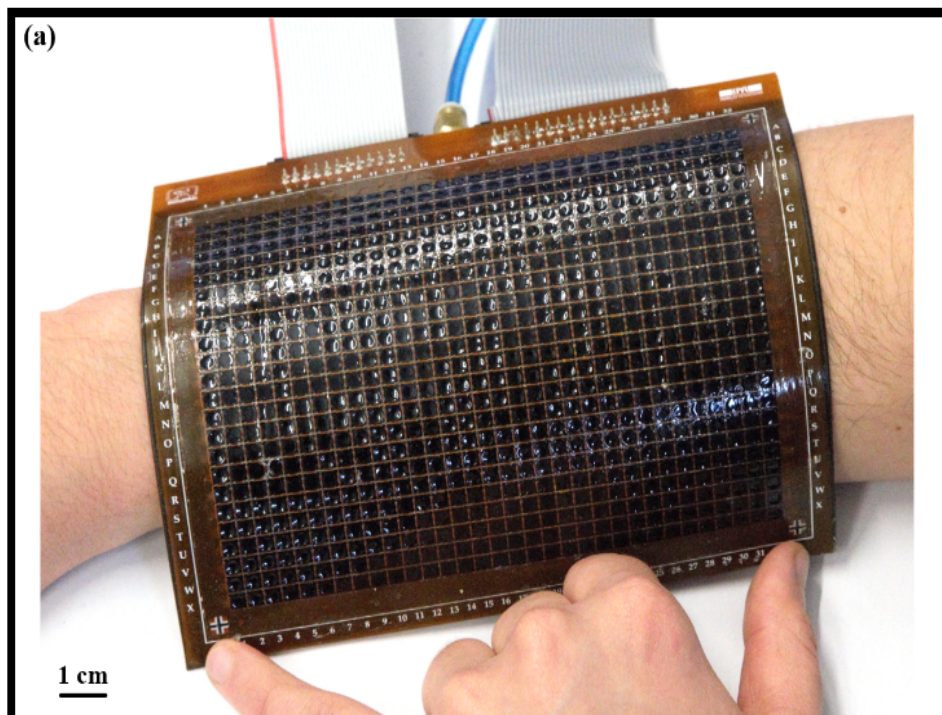


# Flexible 3D Haptic Actuator Strips with Latching Electromagnetic taxels

Herbert Shea  
*EPFL*  
*Switzerland*

[lmts.epfl.ch/haptics](https://lmts.epfl.ch/haptics)

