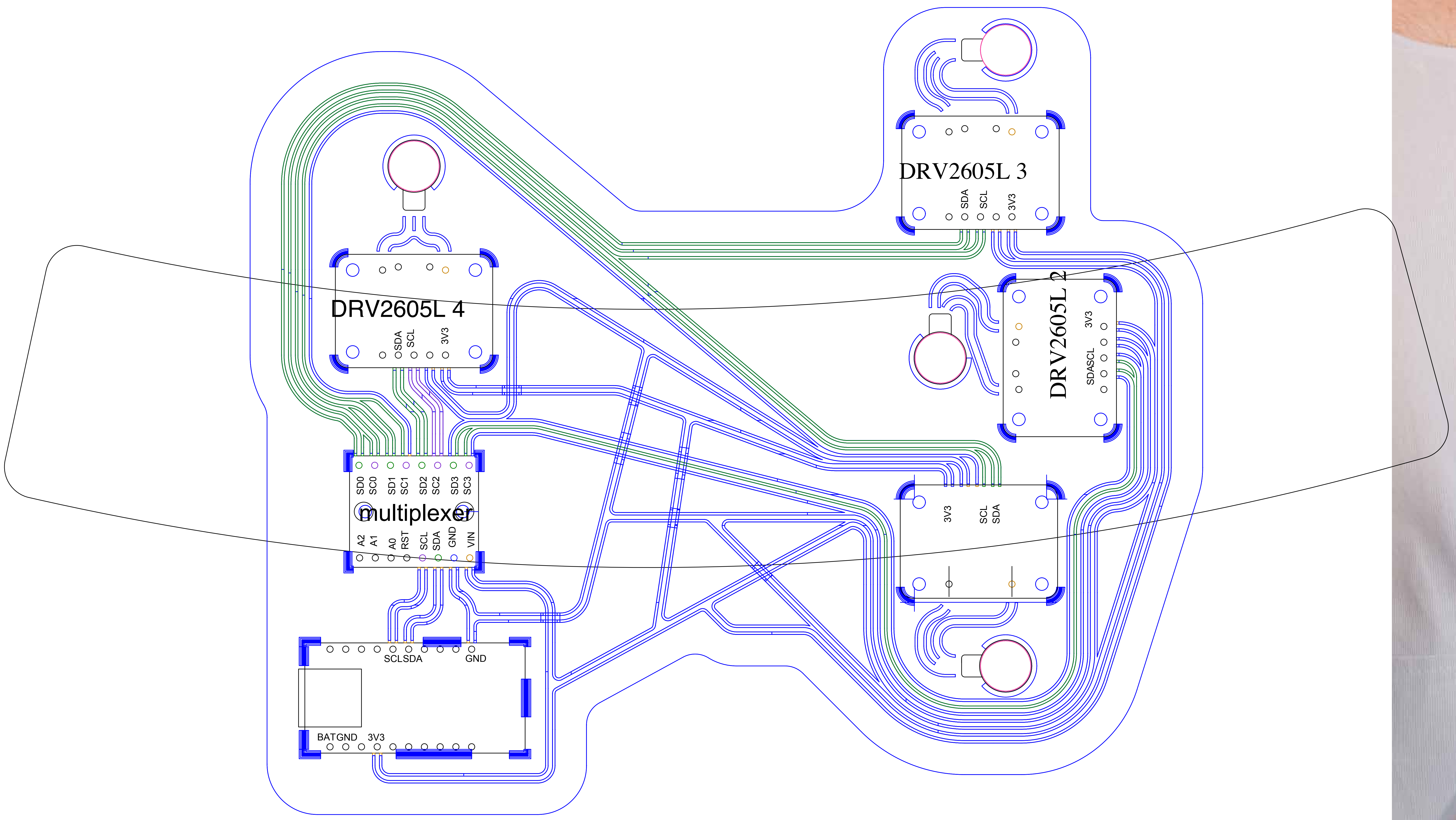

