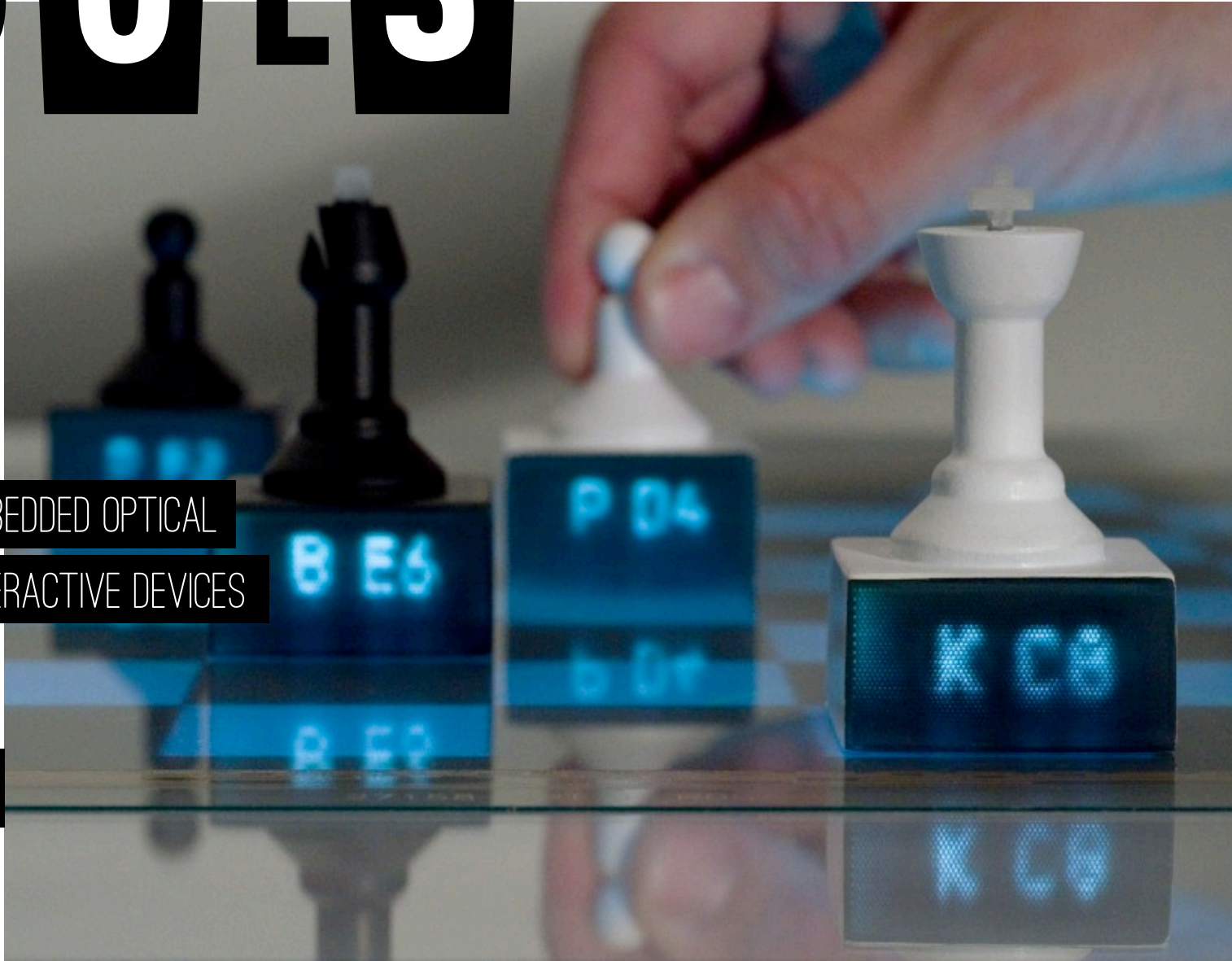


TOOLS

3D PRINTING OF EMBEDDED OPTICAL
ELEMENTS FOR INTERACTIVE DEVICES

JASMINE ROBERTS



Printed Optics

allows us to explore new possibilities
for tomorrow's interactive devices...



0:22 / 3:26



TODAY'S PAPER

1

PRINTED OPTICS: 3D PRINTING OF EMBEDDED OPTICAL ELEMENTS FOR INTERACTIVE DEVICES. KARL WILLIS, ERIC BROCKMEYER, SCOTT HUDSON AND IVAN POUPREV. UIST 2012

GOALS FOR TODAY'S DISCUSSION

3D PRINTED OPTICS

- Outlining 3D printing fabrication process and its capabilities
- Understanding basic optical properties of waveguides
- Examining potential innovations using 3D printed optics

IMPRESSIONS



Student

@ScottKlemmer



Following

I rate it as 3/5 because of unintelligibility of this paper. There are too many terms in this paper, which is hard to understand for readers who don't have related knowledge.

[← Reply](#) [↻ Retweet](#) [★ Favorite](#) [⋮ More](#)

3:00 PM - 3 Nov 2015 · Embed this Tweet



Student

I found that this was not the most enjoyable paper we've read this quarter.

[Like](#) · [Comment](#) · 30 minutes ago ·

4 people like this.



Another Student None of the examples in the paper seem particularly important
11 minutes ago · [Like](#)



Yet Another Student The results of many of their proposals were less than stellar (to an extend) and required some manual intervention.
11 minutes ago · [Like](#)



Write a comment ...