## What I won't talk about! 768 Shape Memory Polymer Actuators



N. Besse et al., accepted, *Advanced Materials Technologies*, 2017

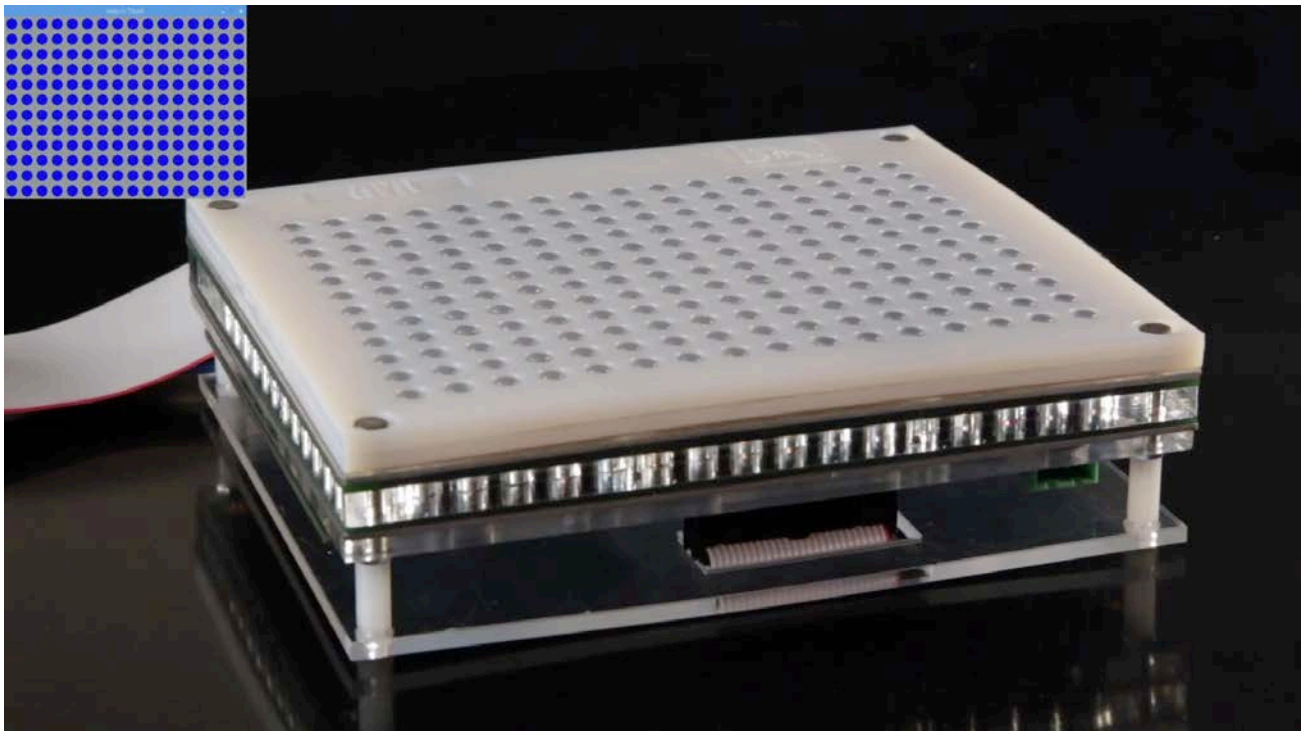
## What I also won't talk about! DEAs driven by integrated flexible 1kV TFTs



A. Marette et al., *Advanced Materials*, 2017 (next week)

3

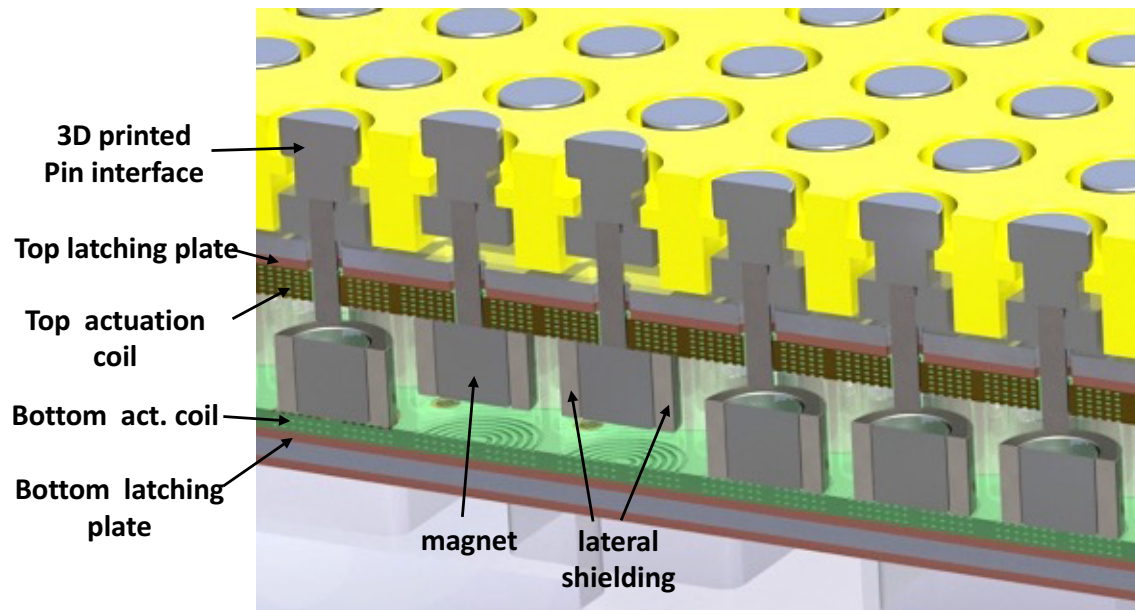
## 12x16 rigid array of electromagnetic latching taxels