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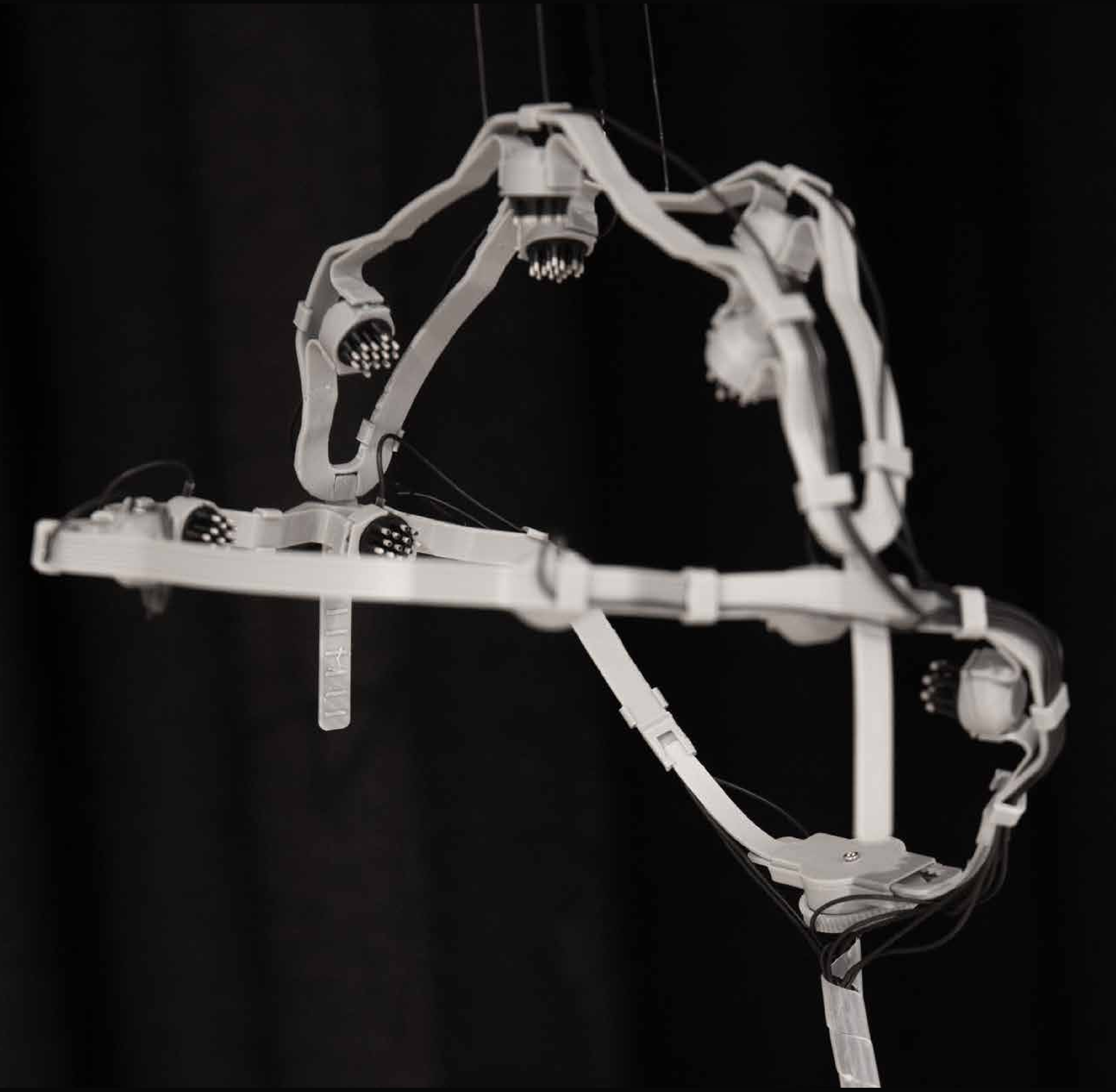

