skin drag displays

dragging a physical tactor across the user's skin produces a stronger stimulus than vibrotactile

Alexandra Ion, Edward Wang, Patrick Baudisch

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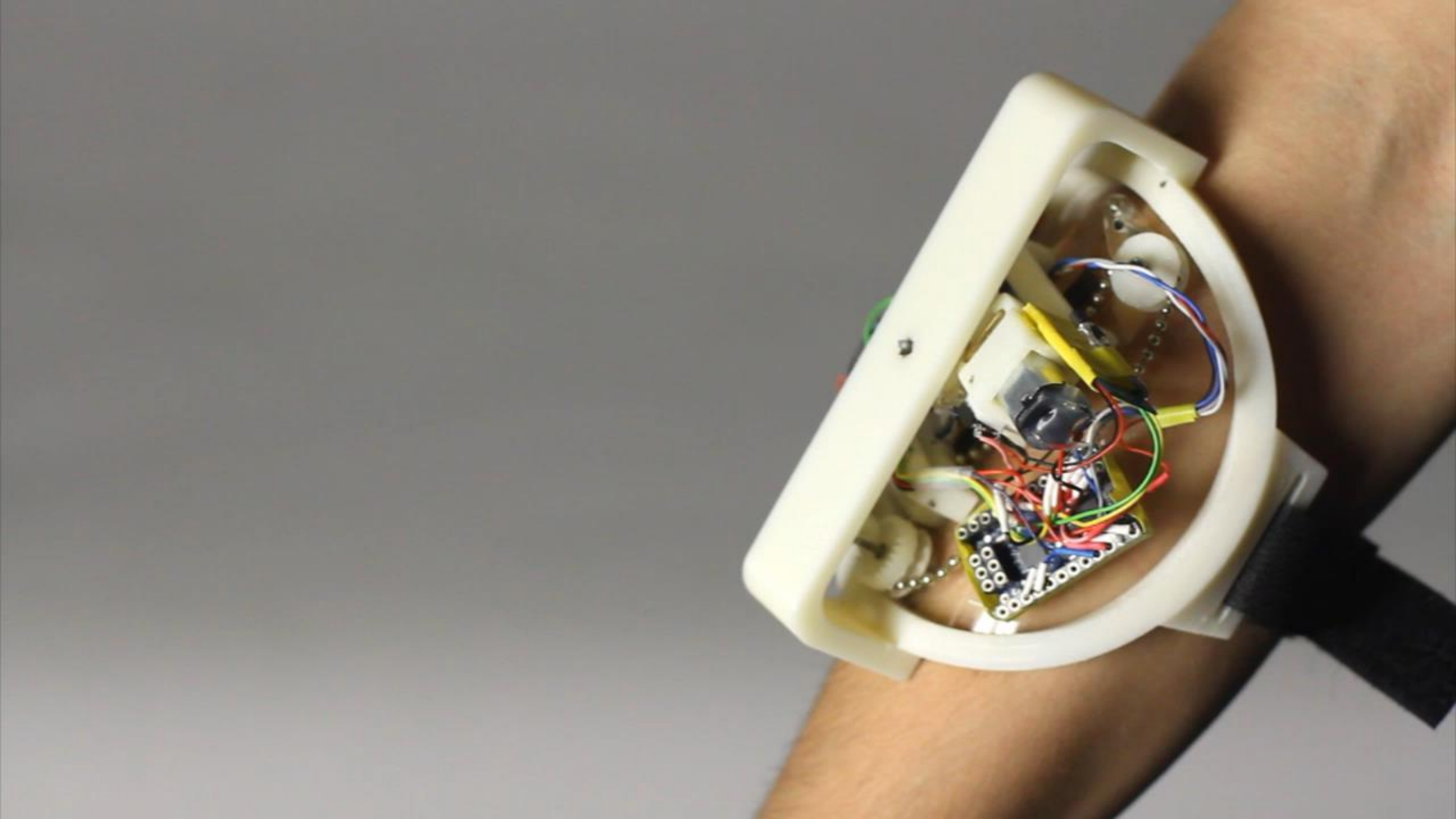


introduction

in contact with the wearer

single motor

vibrotactile arrays

[Lee, CHI EA'09]

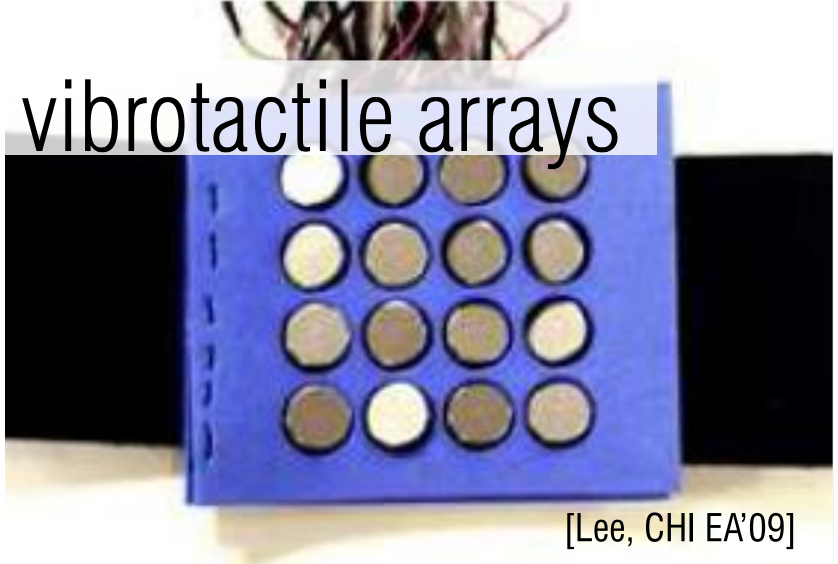
[Israr, CHI'11]

skin stretch

[Gleeson, Haptics'10]

single motor

vibrotactile arrays



[Lee, CHI EA'09]

[Israr, CHI'11]

skin stretch

[Gleeson, Haptics'10]

single motor

vibrotactile arrays

[Lee, CHI EA'09]

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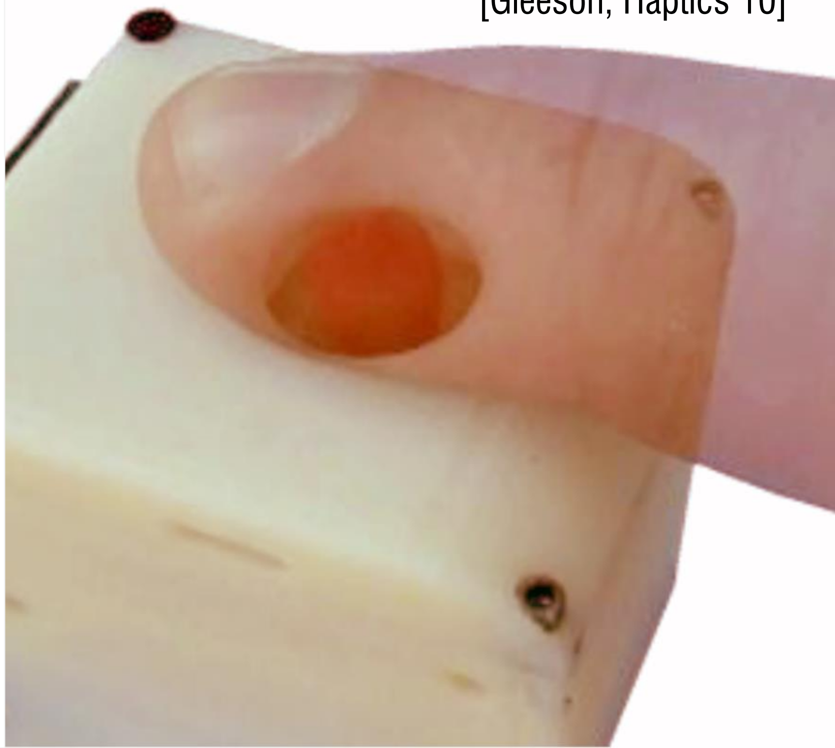
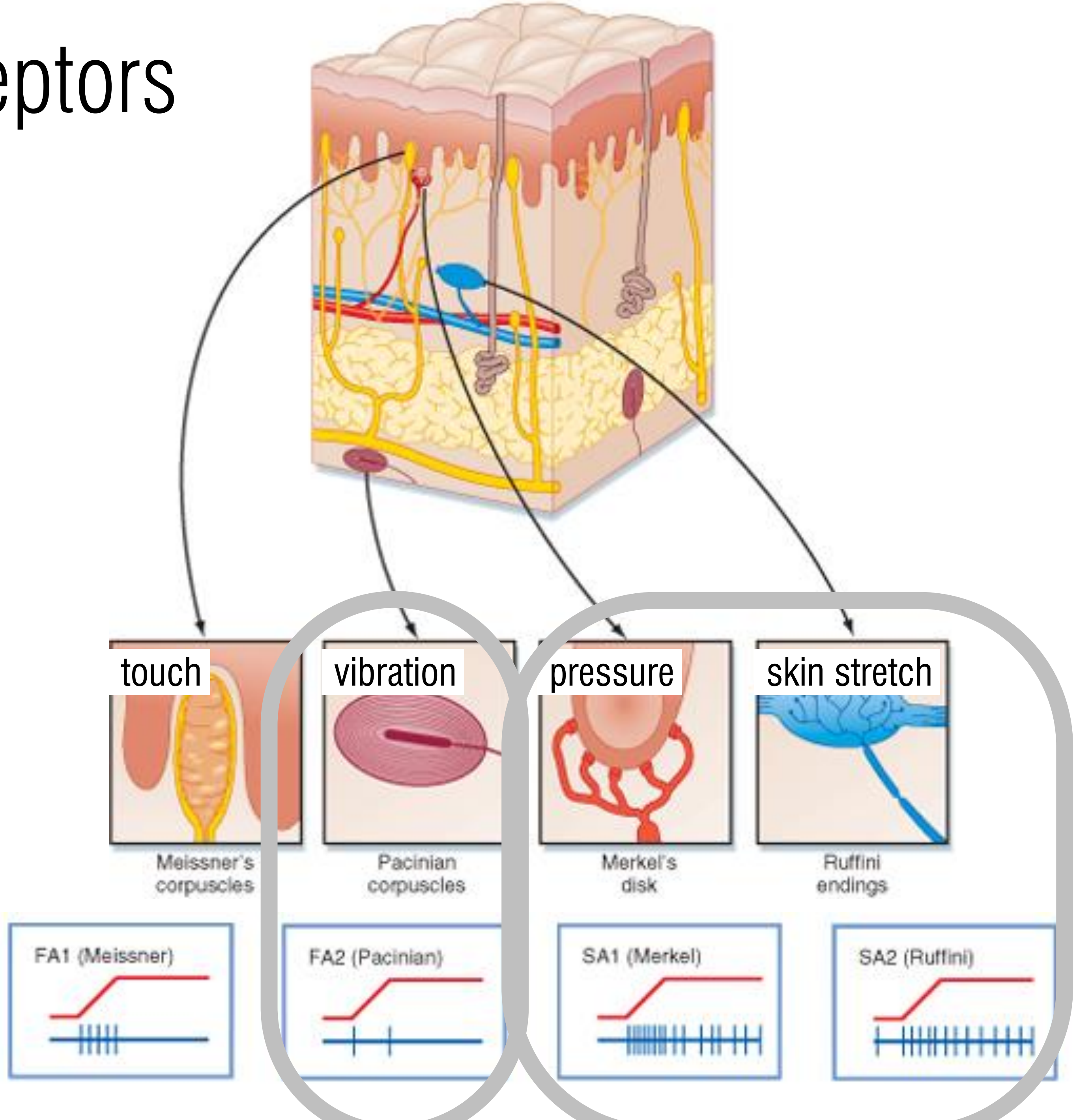
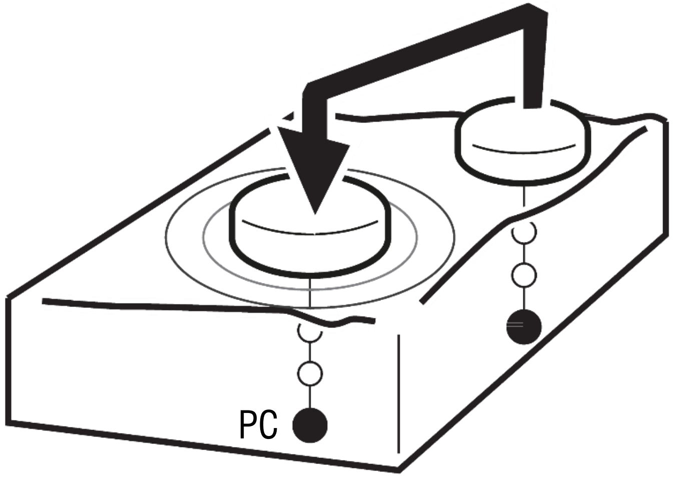


mechanoreceptors

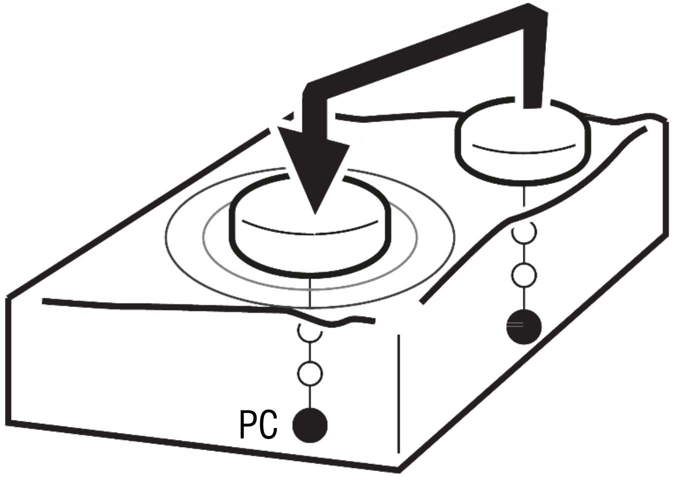


however, stimulates only
fast adapting receptors



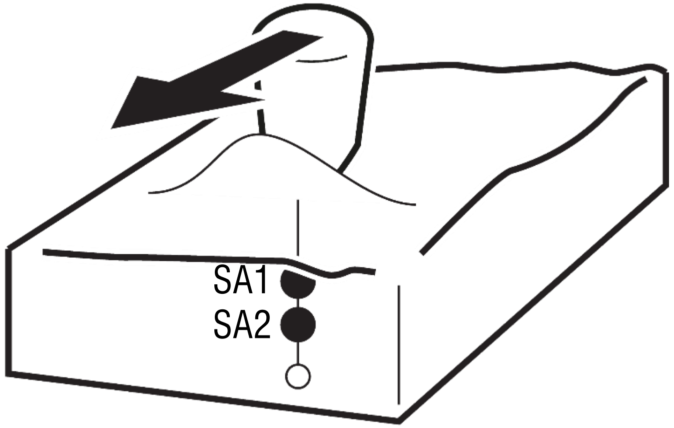
vibrotactile

however, stimulates only
fast adapting receptors

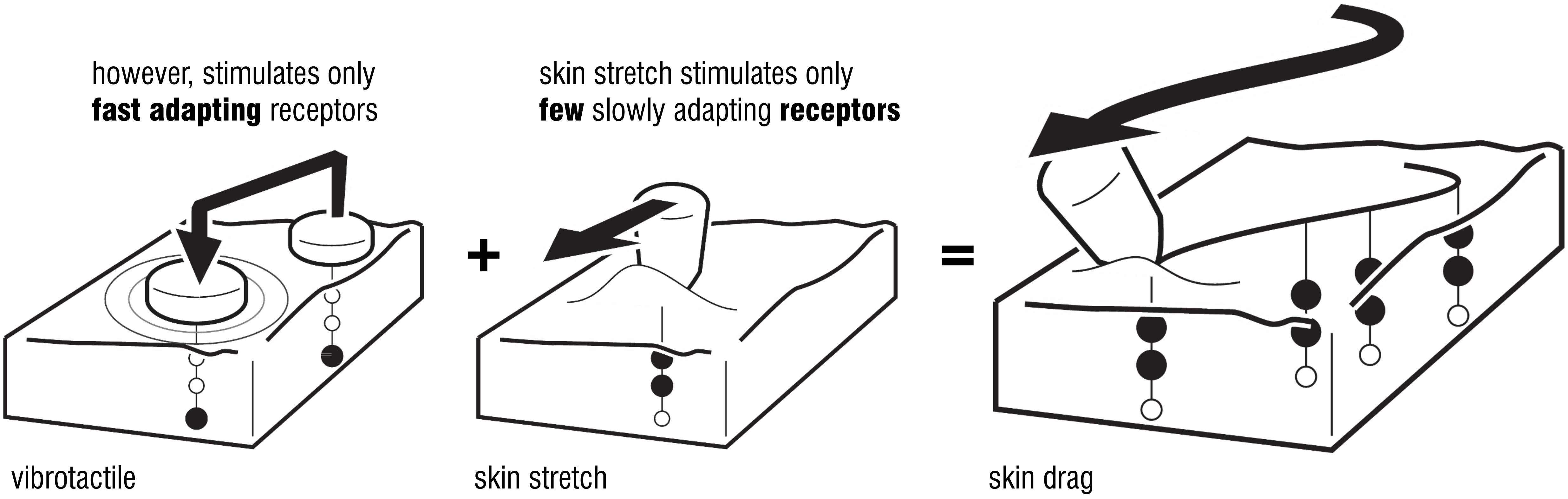


vibrotactile

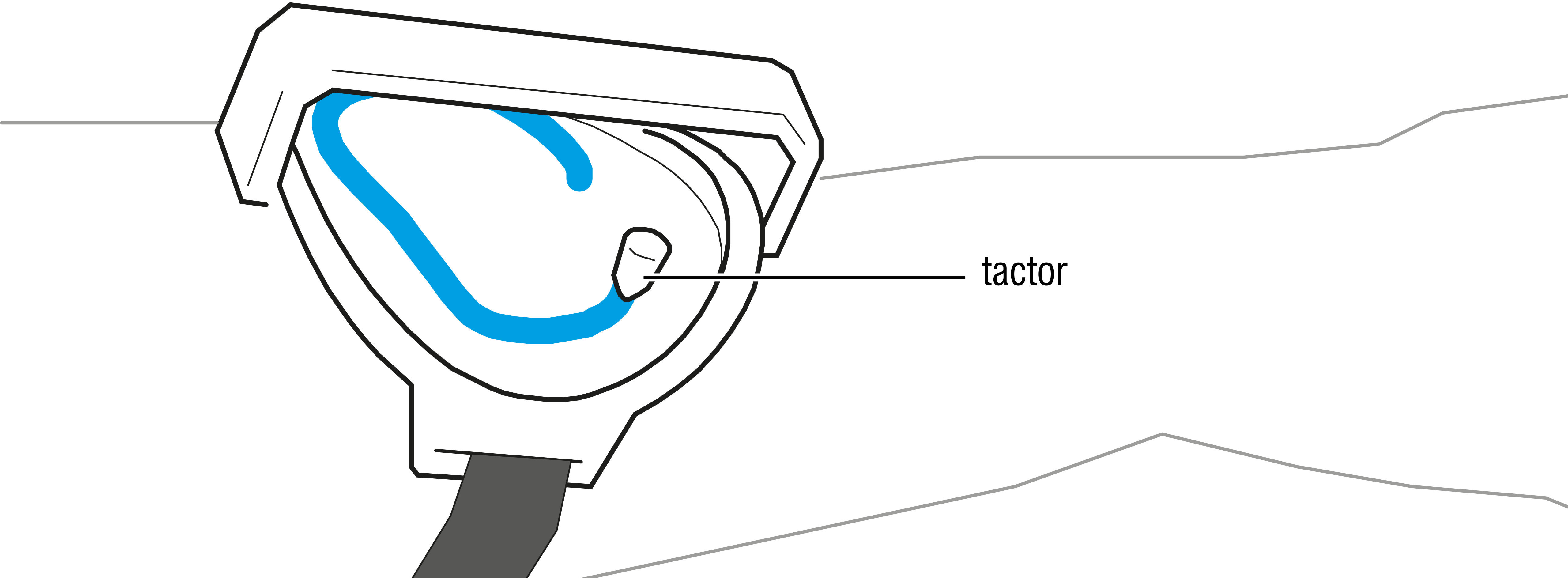
skin stretch stimulates only
few slowly adapting **receptors**