- Low-weight magnet shielding: eliminates cross-talk
- Efficient pcb design: high EM force generated (so can get high latching force)
- Bi-stable latching
- Fast (10 ms)

4

# Electromagnetic bi-stable actuator array



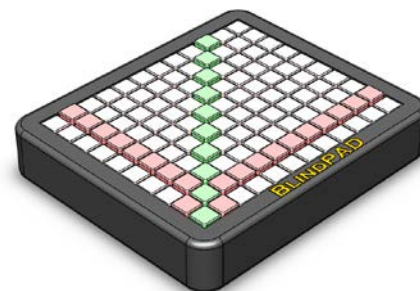
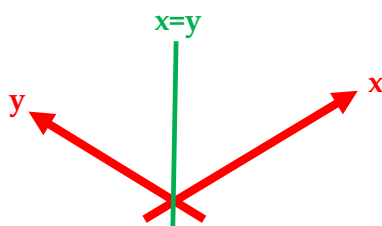
- Latching holding force = 200 mN
- Indentation Displacement = 0.8 mm
- Pin pitch = 8 mm
- Number of actuators = 192 (12x16)
- Switching pulse = 3.6 A, 22 V ( 80 W)
- Switching Speed = 10 ms / pin

5

## BlindPad:

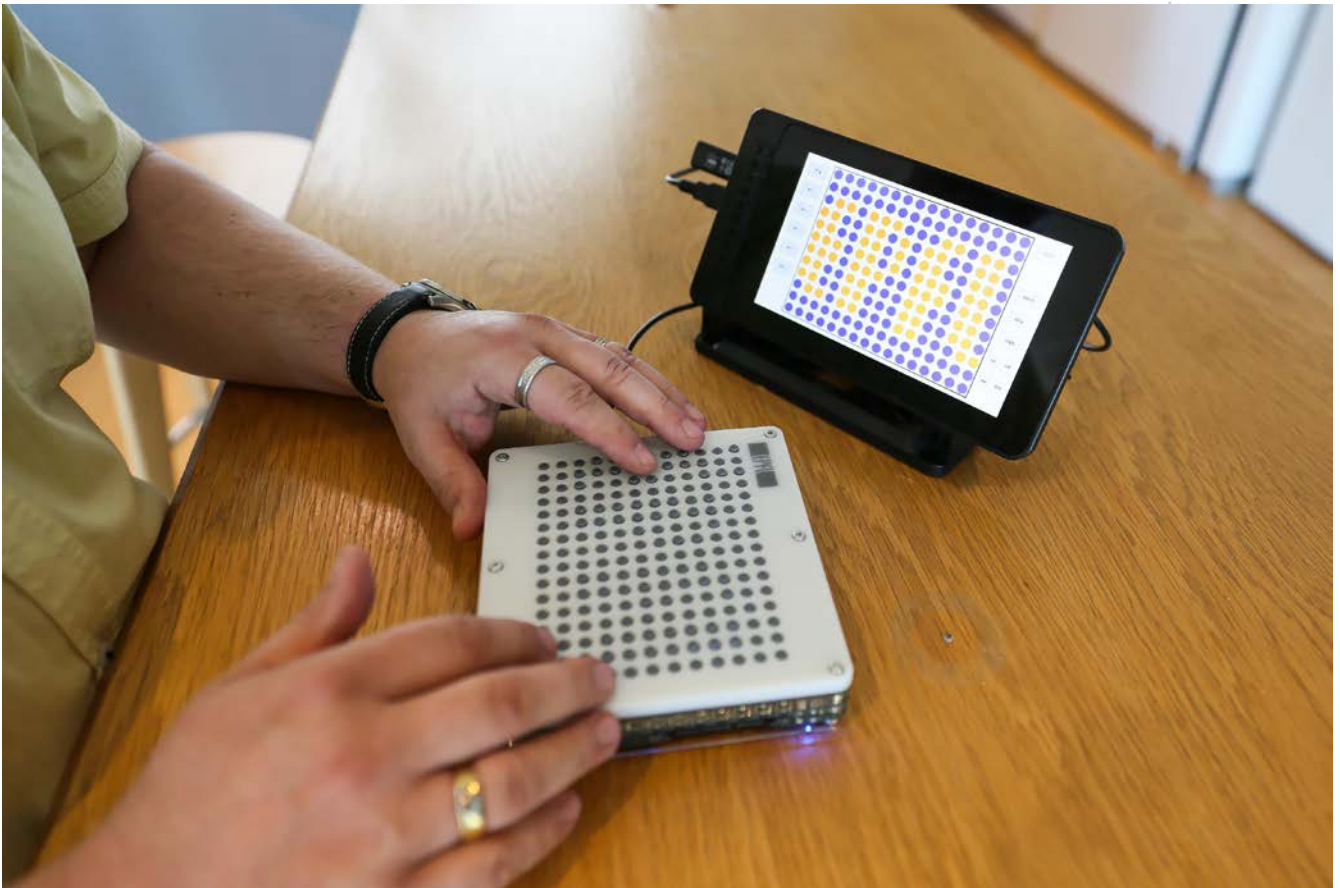
dynamic tactile display for blind and visually impaired users to interact with graphical data