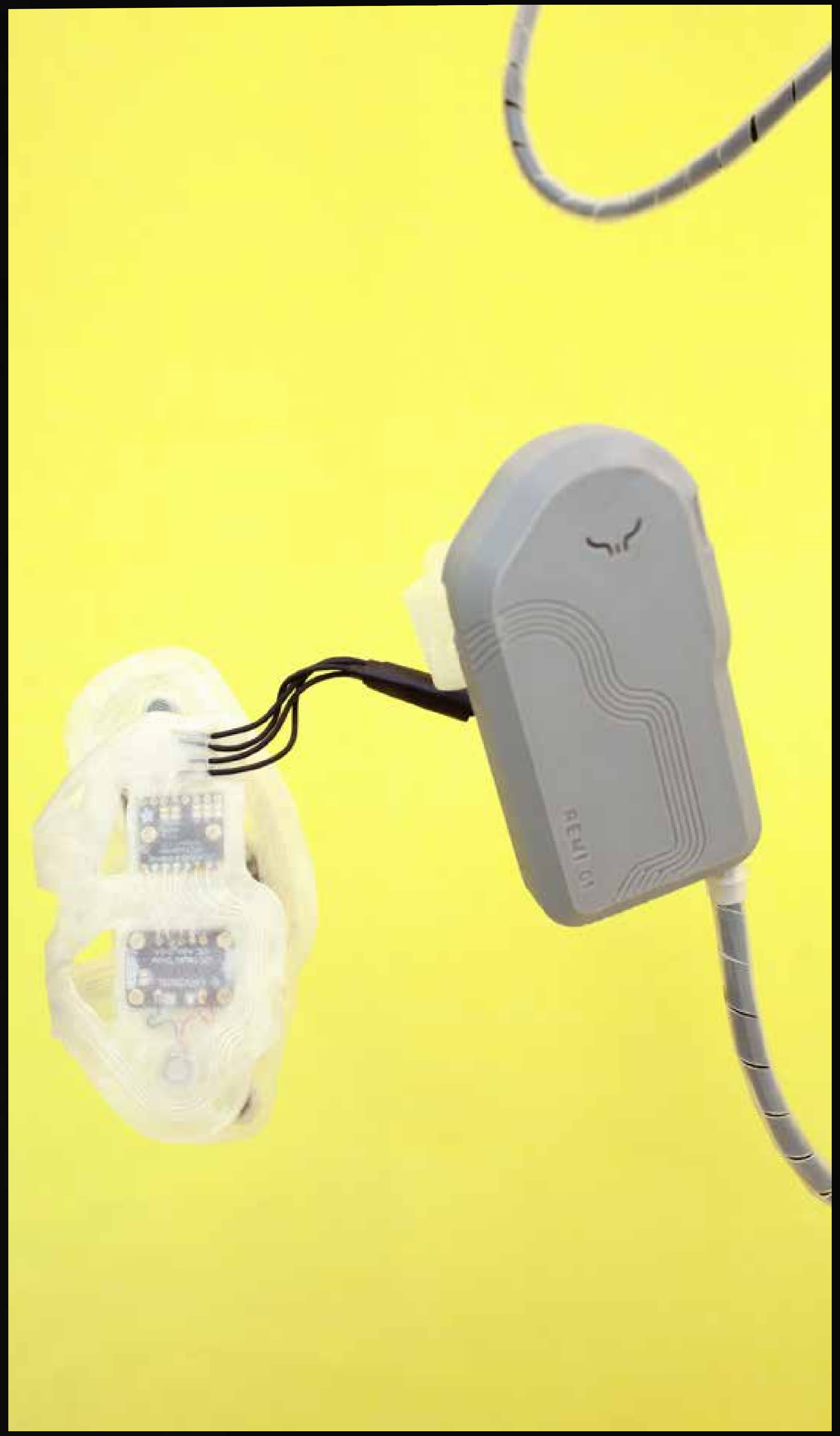

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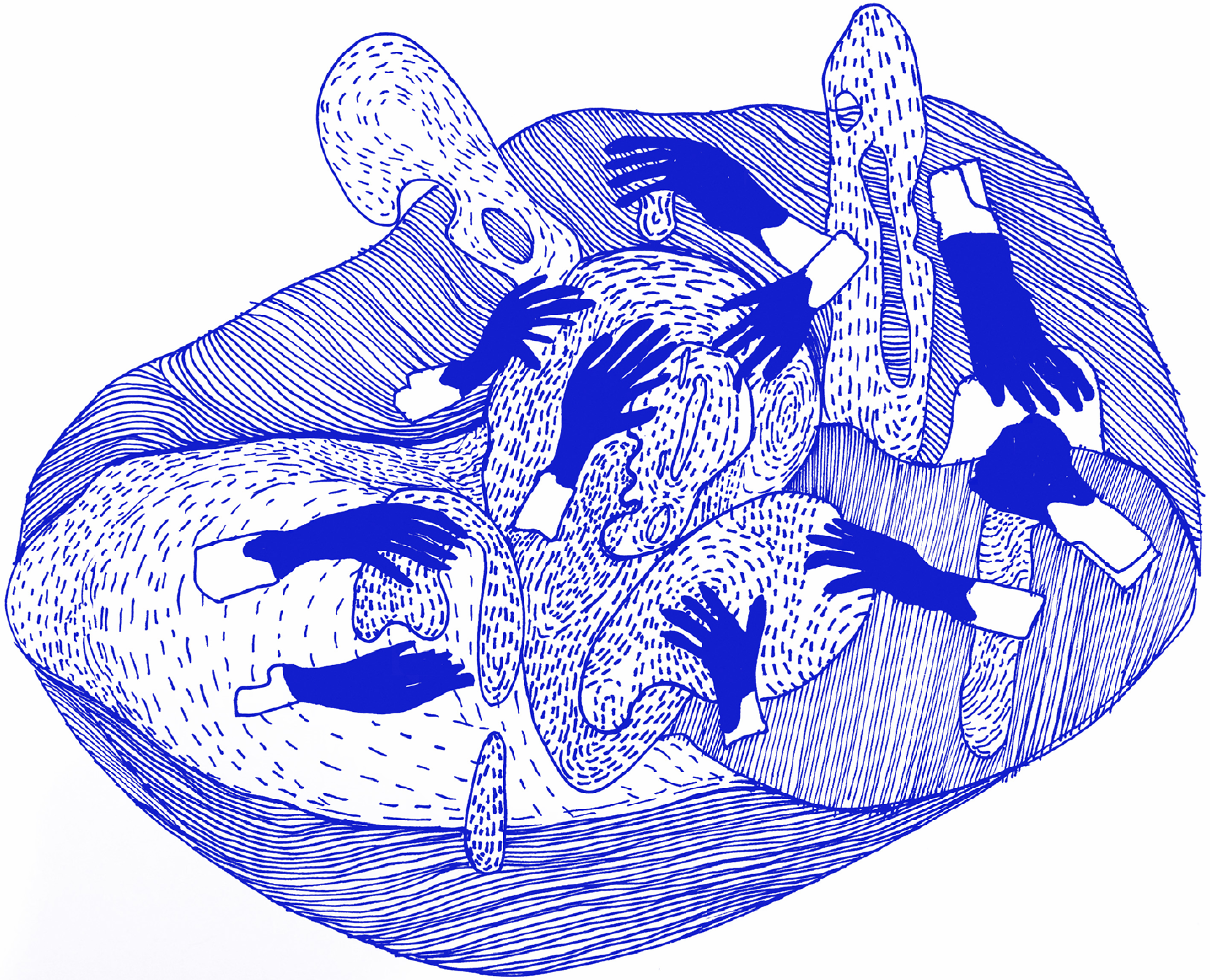
USE/POTENTIAL

Our project uses commonly accessible technologies to investigate the interface between brain and touch, drawing on the therapeutic properties of the multisensory practice of bread baking. The wearable can be used for examination and research purposes, but also for improving mental well-being and training fine motor skills and the dynamics of movement. This principle works not only with dough — with further development, it could be applied, for example, to learning musical instruments. It is a wearable designed to help us pay closer attention to our senses, with the ultimate goal of stepping back a little from technology.