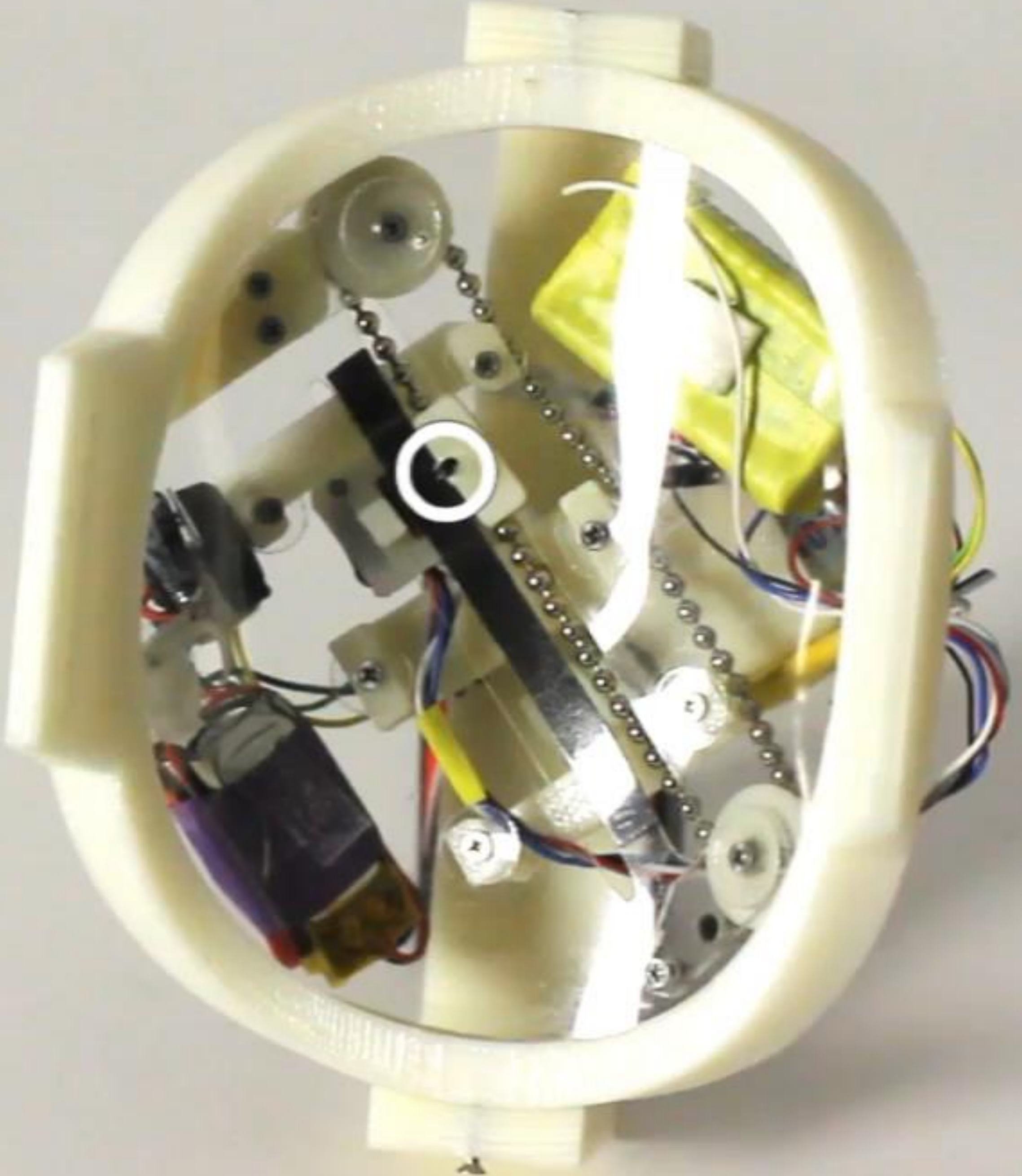
skin stretch


however, stimulates only
fast adapting receptors
skin stretch stimulates only
few slowly adapting **receptors**
+
=
vibrotactile
skin stretch
skin drag

skin drag displays



S



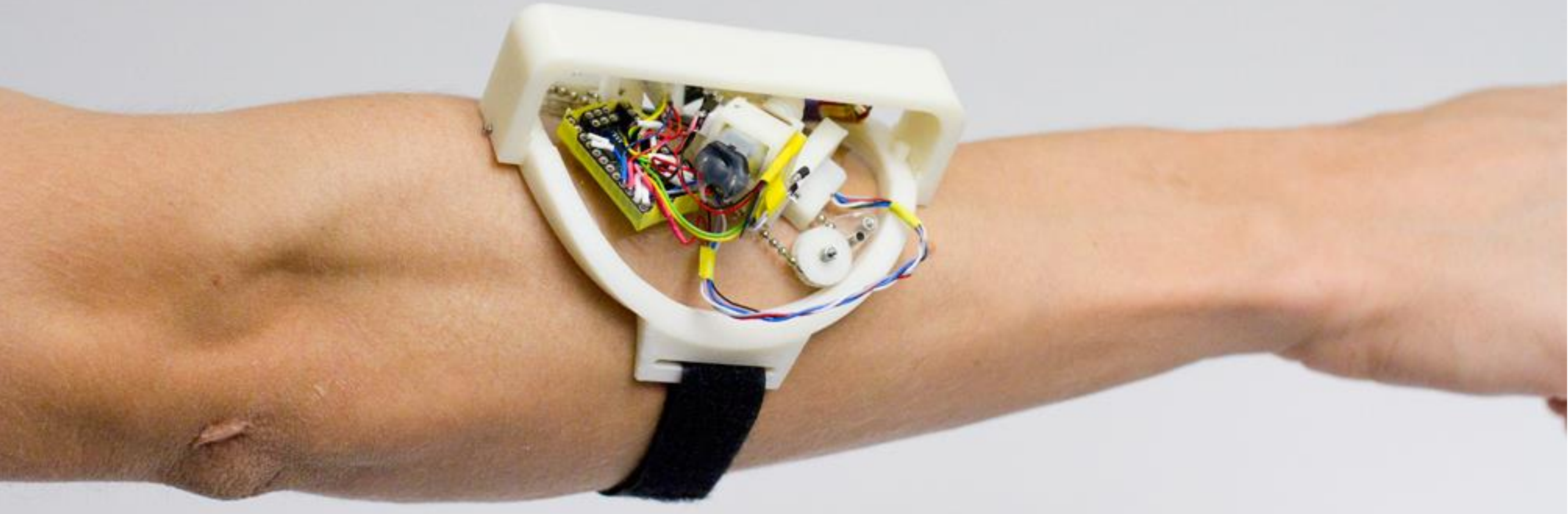
implementation

challenges

arm has a low receptor density

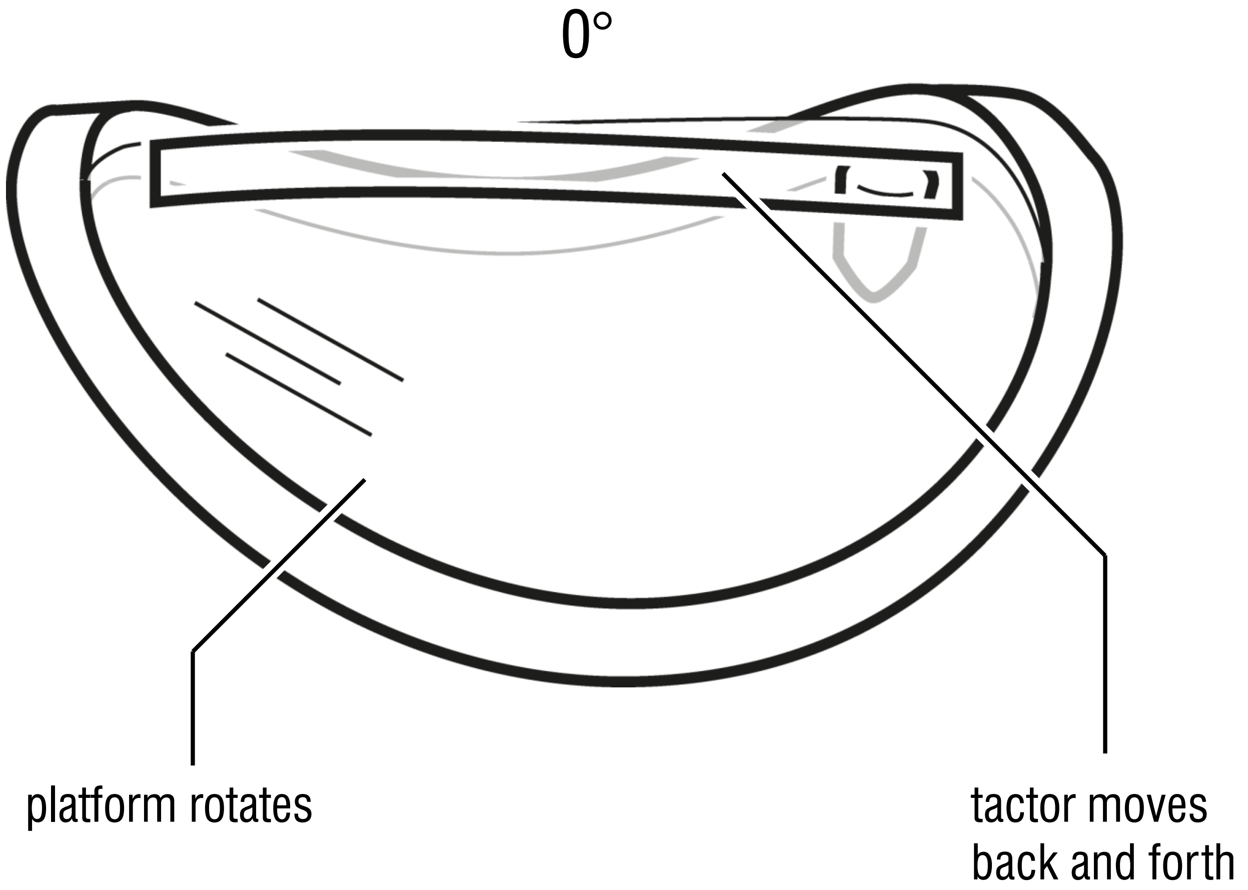
the device needs to cover a larger surface

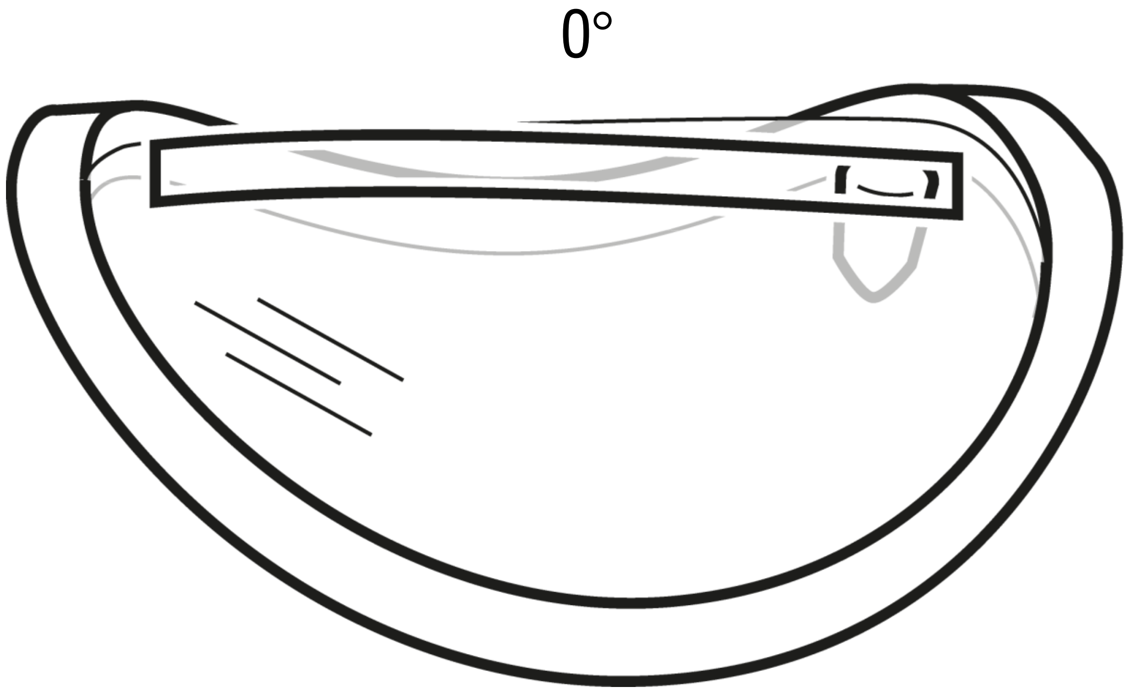
we need to respect the **arm’s curvature**