- Learning at school with sighted students
- Navigation (dynamic maps)
- Explore graphical information (charts, graphs)



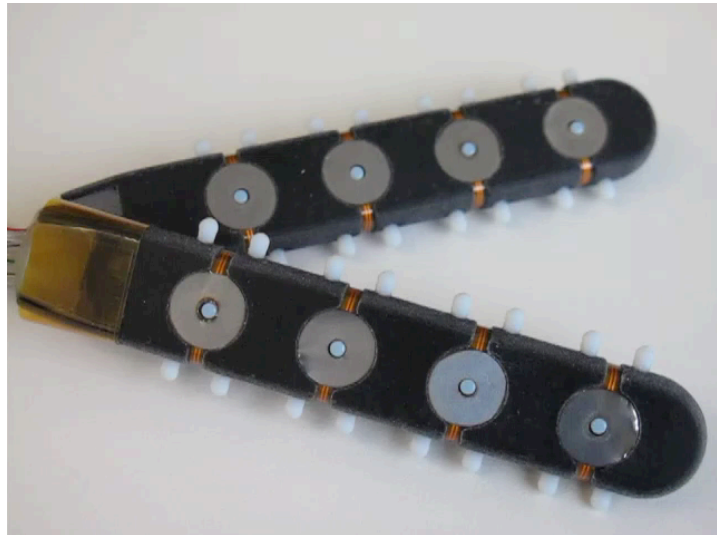
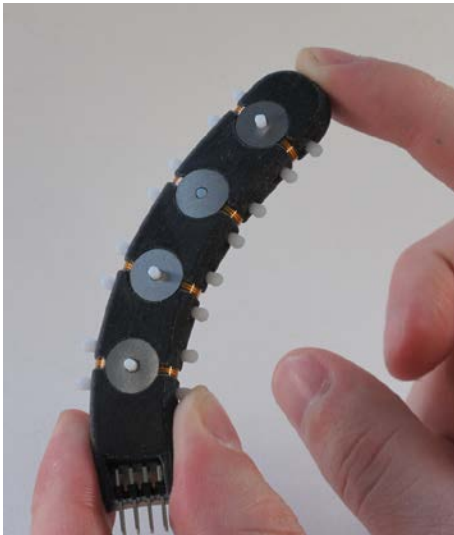
6