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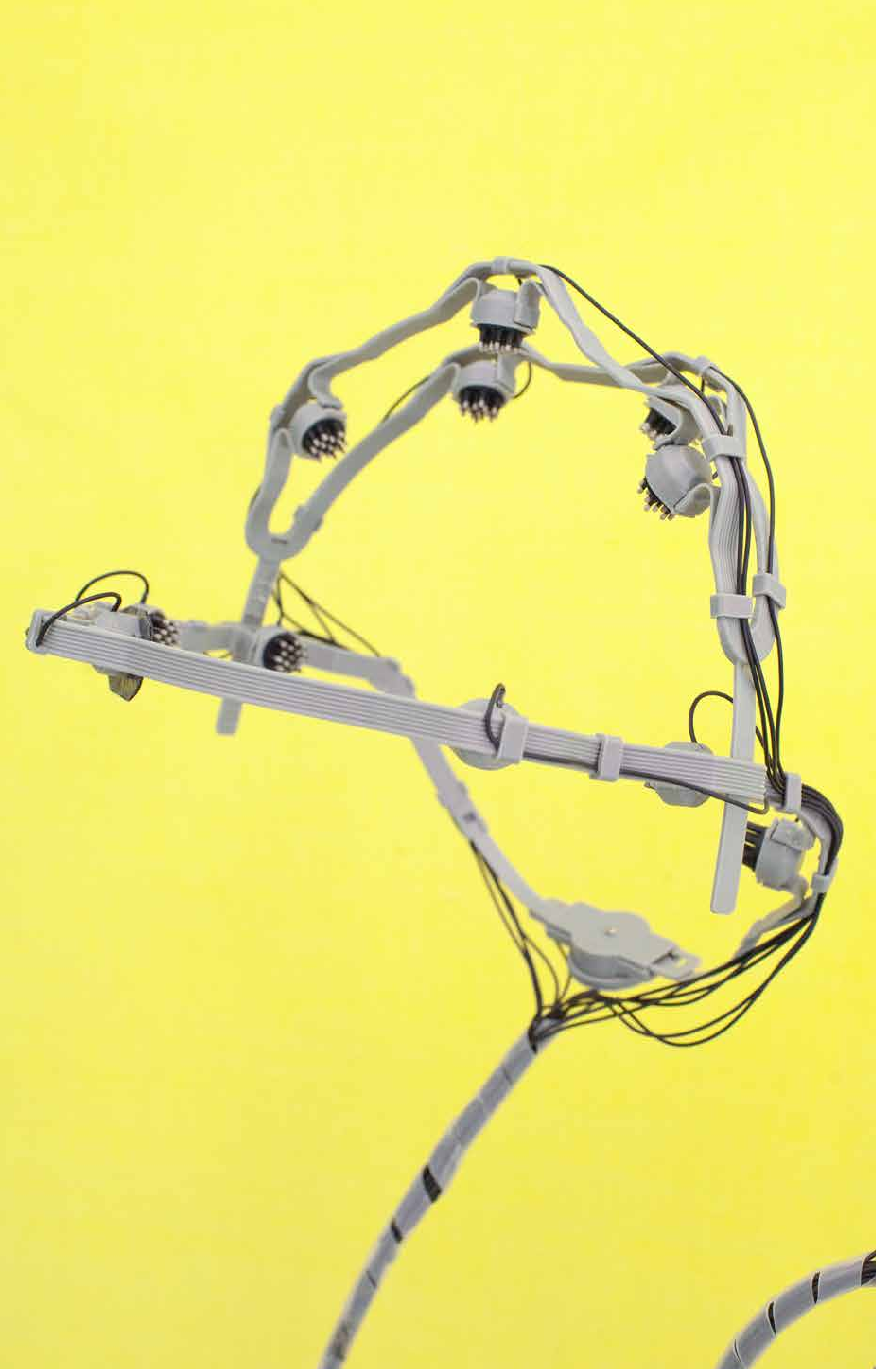