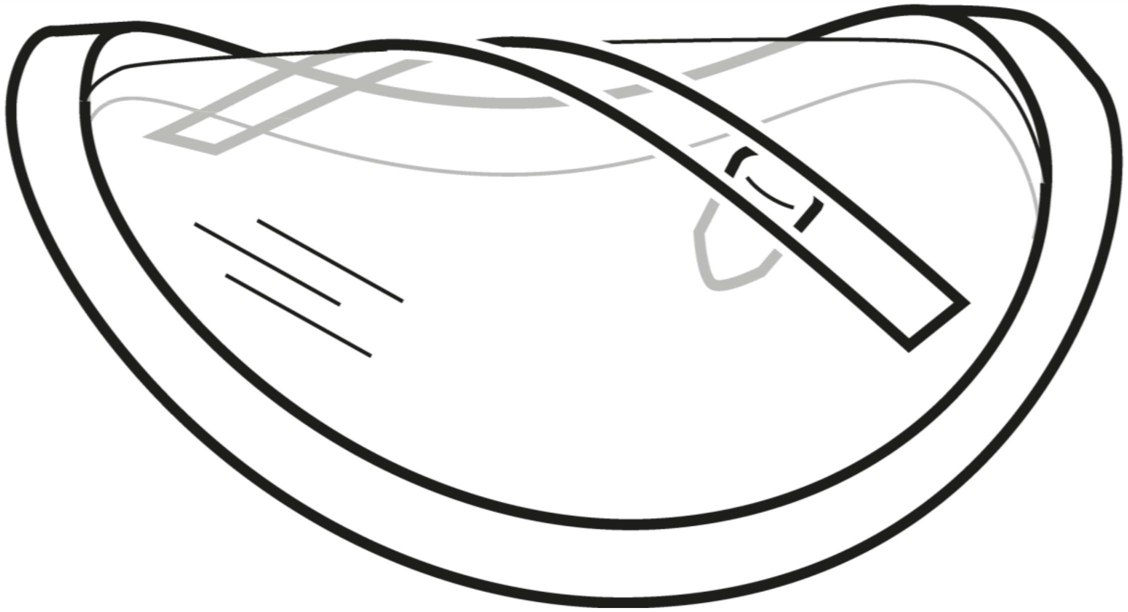
building for the arm's curvature

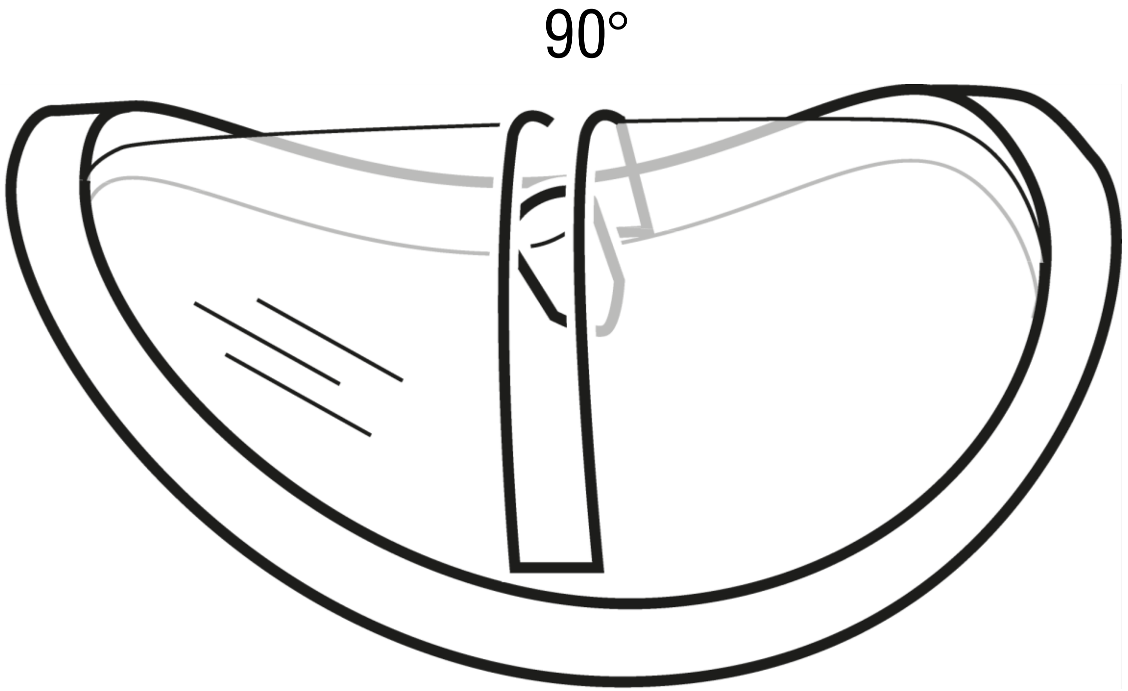
based on rotating diaphragm



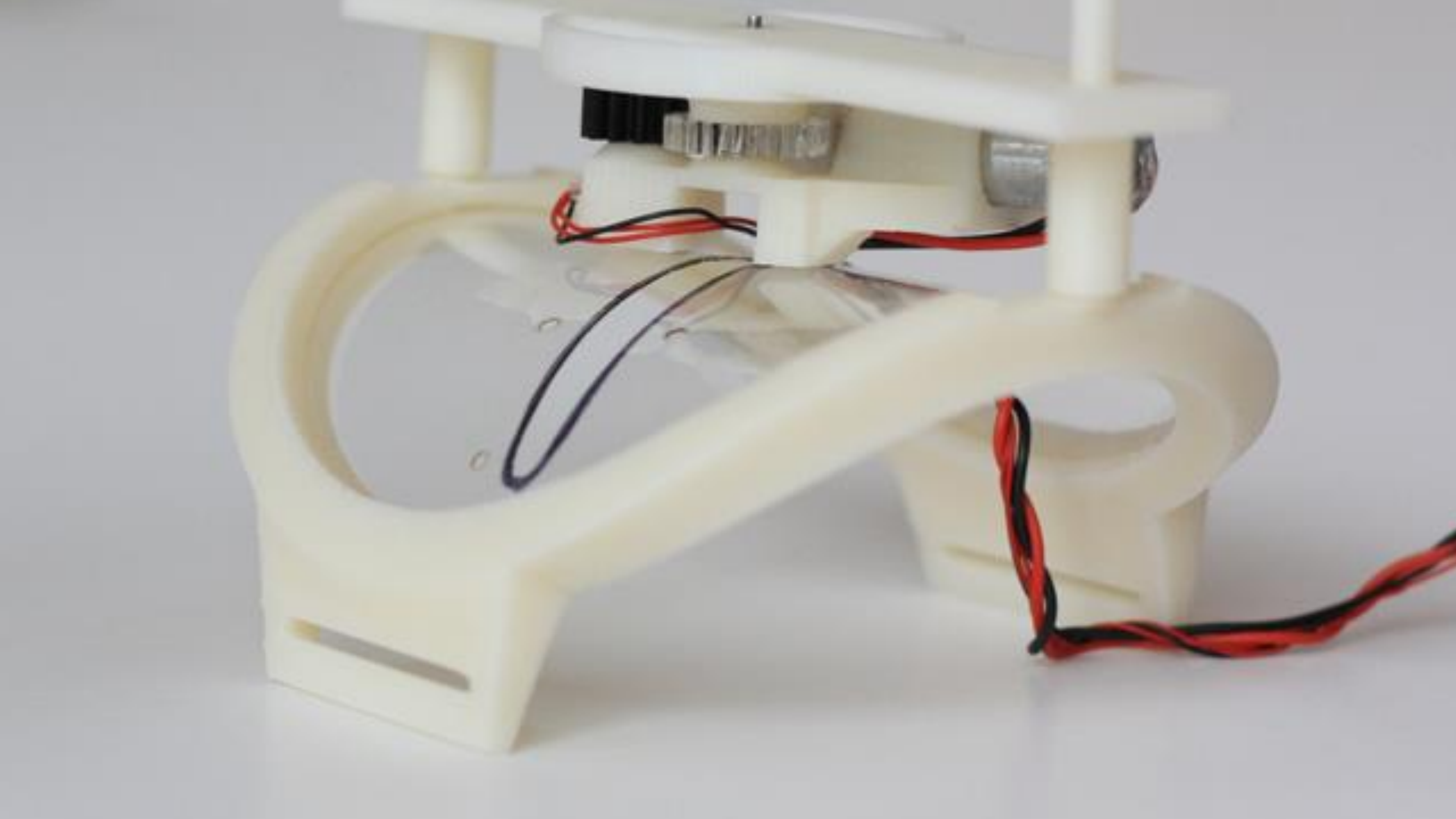

0°

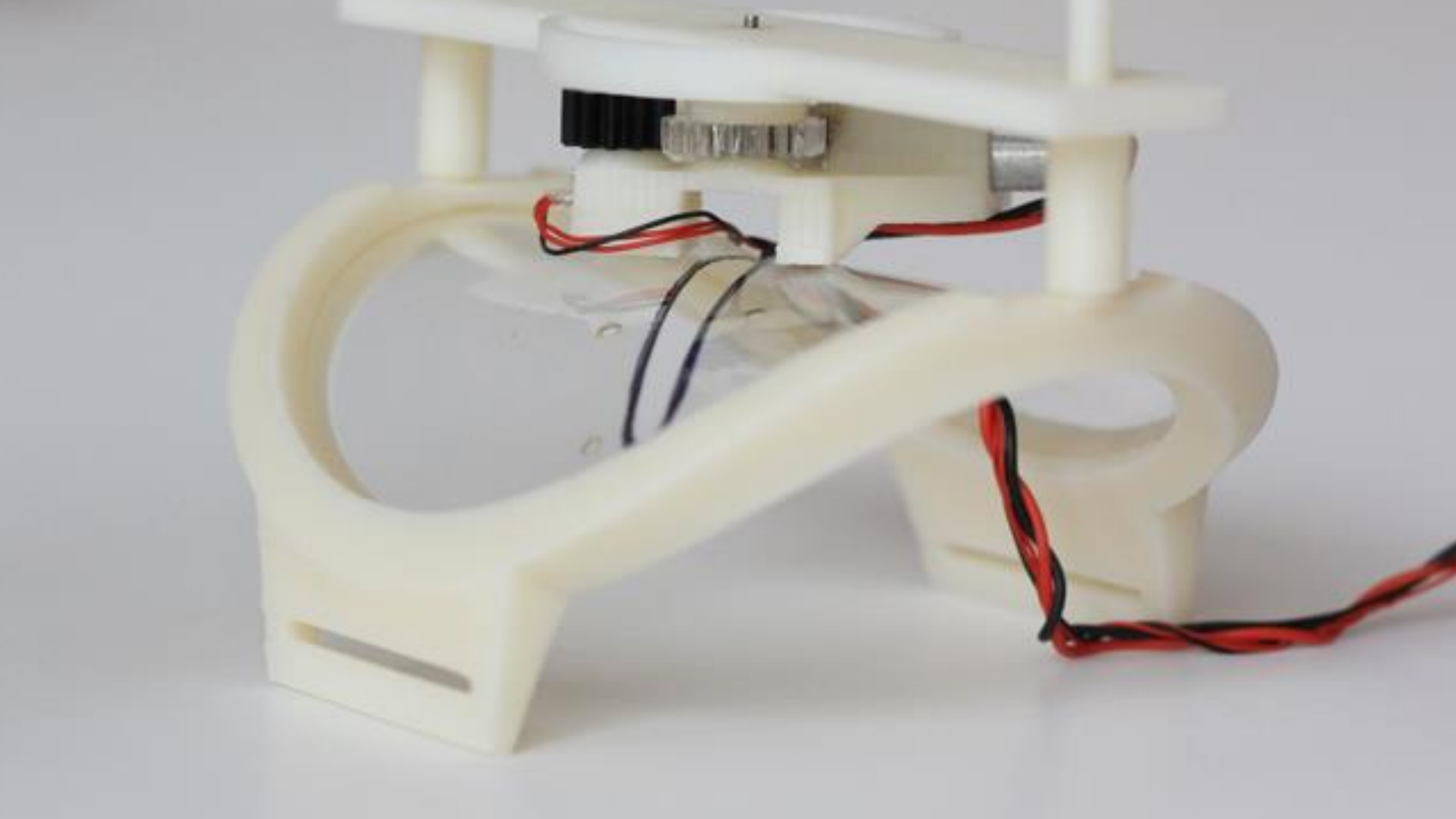
45°

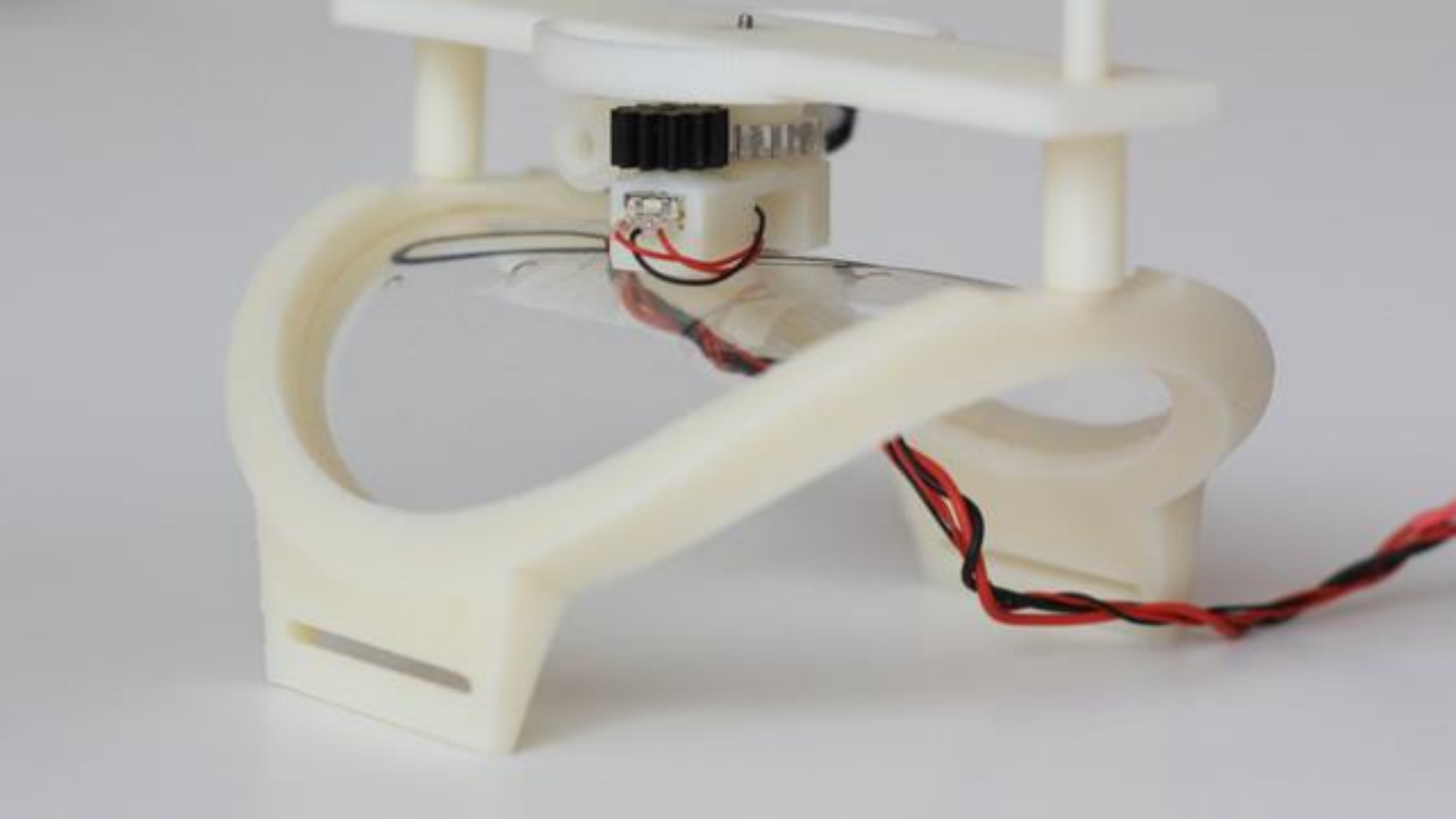


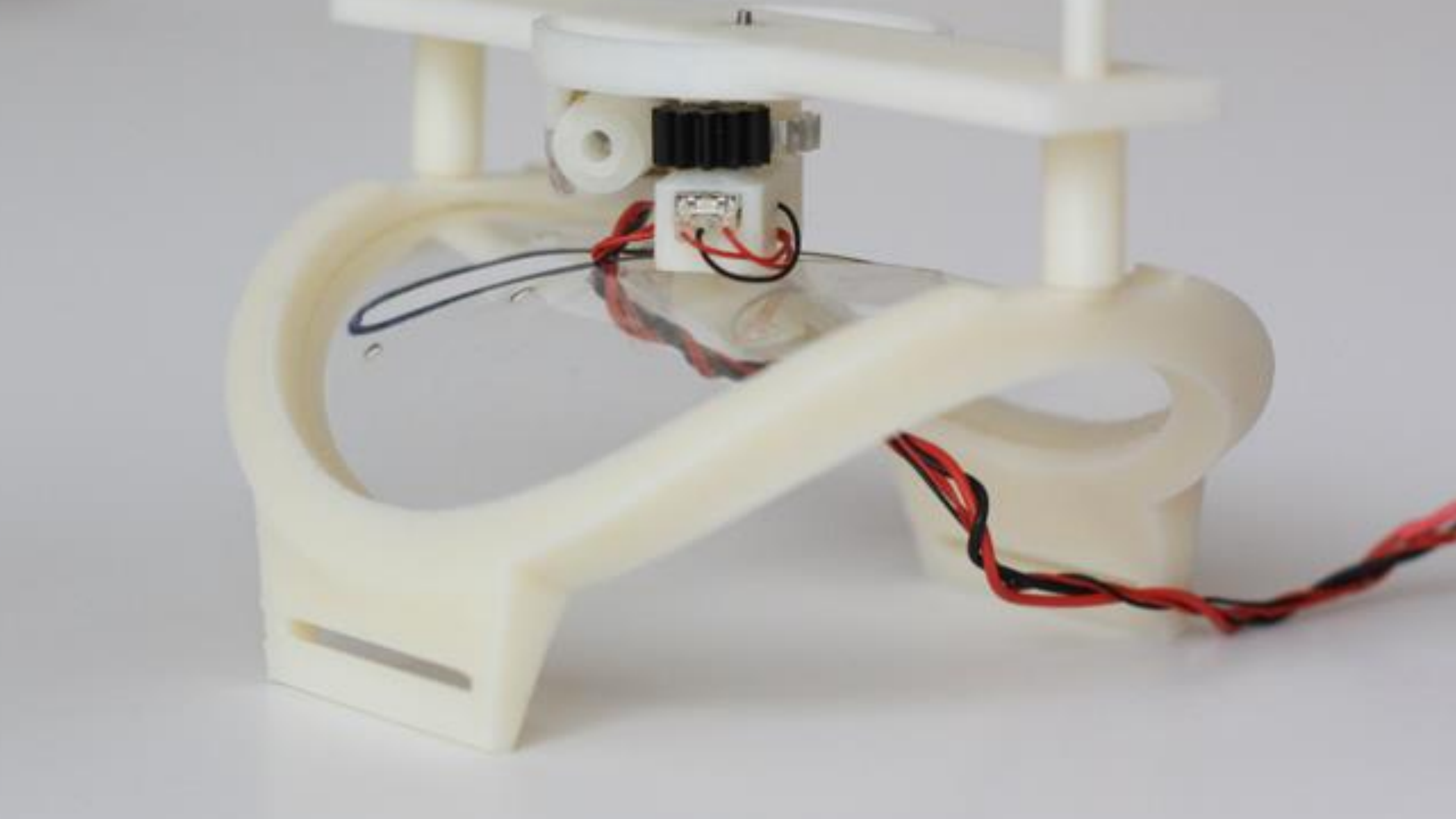

90°

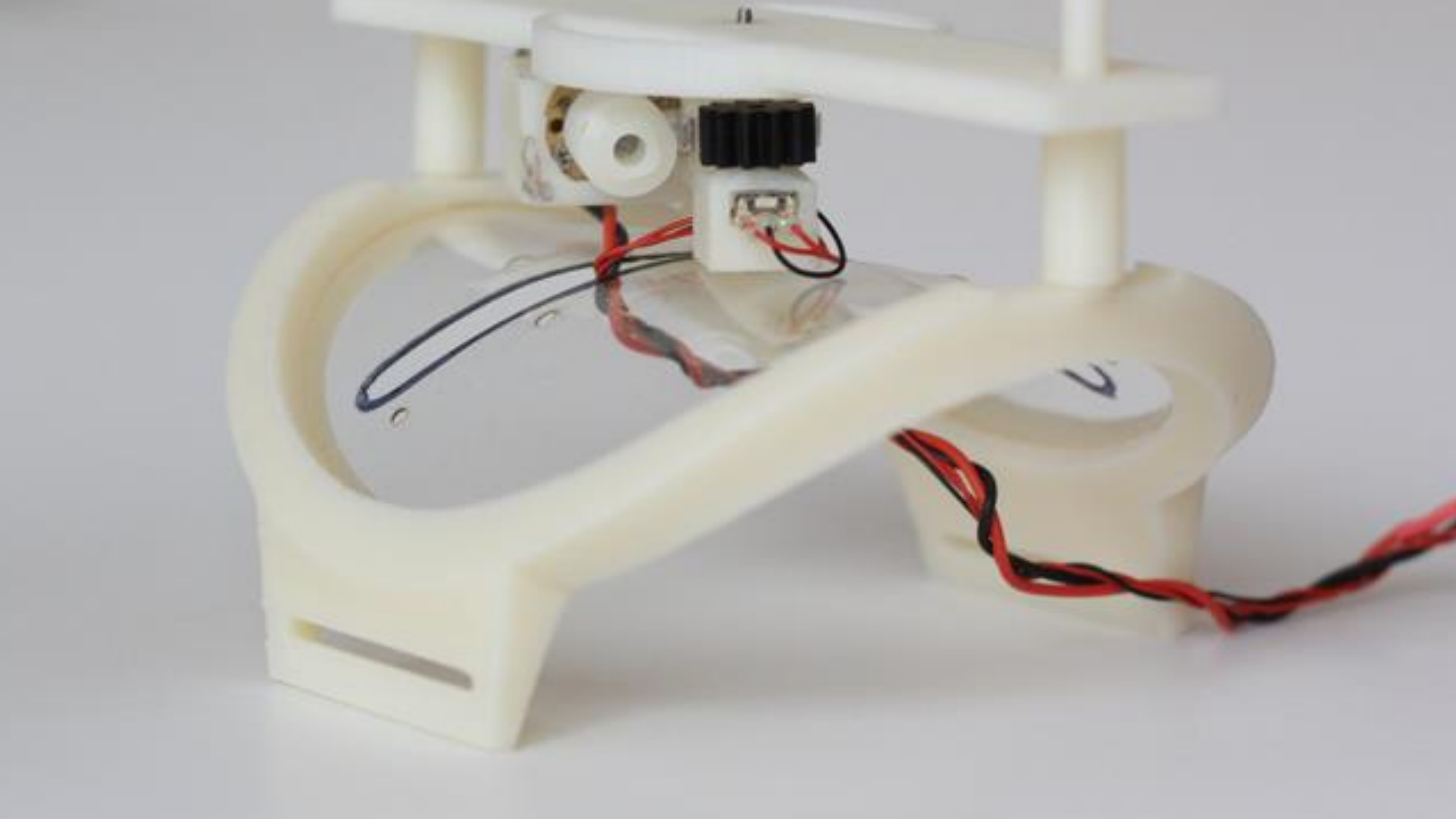
rotation