7

## Let's make that array flexible for wearables

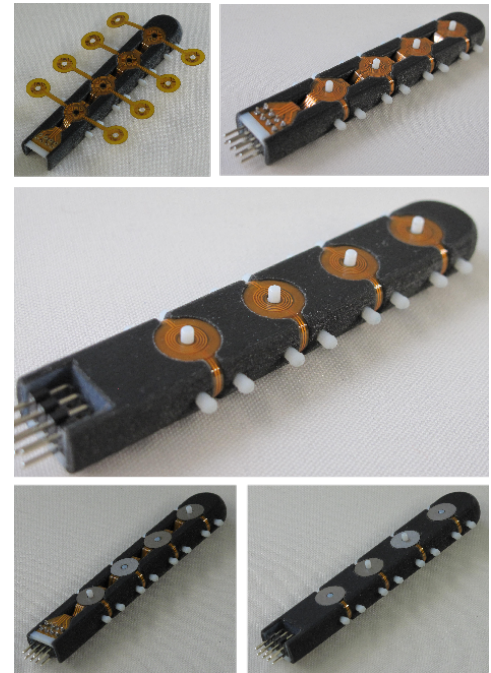
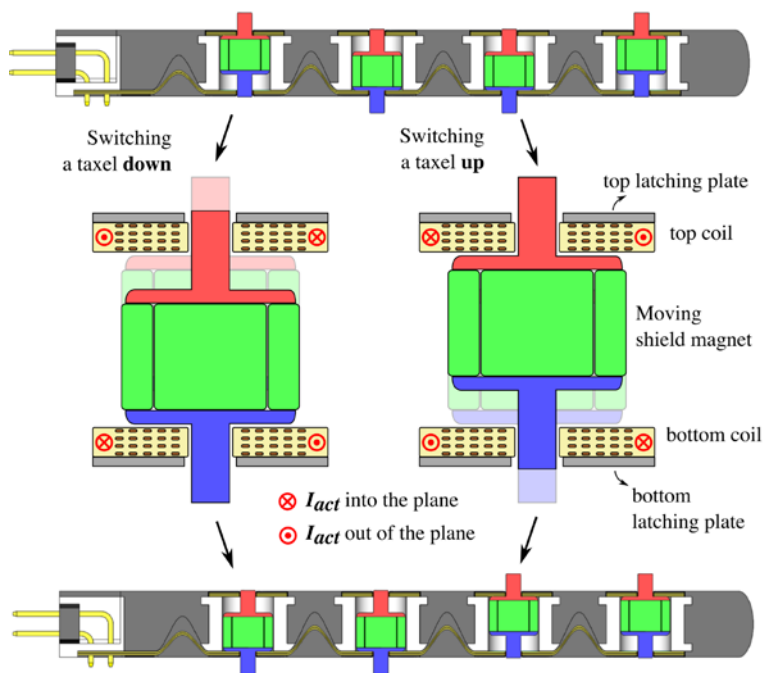


- Rigid actuation unit (10 mm diameter) embedded in a soft 3D printed case.
- The actuation coils and interconnections made using flexible PCBs.
- Easy to fabricate and scale up.

Work in collaboration with Prof. Otmar Hilliges' Lab (ETHZ, Switzerland)  
<https://ait.ethz.ch/8>

## bi-stable EM actuation principle

printed inside an soft 3D printed (arbitrary-shape) surface



Work in collaboration with Prof. Otmar Hilliges' Lab (ETHZ, Switzerland)

<https://ait.ethz.ch/>

10

## Application Scenarios

Work in collaboration with Prof. Otmar Hilliges' Lab (ETHZ, Switzerland)

<https://ait.ethz.ch/>

11

## Haptic team at LMTS

Neuchatel, Switzerland

EM



Dr. Juan  
Zarate

DEA



Alexis  
Marette

SMP



Nadine  
Besse

electronics



Olexandr  
Gudozhnik

machining



Anthony  
Ruch

\$



Prof. Herbert  
Shea

[lmts.epfl.ch/haptics](https://lmts.epfl.ch/haptics)

### Financial Support from:

- European Commission FP7 Blindpad
- European Space Agency
- Swiss National Science Foundation
- EPFL



SWISS NATIONAL SCIENCE FOUNDATION

12

### Contact Info:

**Herb Shea**

LMTS - EPFL  
Neuchâtel, Switzerland

[lmts.epfl.ch/haptics](https://lmts.epfl.ch/haptics)

herbert.shea@epfl.ch

13