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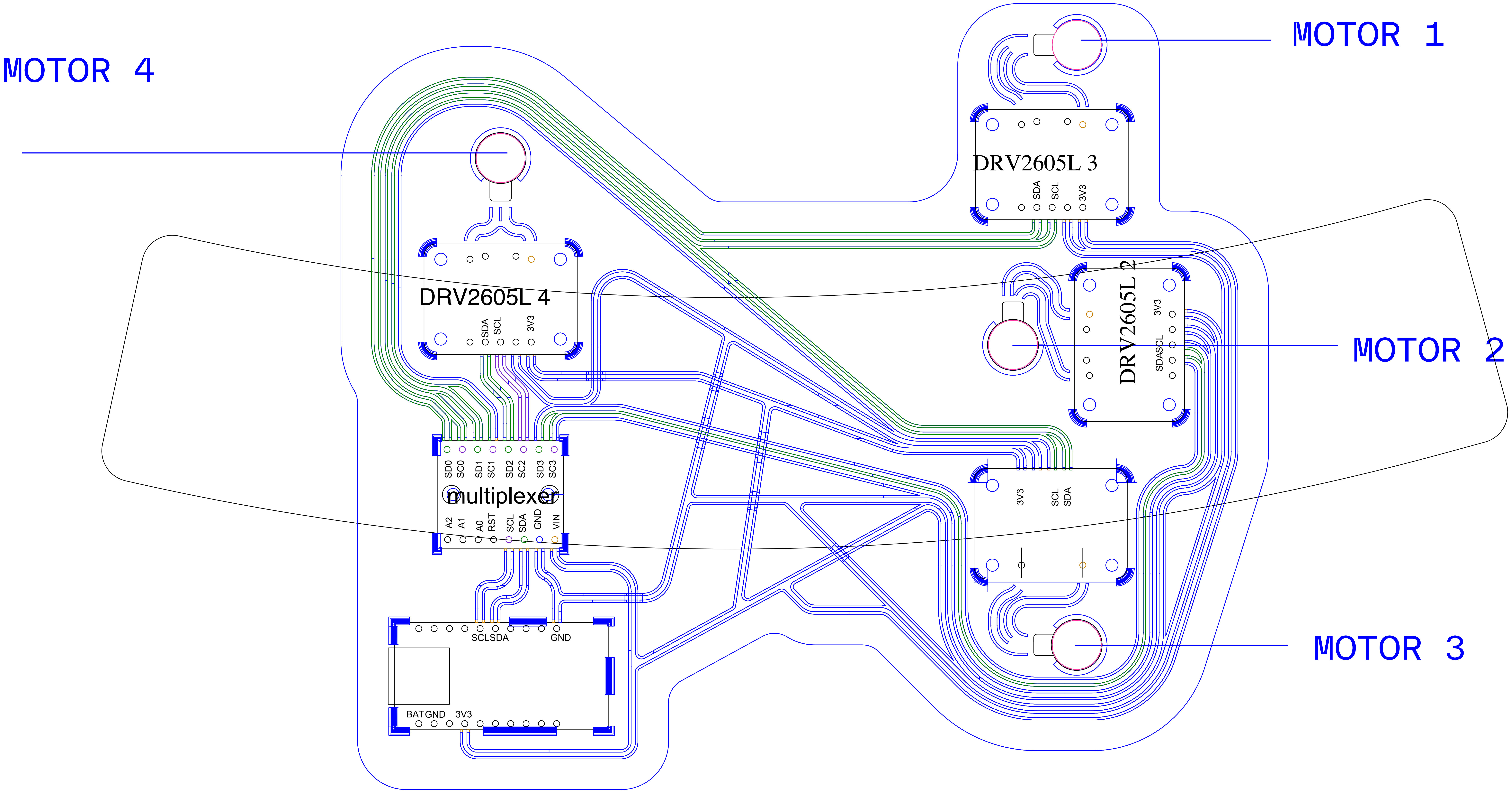

3-Final prototype - haptic feedback sleeve -4 lra haptic motors creating tactile pattern

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EEG
EKG
EMG1
EMG2
motion sensor
tactile feedback sleeve

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3-Final prototype -EKG, EMG 1 AND EMG2 easy to put on and flexible monomaterials

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REMI - is a wearable system that supports the development of therapeutic bread-making routines using haptic responses that are triggered by live data from EEG, EKG, and EMG sensors

This tool is designed to be integrated into established therapeutic practices like Mindfulness-Based Stress Reduction (MBSR) or various forms of occupational therapy in contexts such as food-related anxiety and impaired motor skills.

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2-Design exploration - process

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