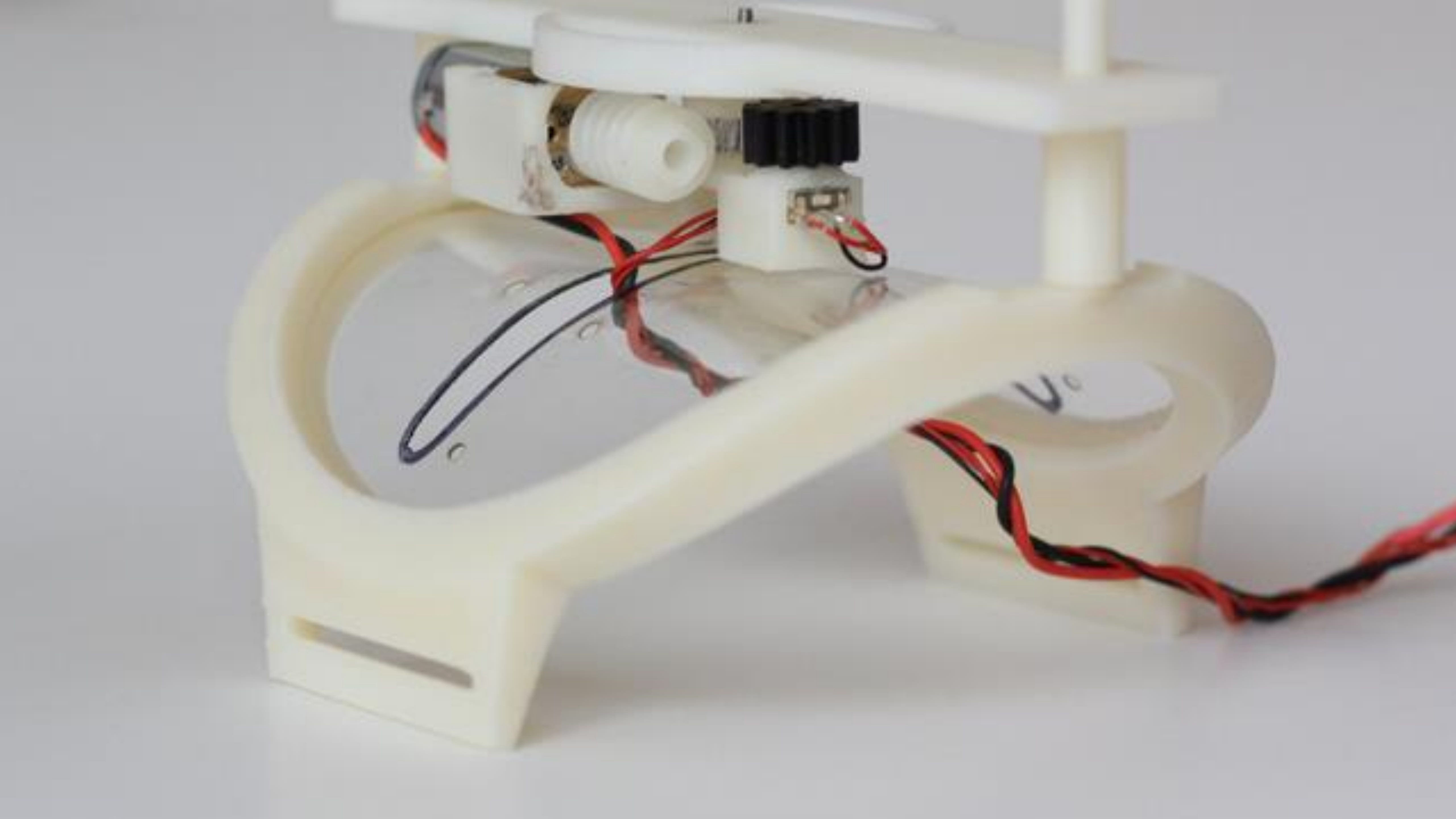


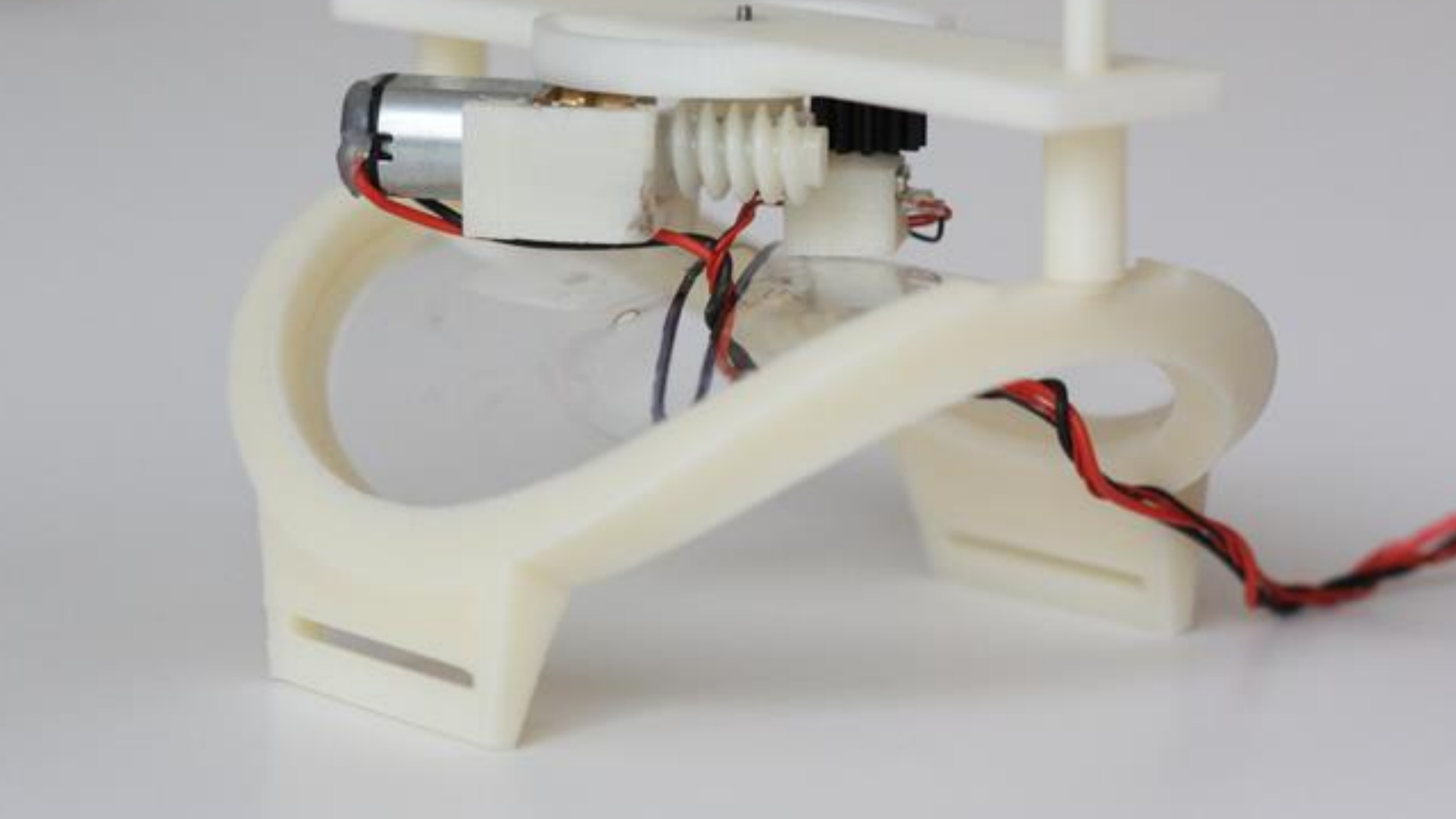


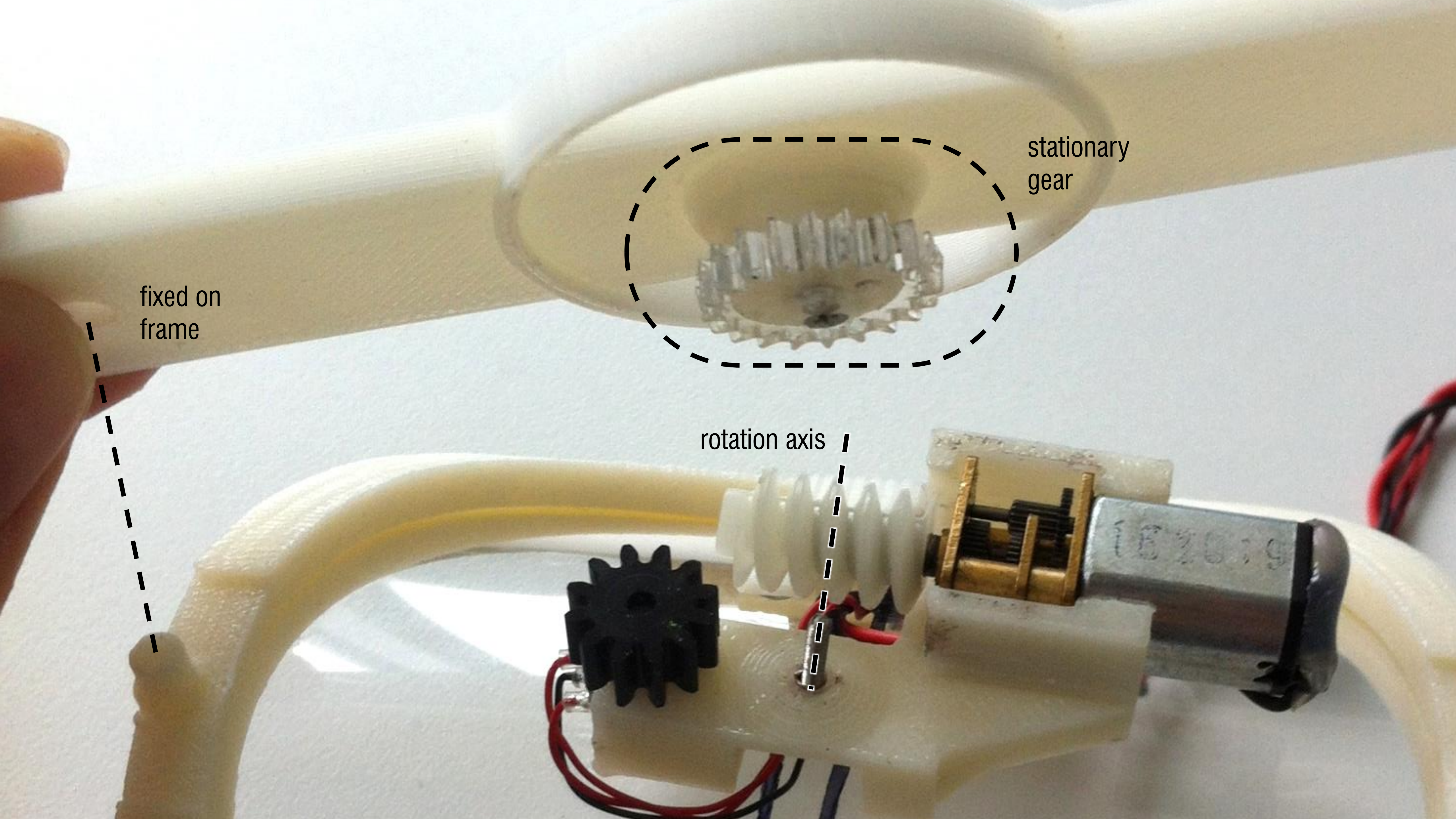




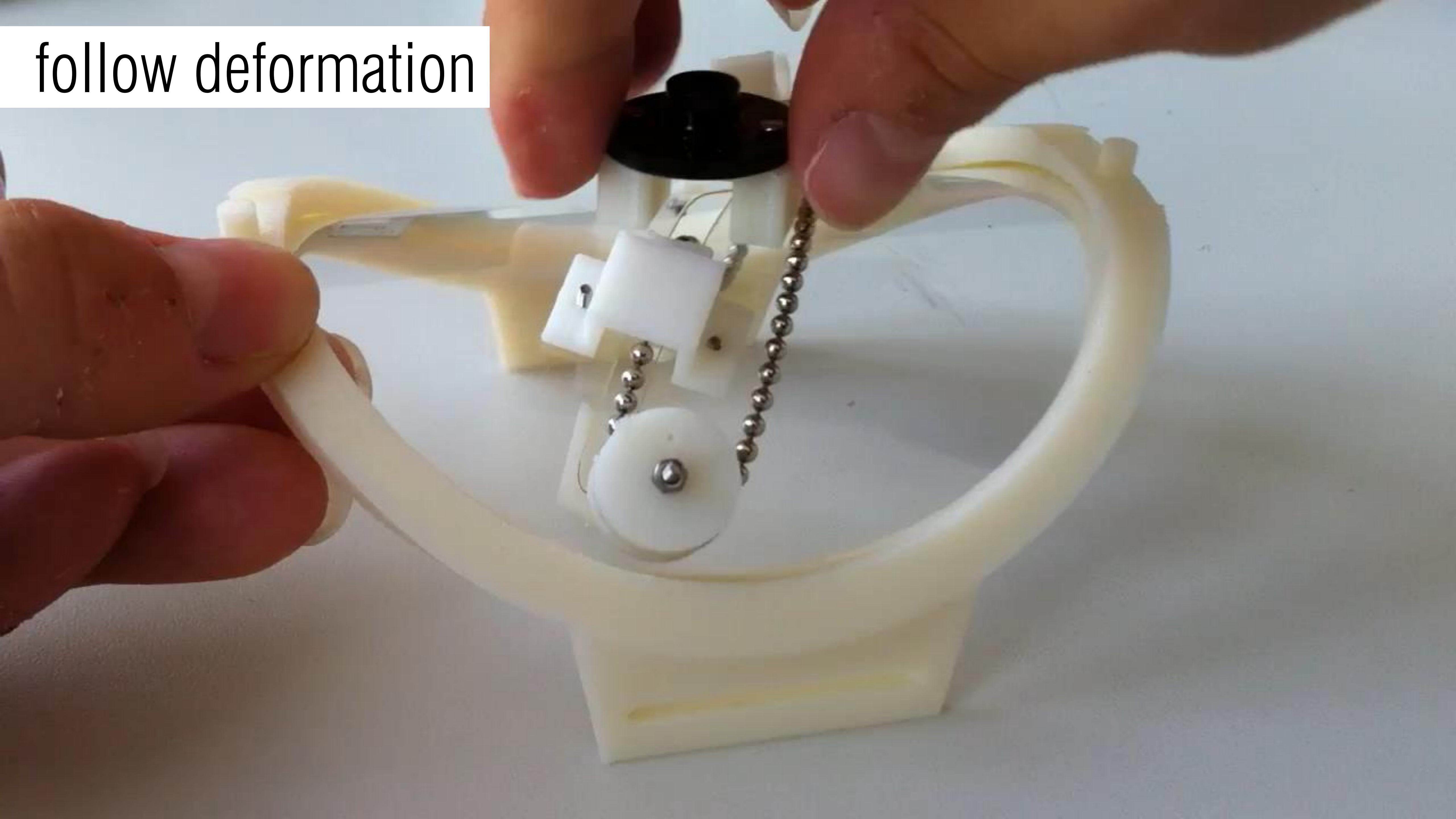




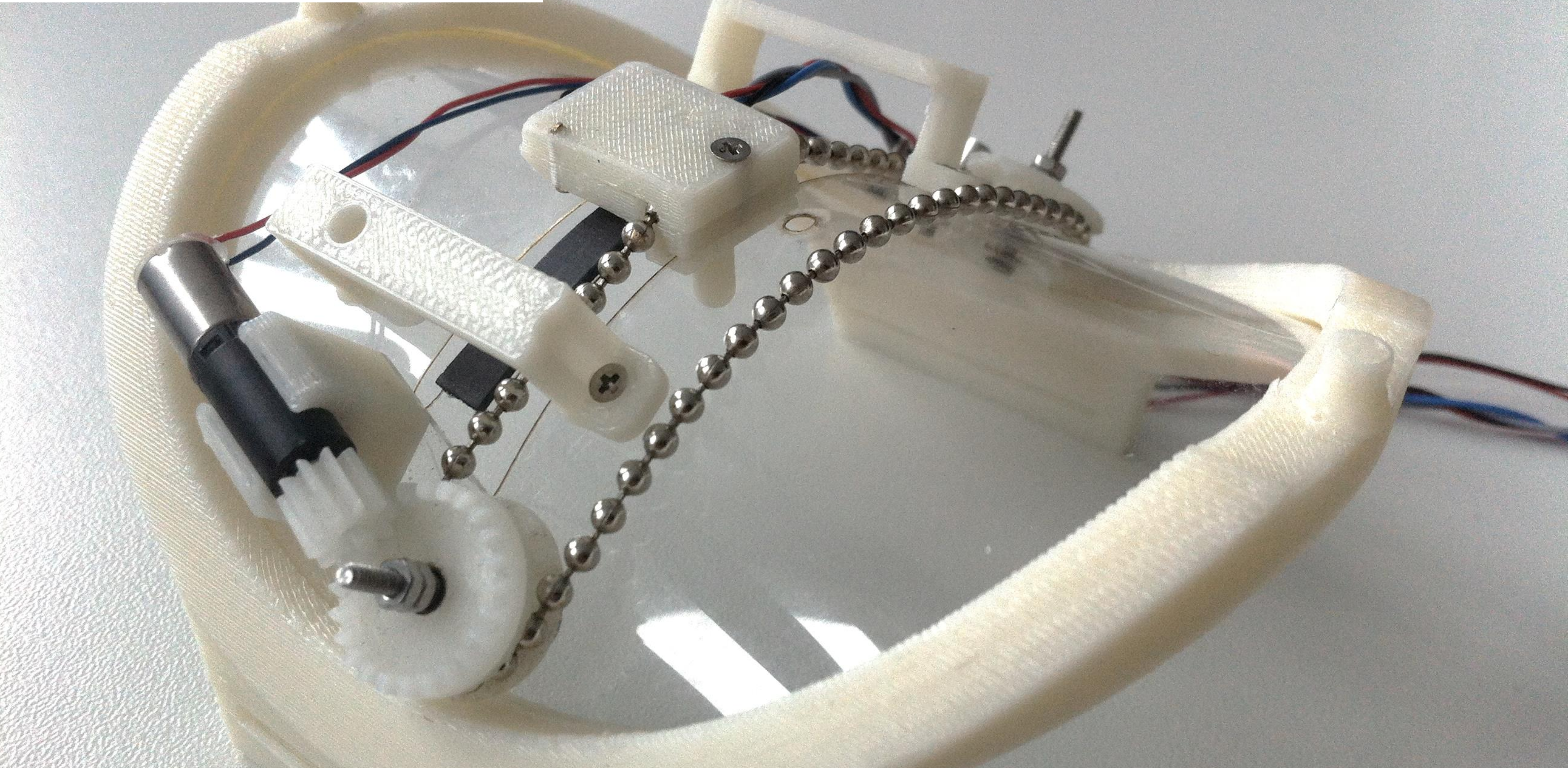



stationary
gear
fixed on
frame
rotation axis

linear motion

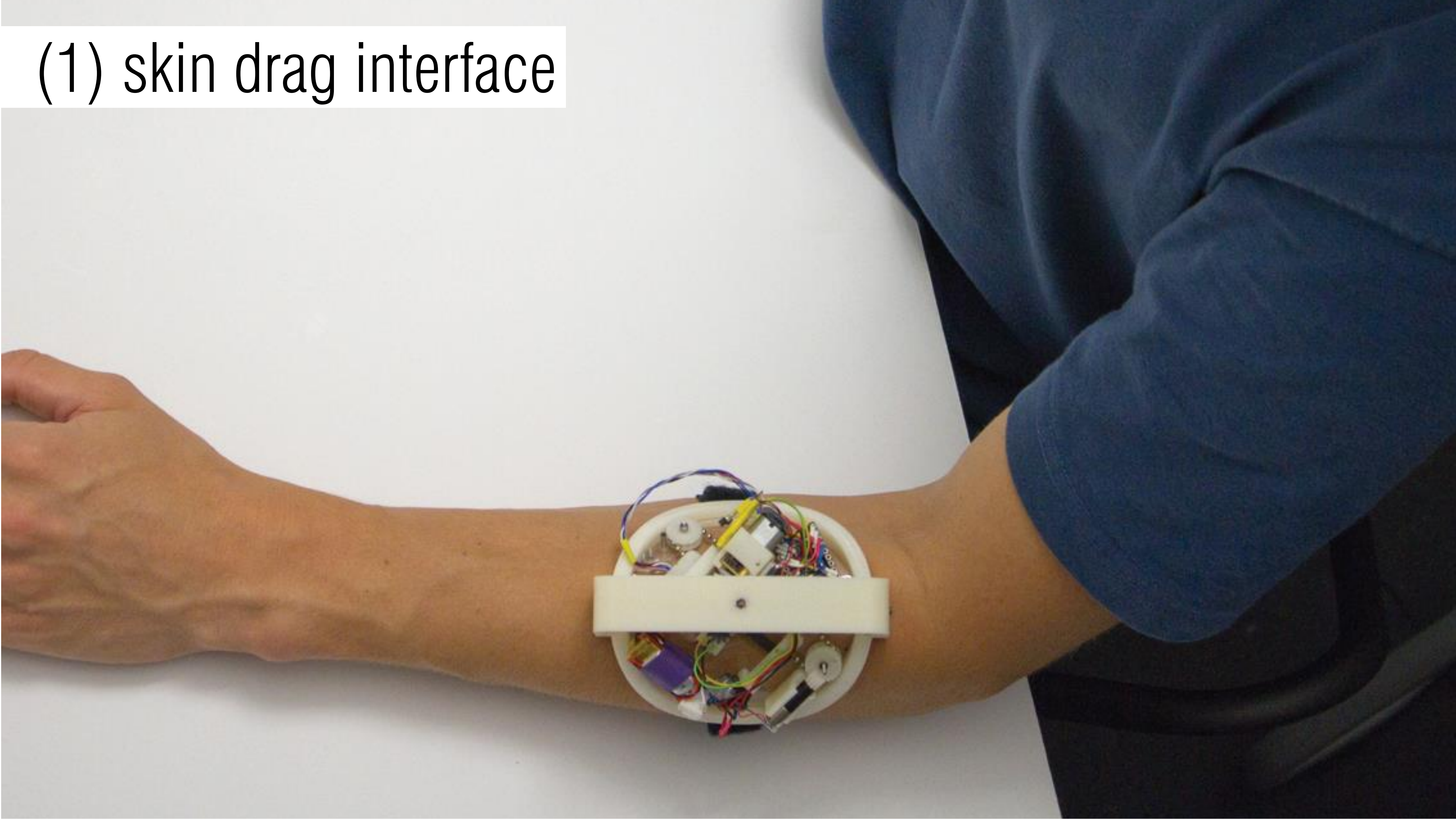

follow deformation

ball chain deforms



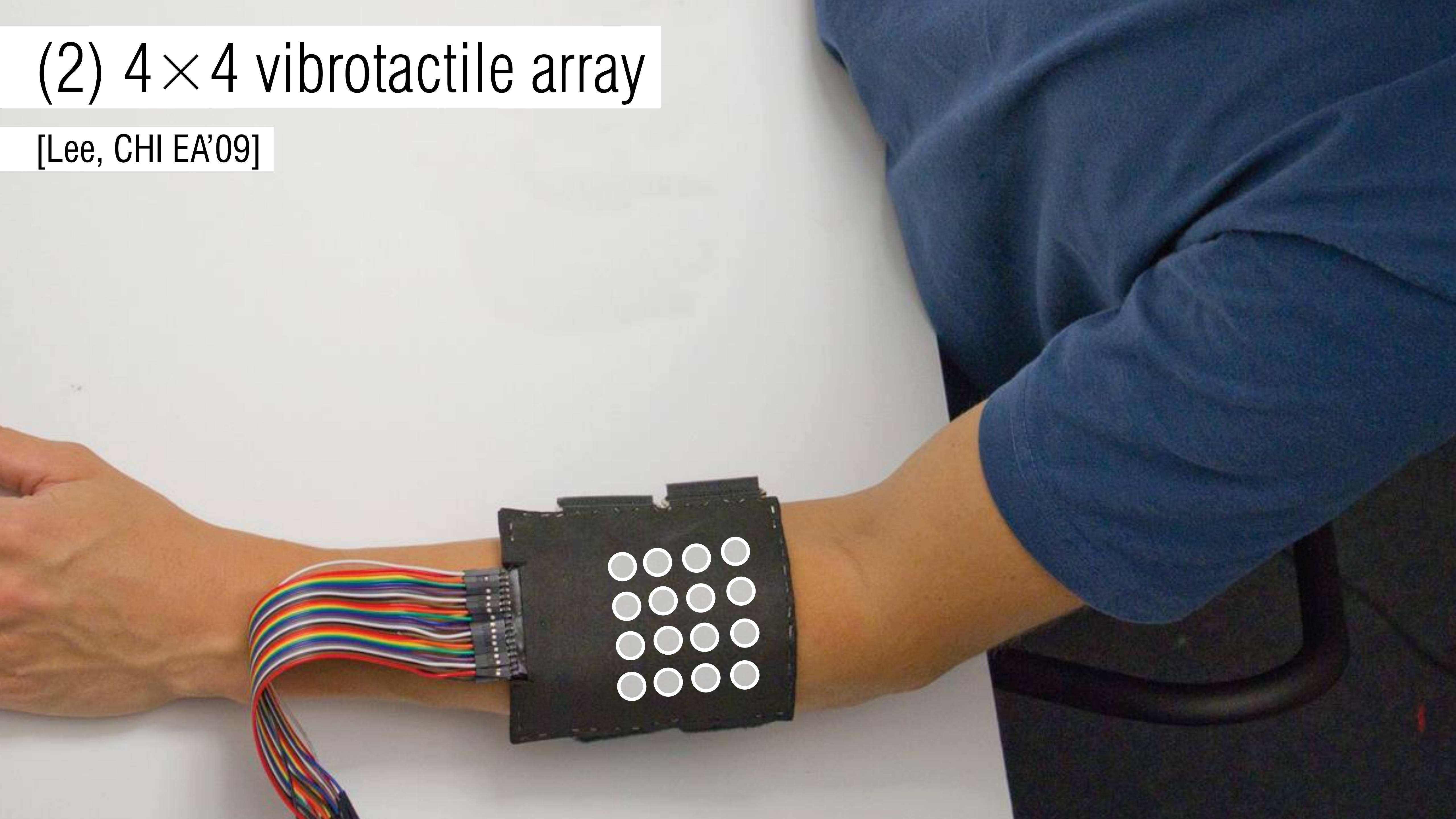
electronics

study

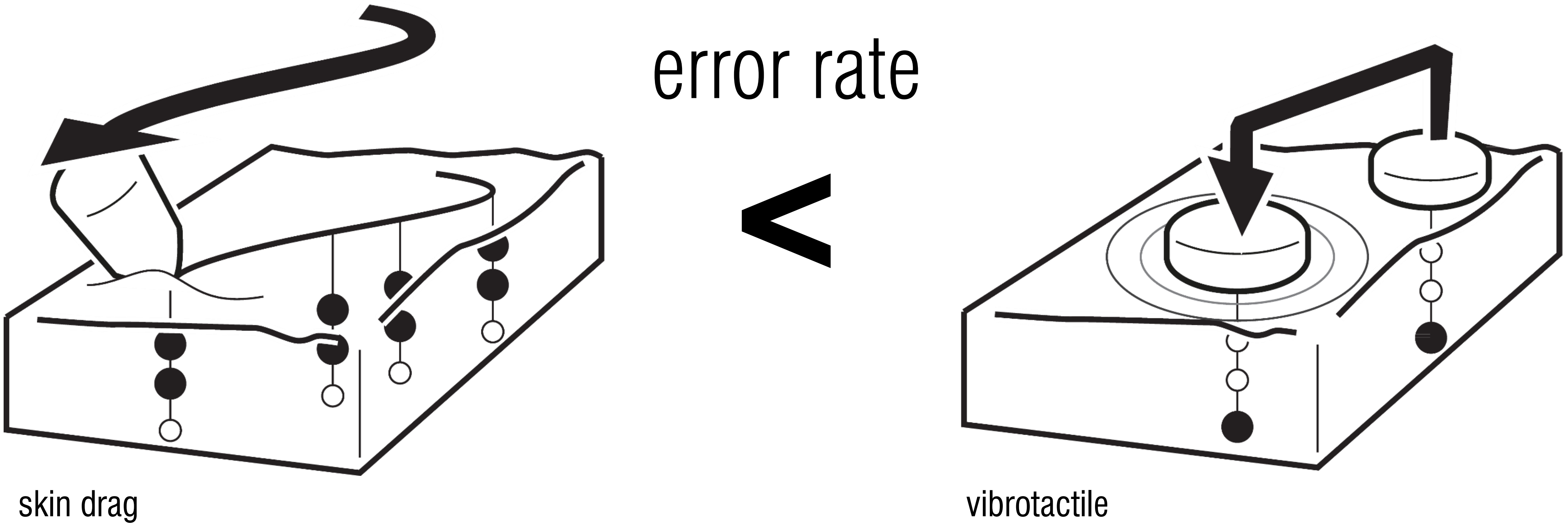

(1) skin drag interface

(2) 4×4 vibrotactile array

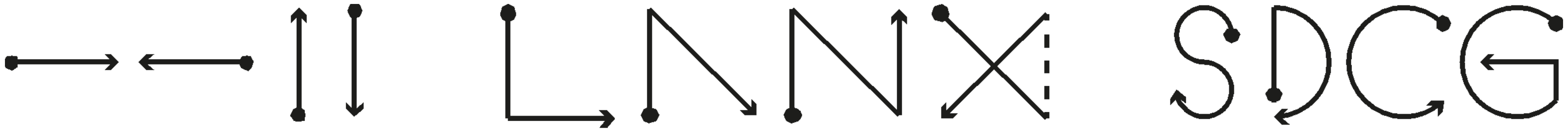
[Lee, CHI EA'09]



hypothesis



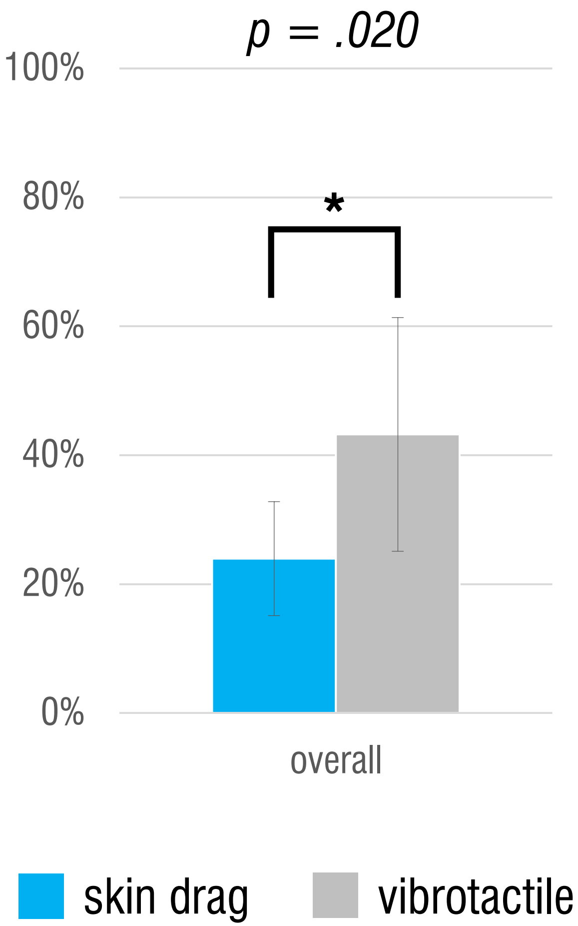
shapes



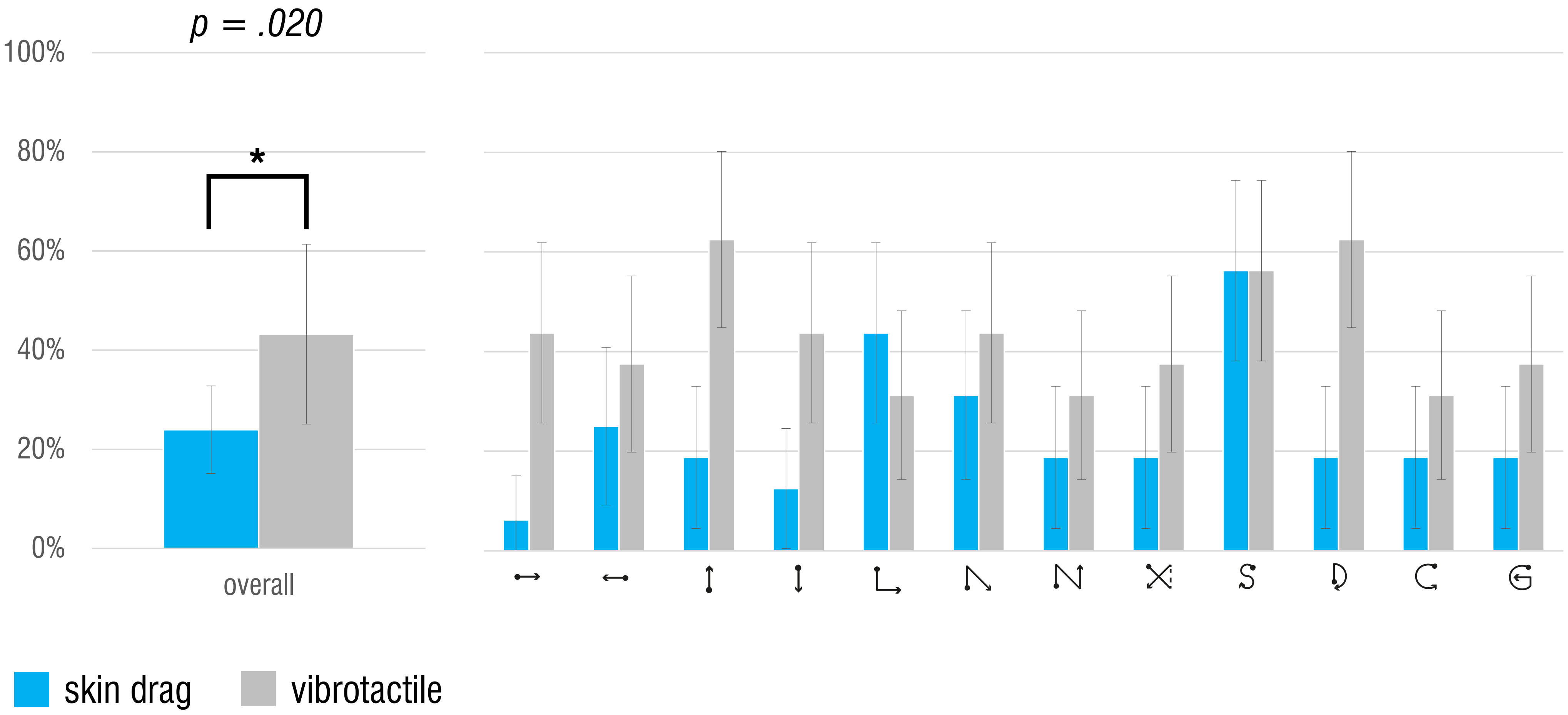
directional compound curved

3 blocks, 8 participants (age $M = 22.12$ years, $SD = 3.22$)

error rate



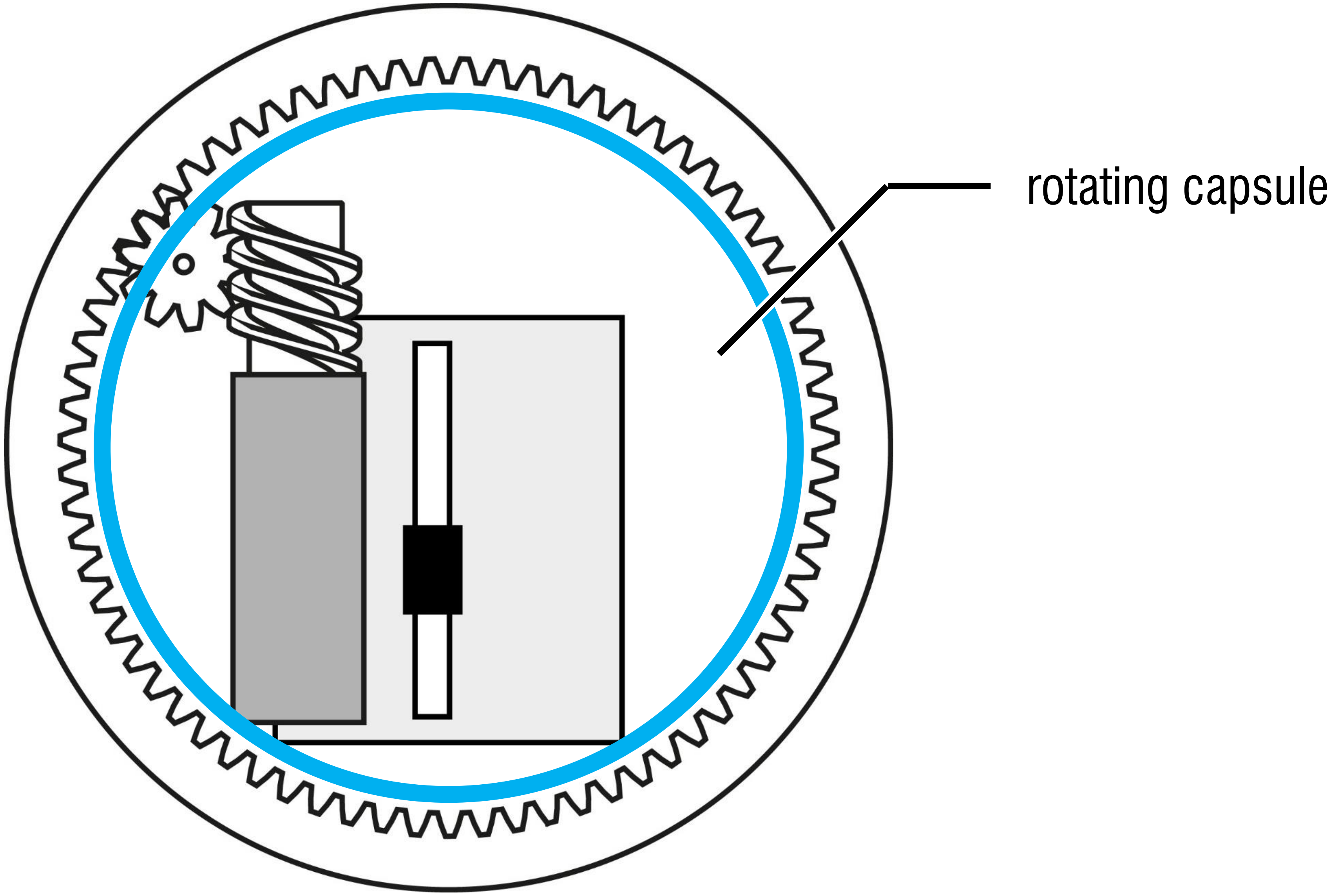
error rate

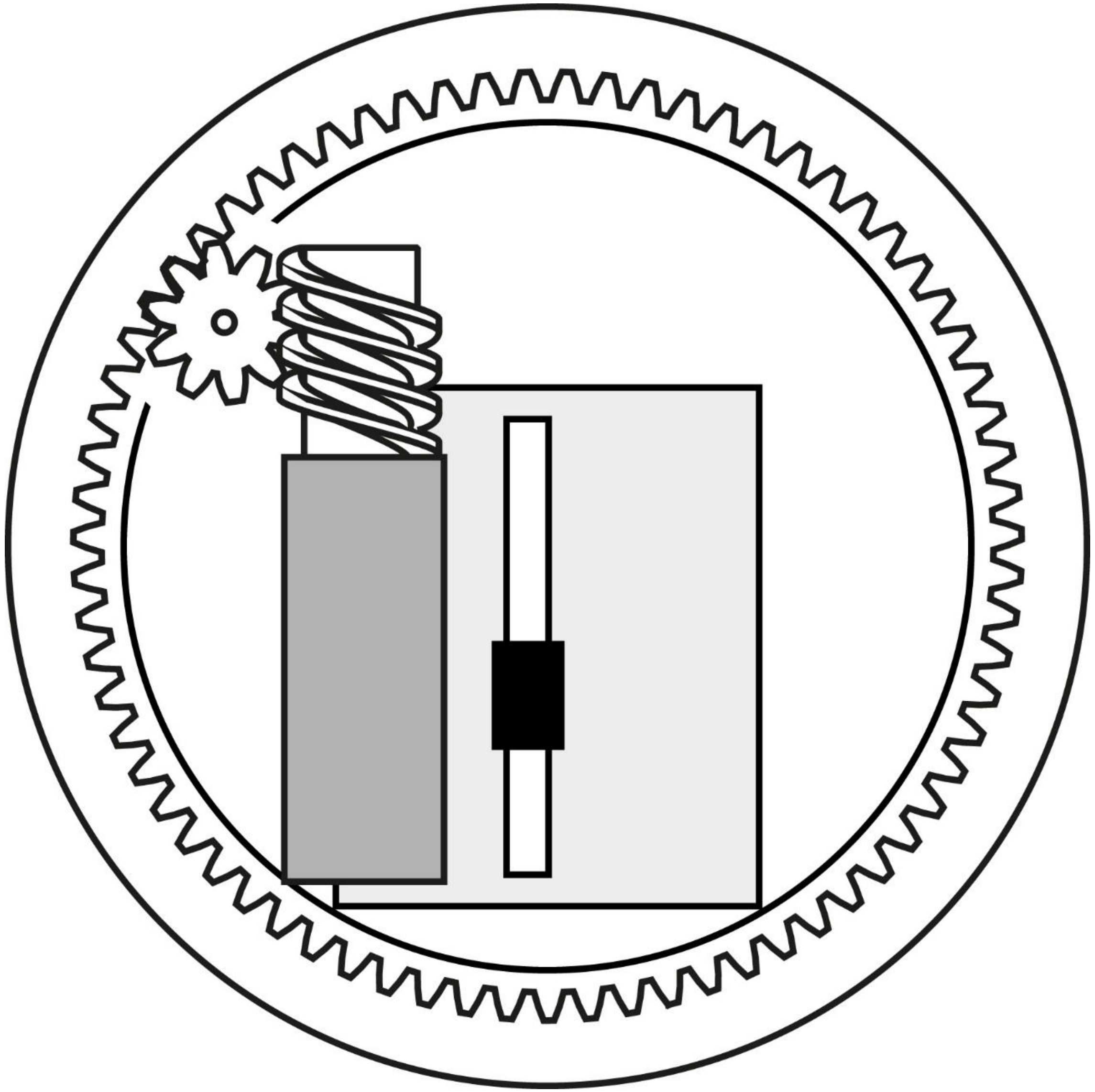


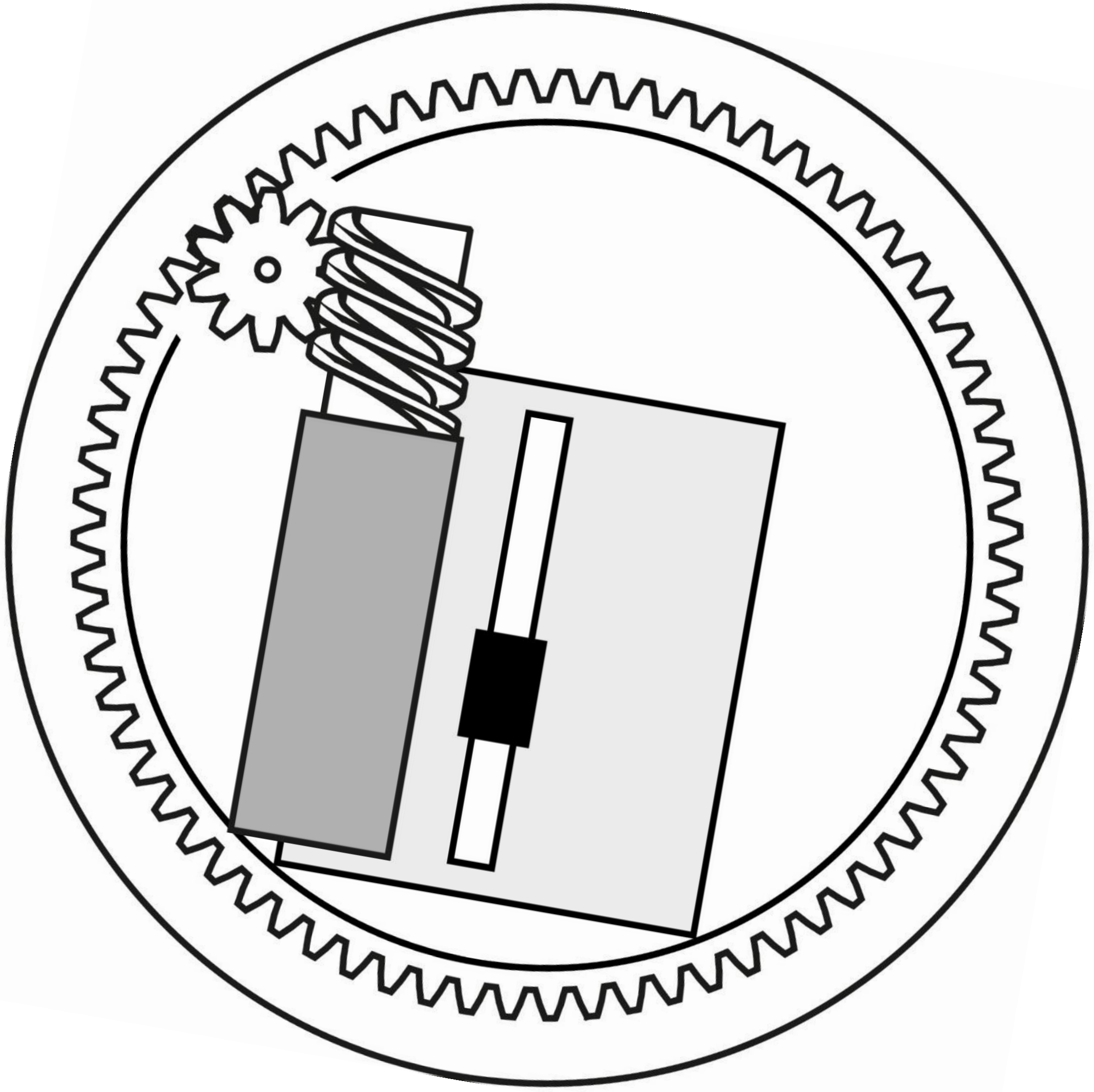
watch-size prototype

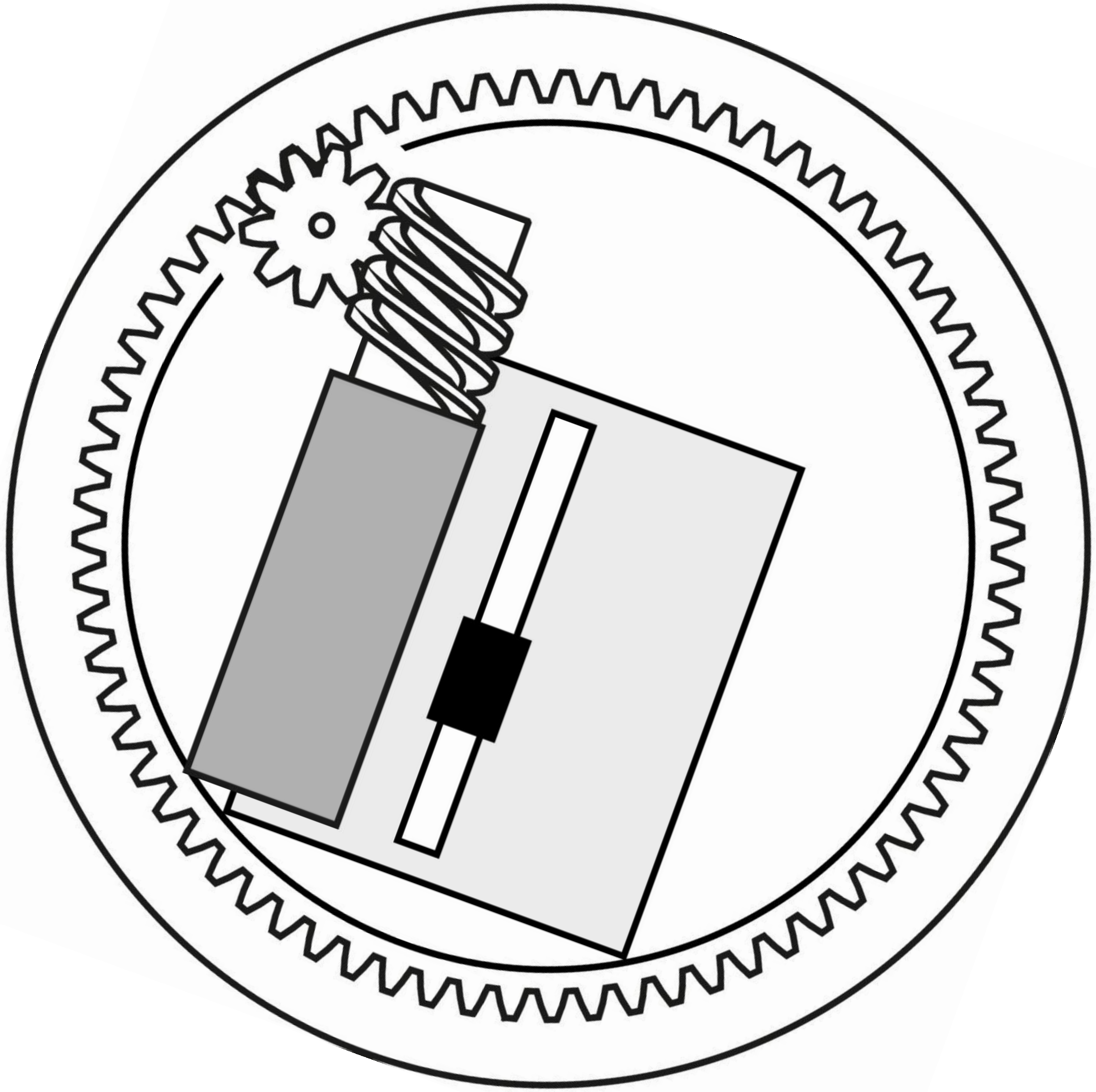

BAHNHOF

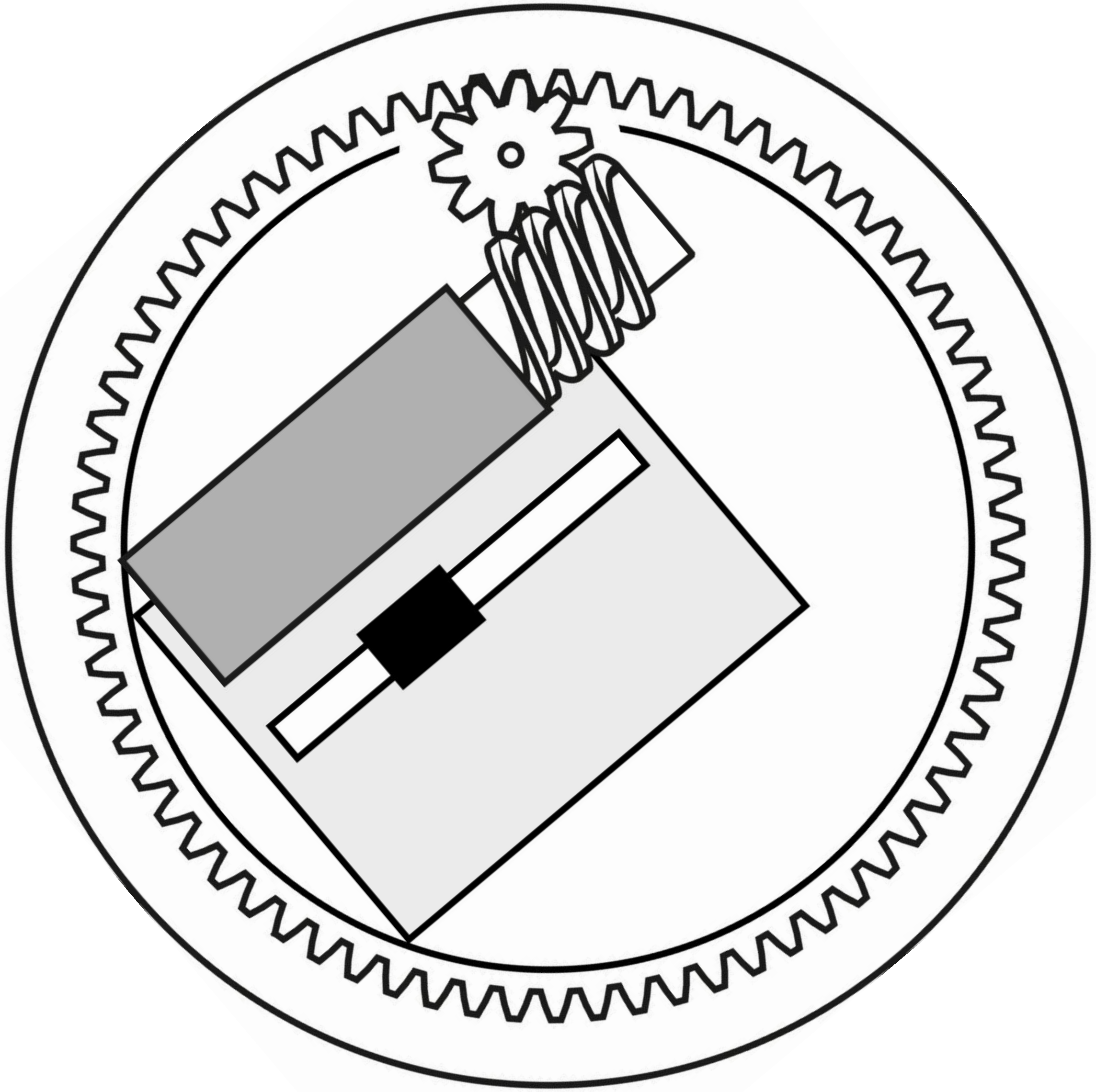
key to miniaturization:
the polar design

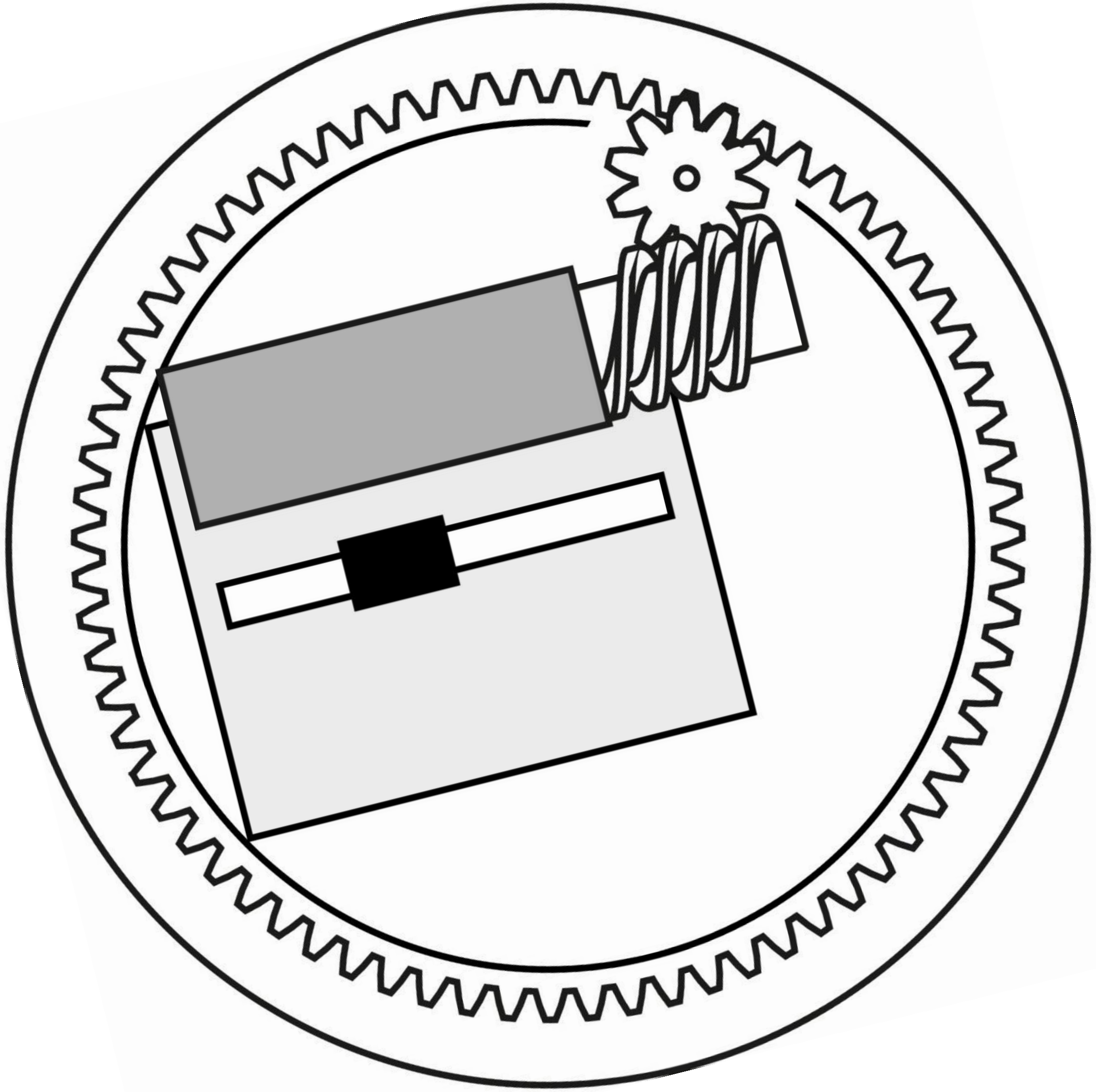

rotating capsule

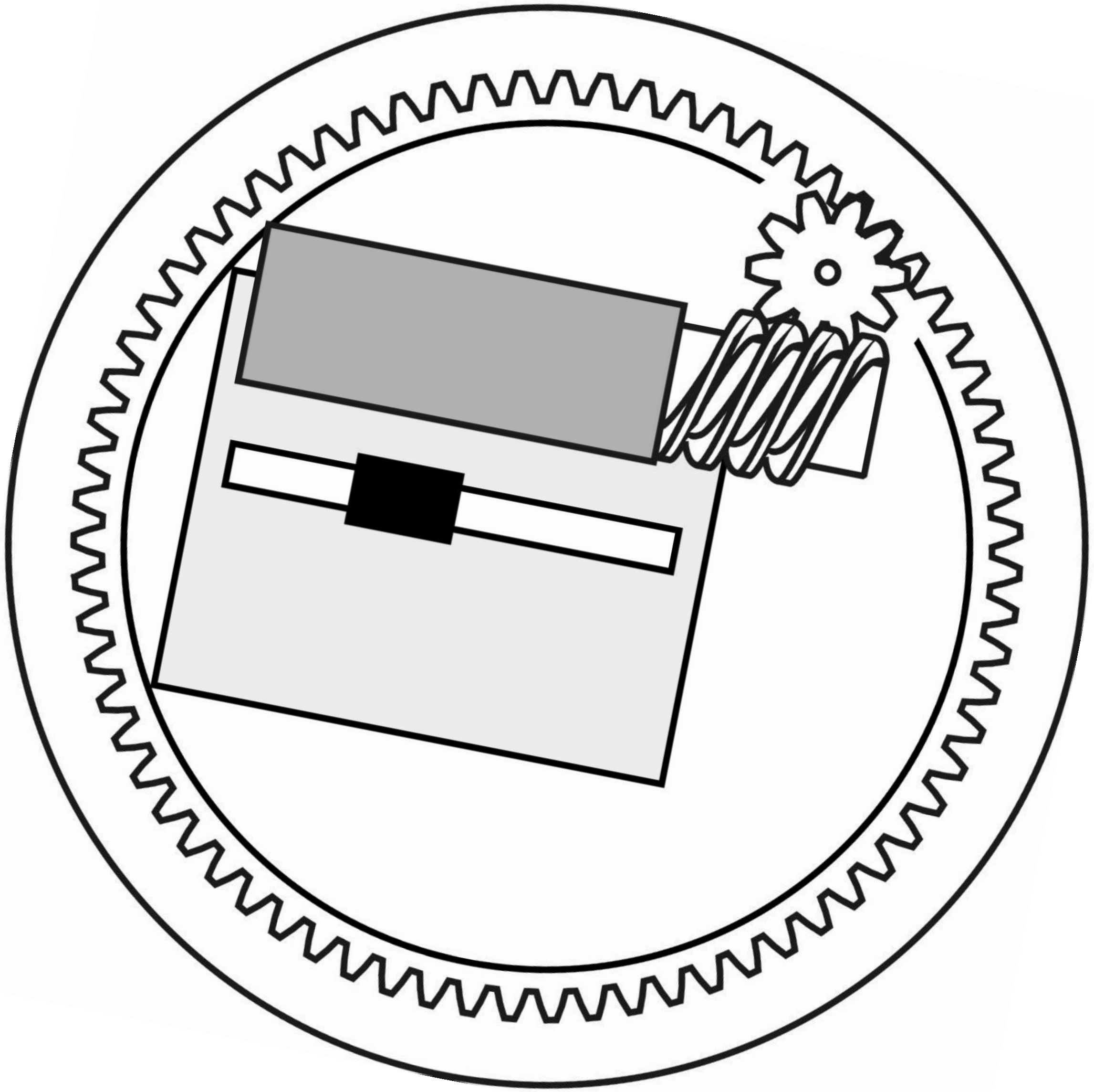




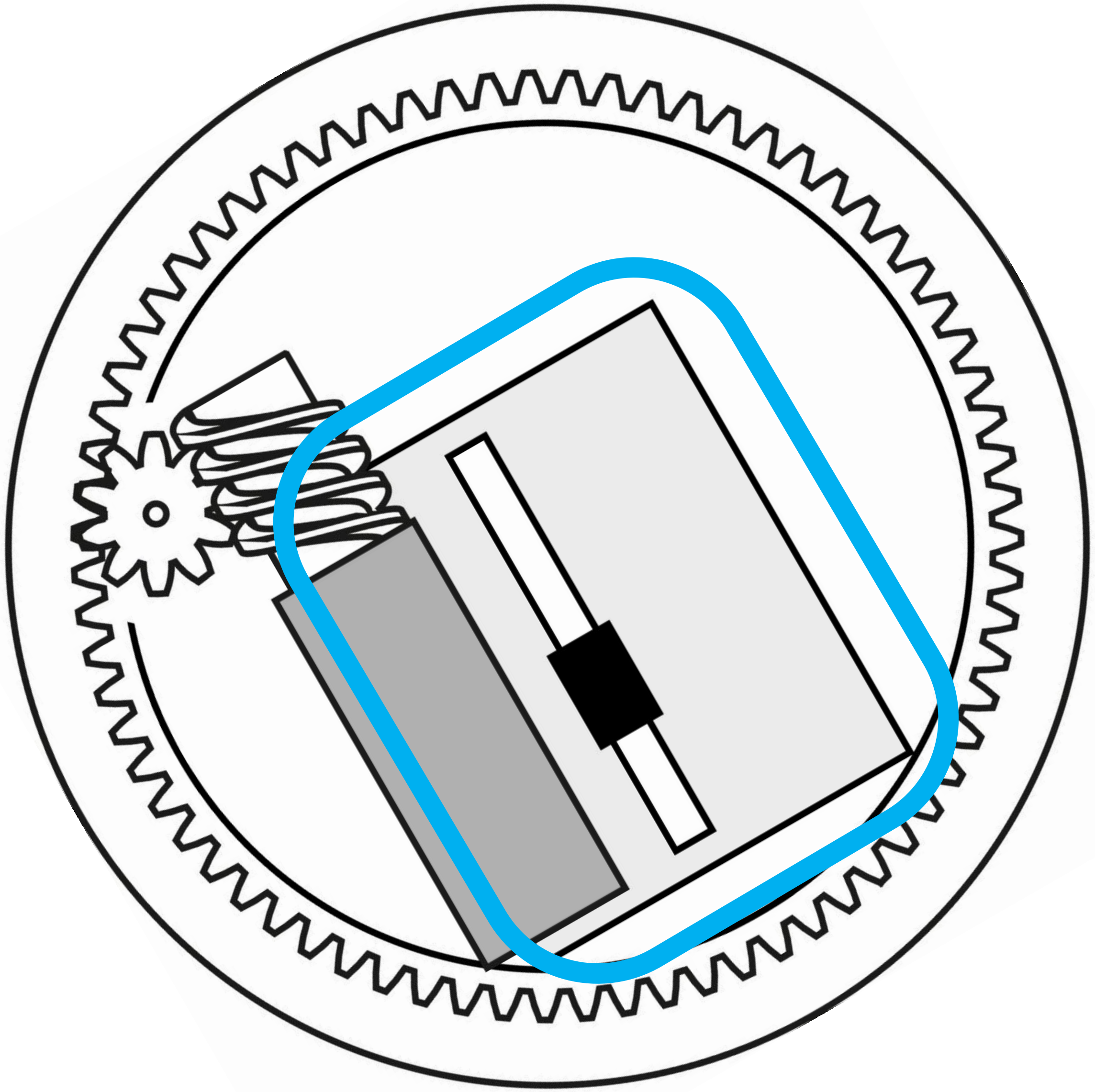


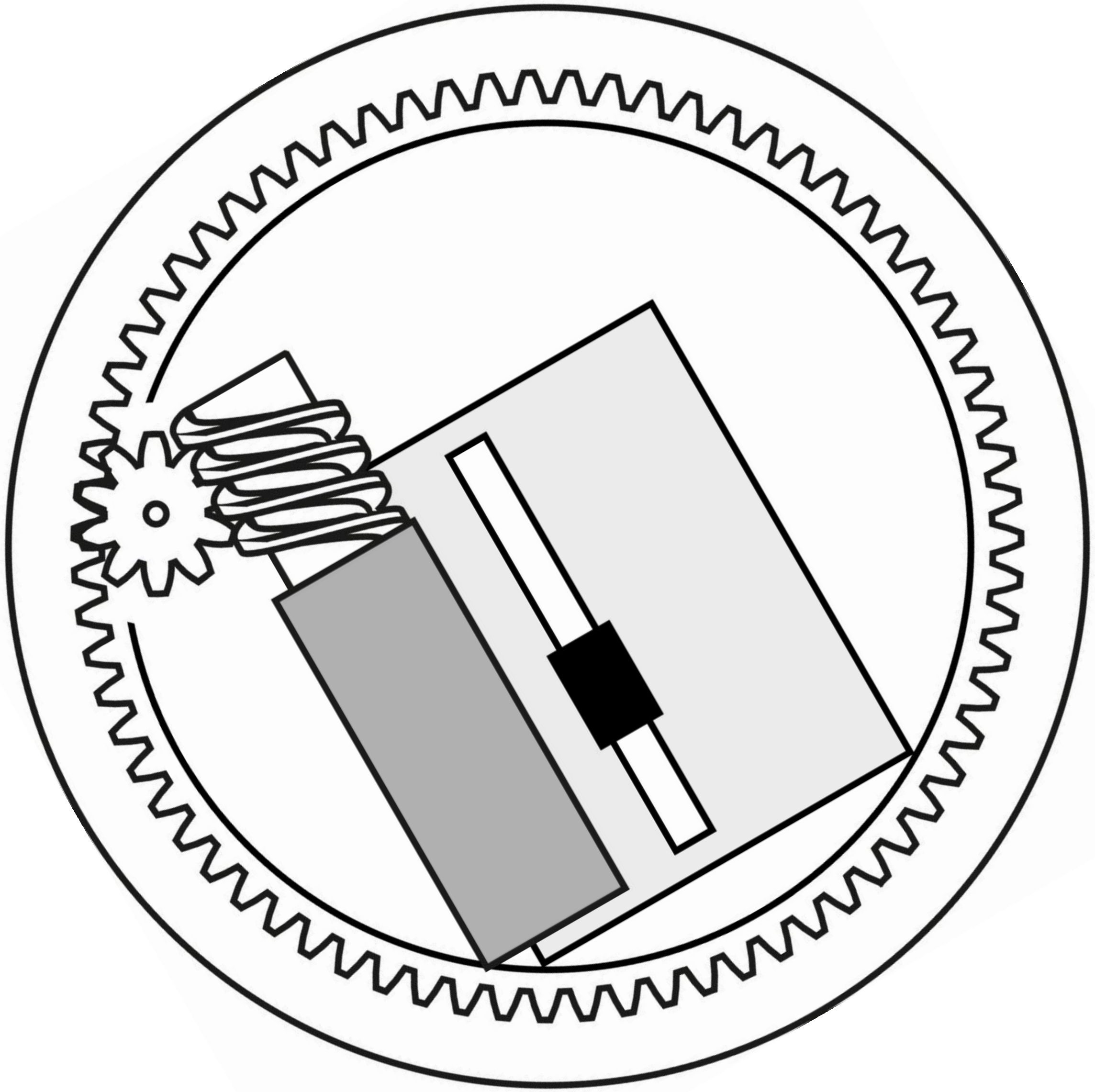


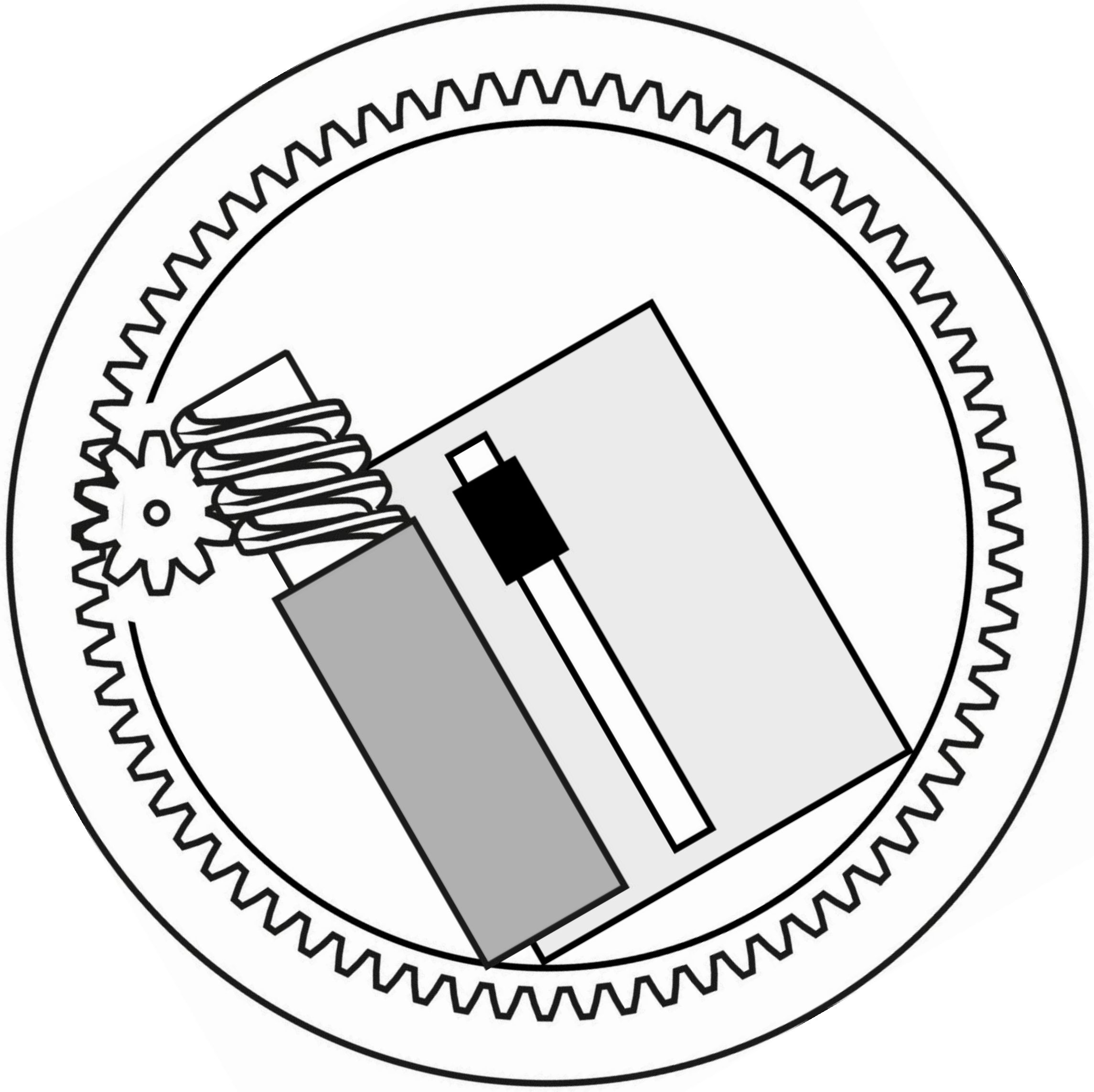


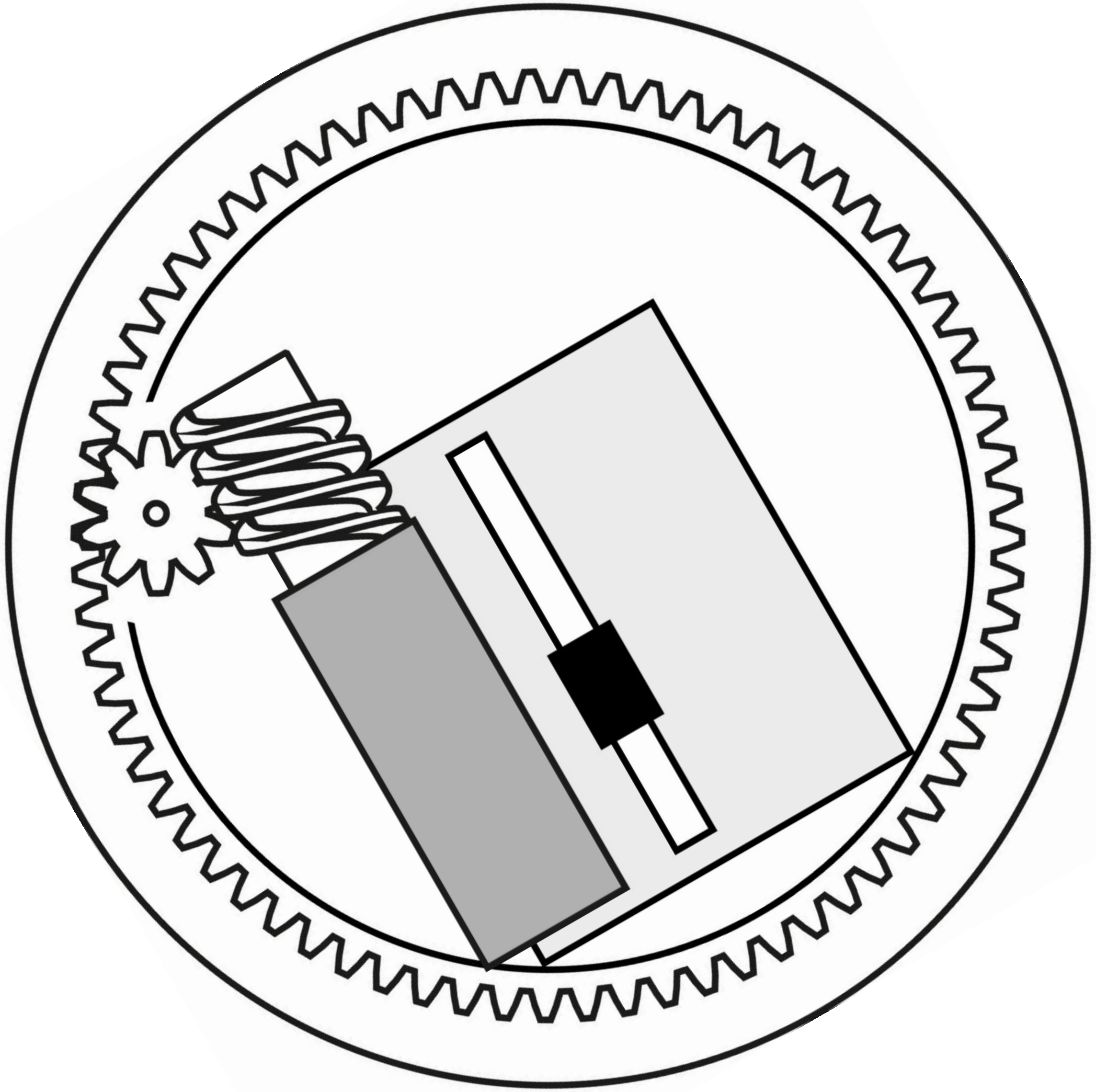


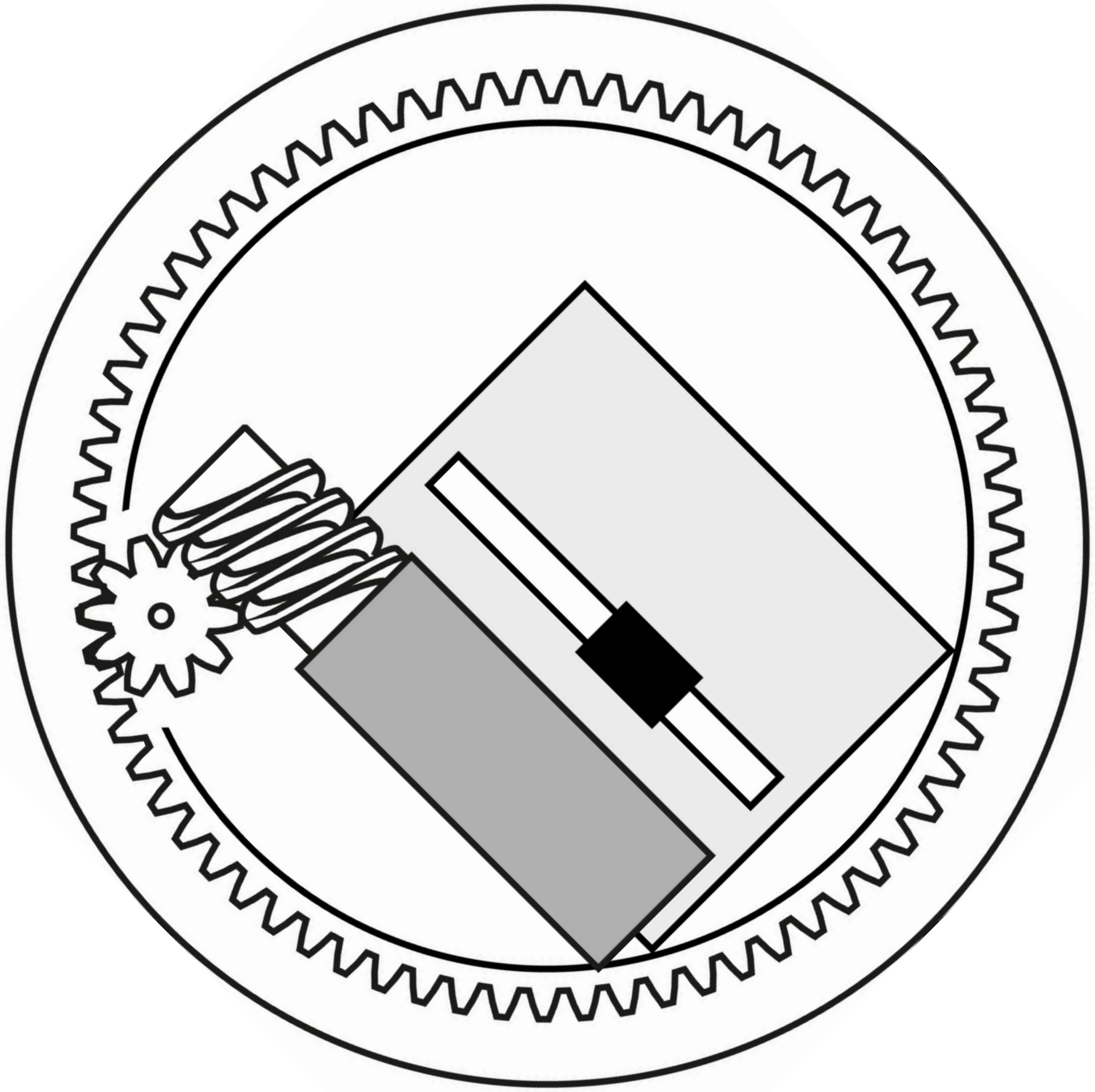
radius

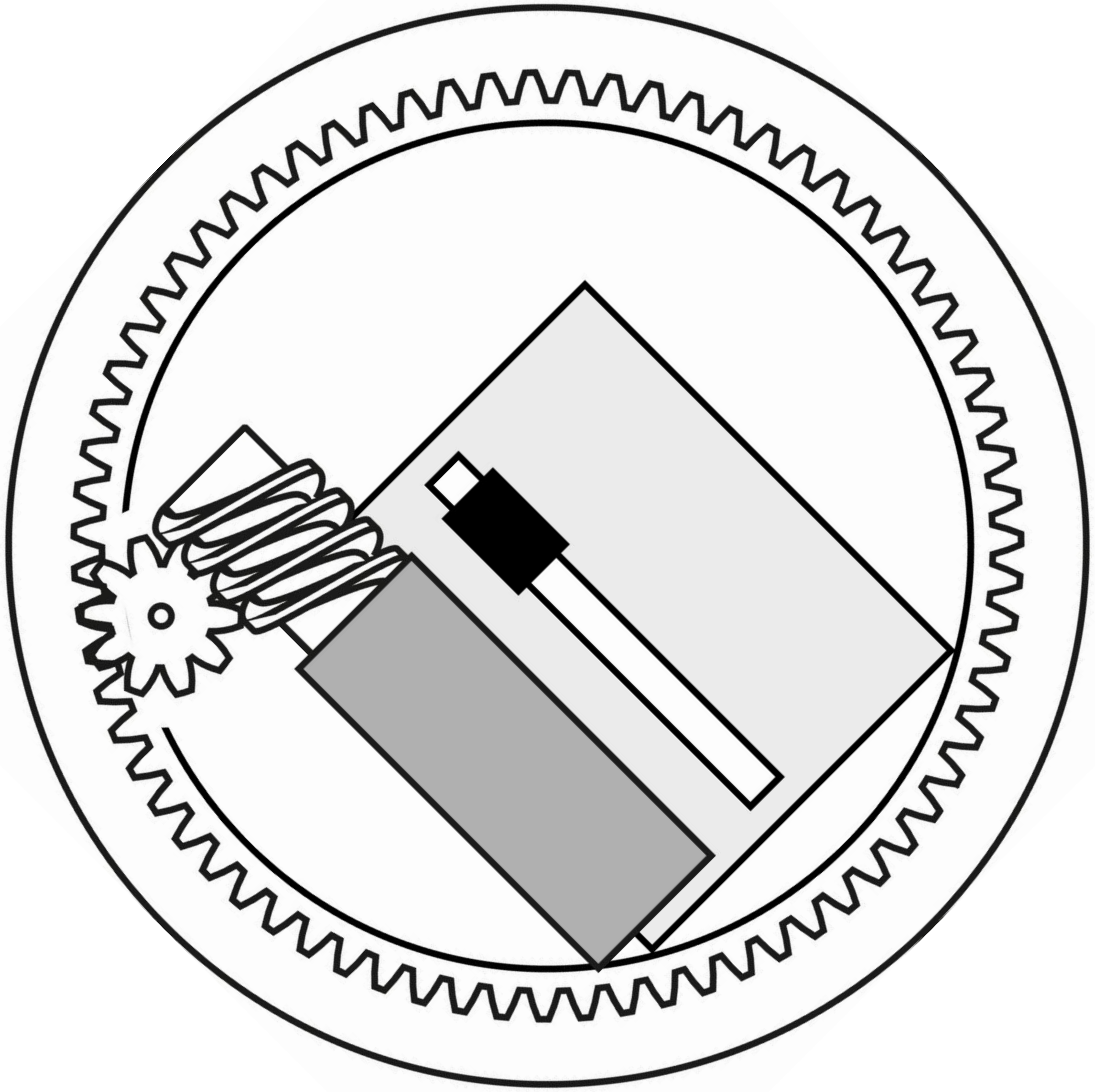


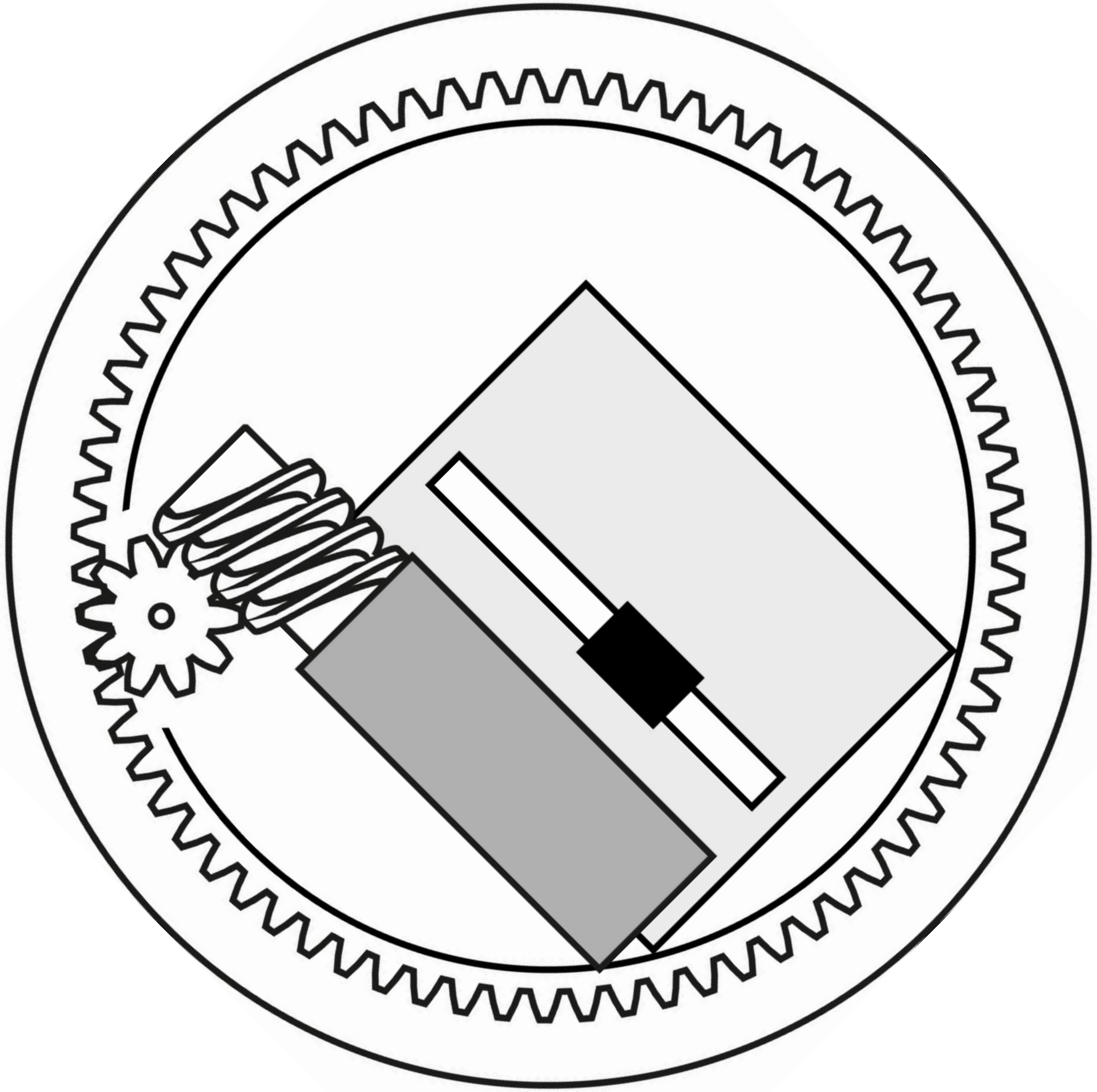








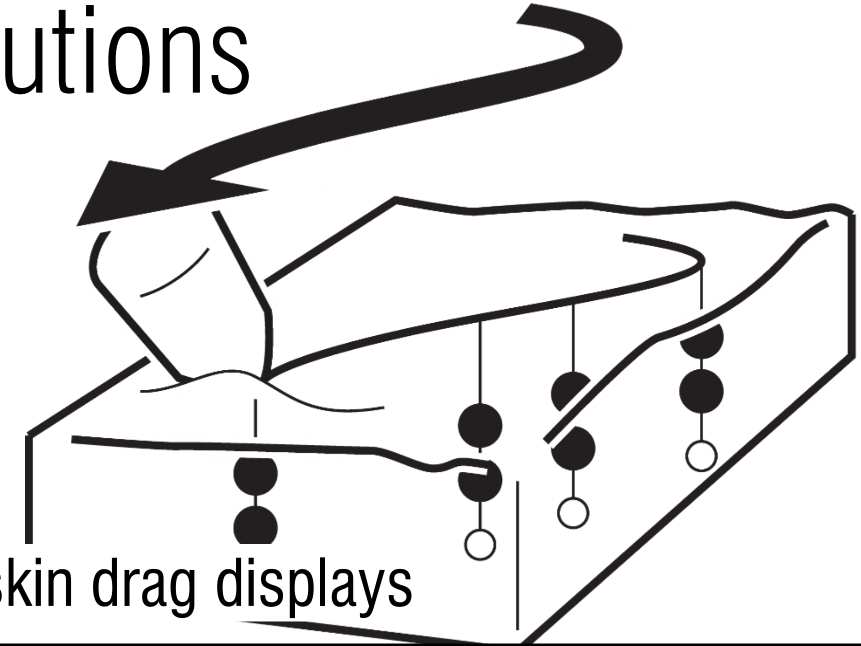




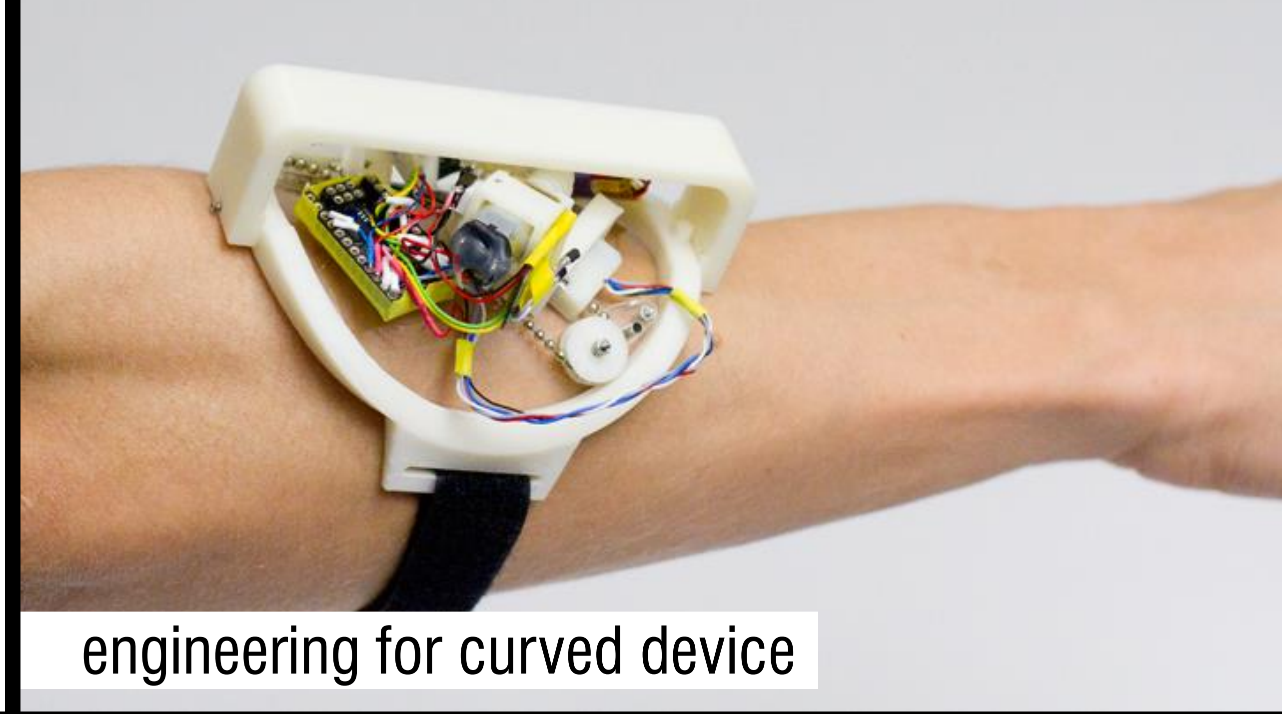
assembly

conclusion

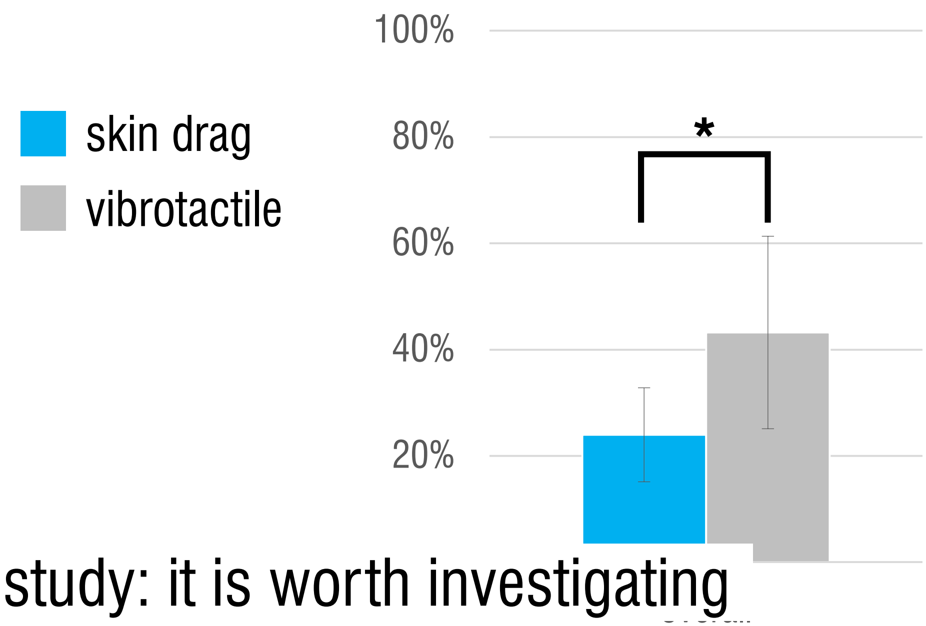
contributions



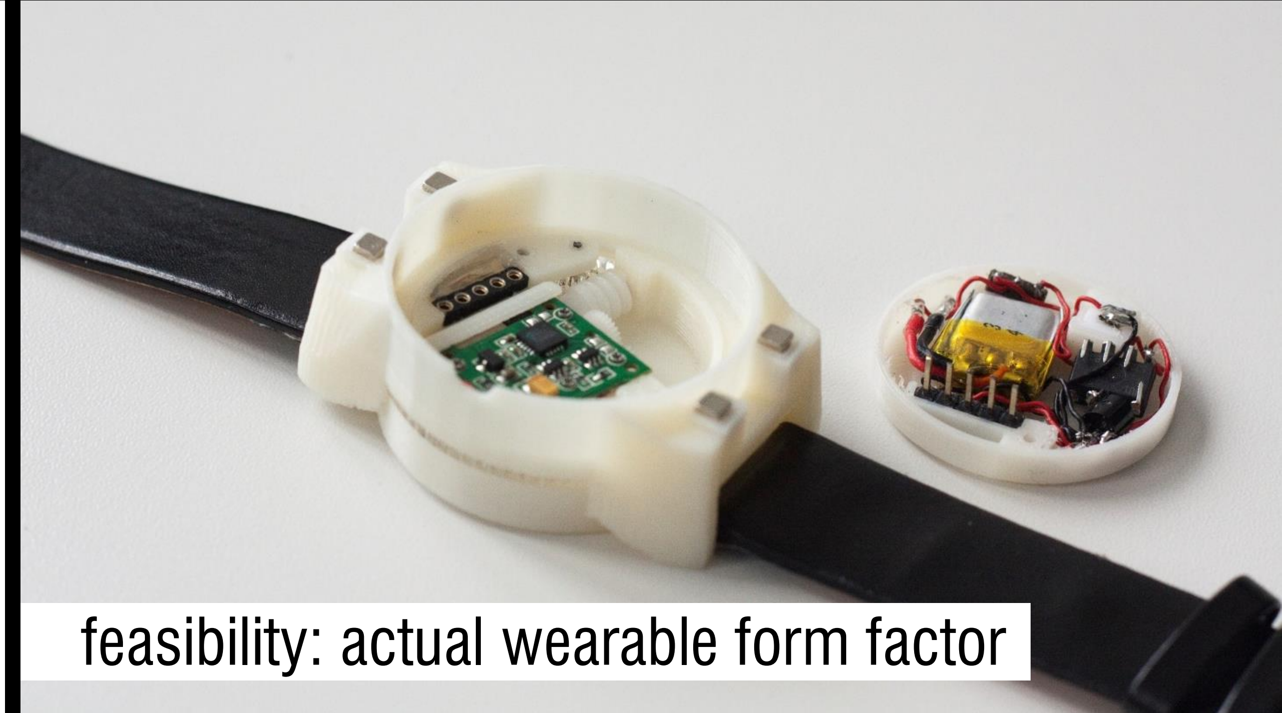
concept of skin drag displays



engineering for curved device



study: it is worth investigating



feasibility: actual wearable form factor

future work

study the **performance** of the **watch-size prototype**

effect of location (wrist vs. forearm)

effects of size

design shape **alphabet** for tactile letter reading

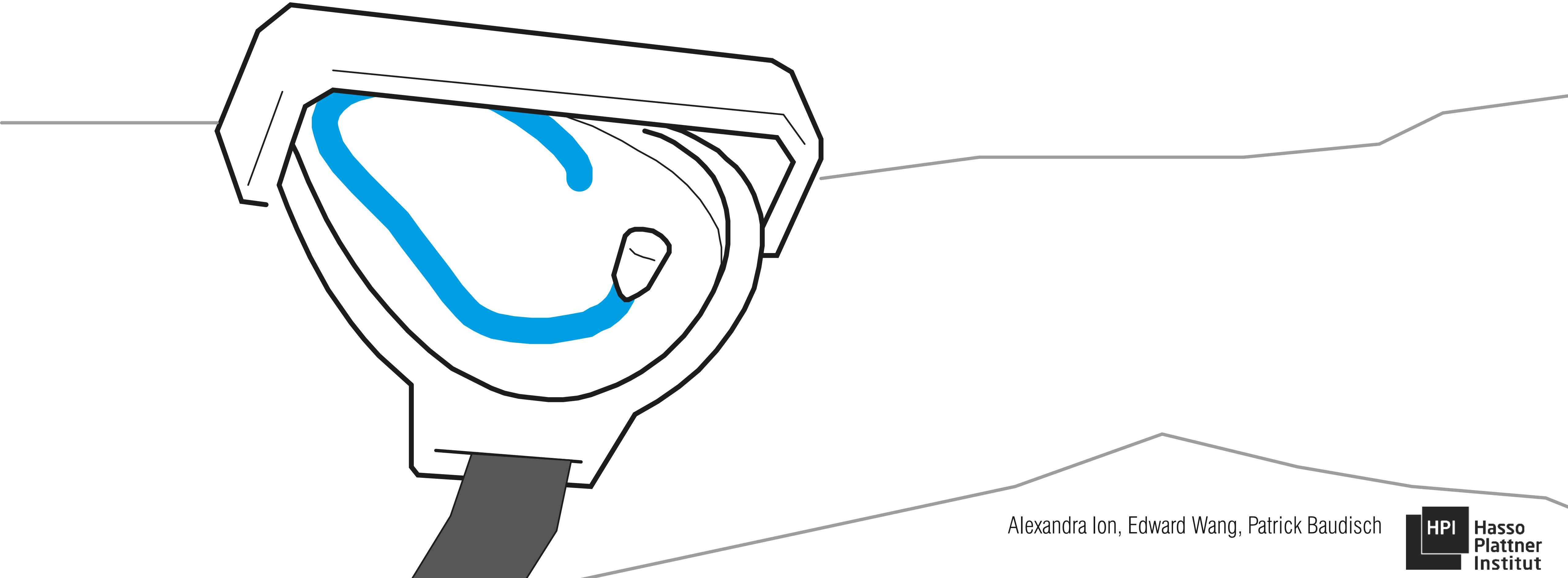
what if we have **multiple** devices all over the **whole body?**

build a **flexible** version of the forearm-worn prototype

that adjusts to different arms or limbs

skin drag displays

dragging a physical tactor across the user's skin
produces a stronger stimulus than vibrotactile



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