AnotherStudent

@ScottKlemmer

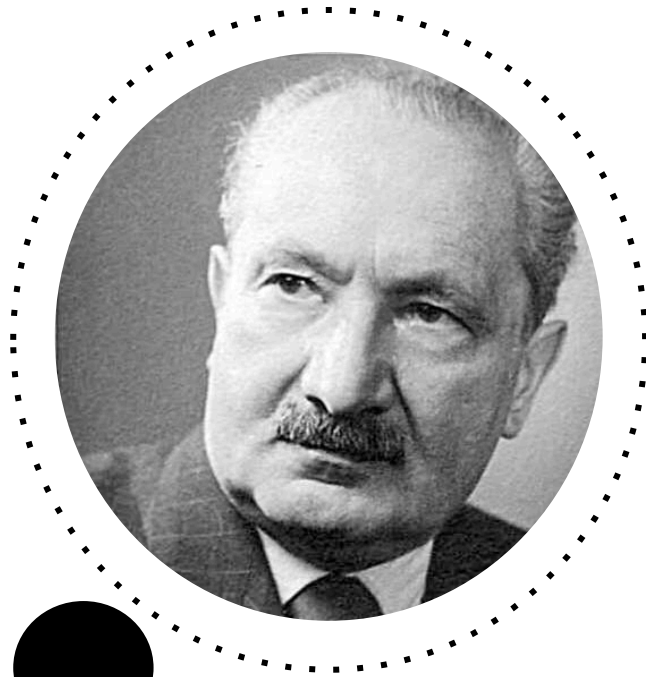


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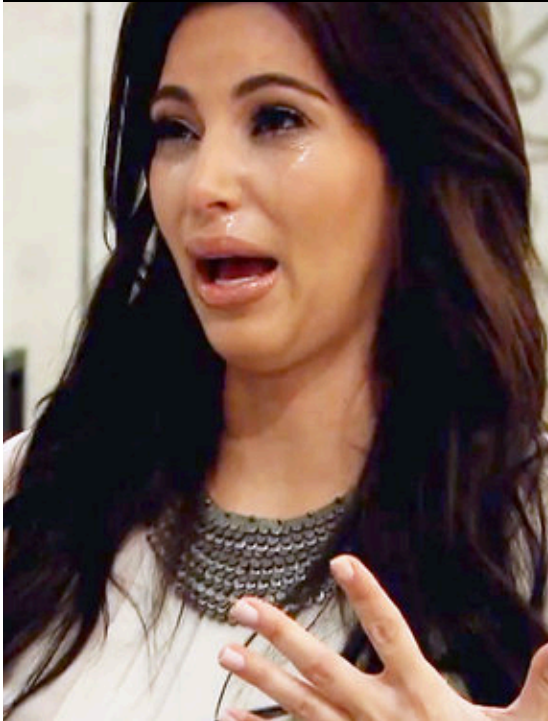
1:15 PM - 3 Nov 2015 · Embed this Tweet

NOT
COMPLETE & FINAL LIST OF APPLICATIONS
IS
PROOF OF CONCEPT



WHY WE OVERHYPE 3D PRINTING?

CAPABLE



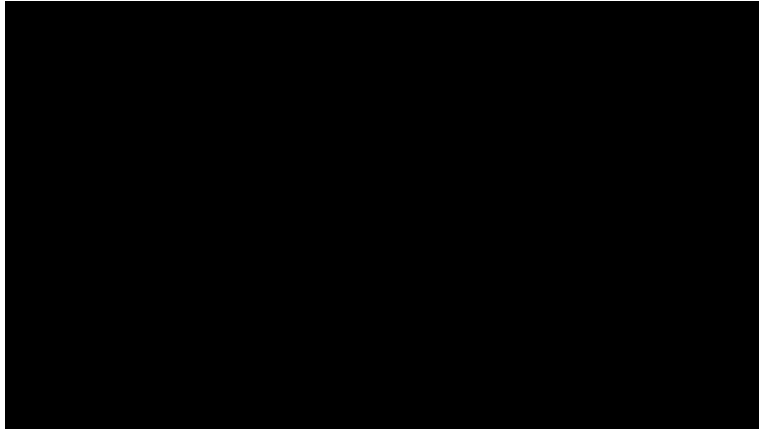
AFFORDABLE



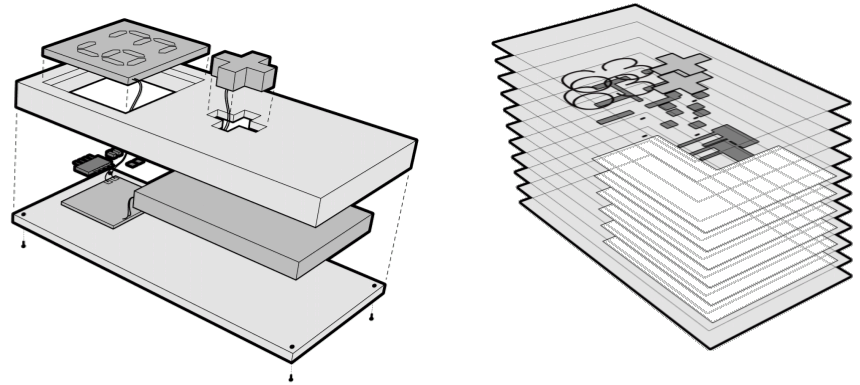
PRACTICAL



3D PRINTING



layered NOT assembled



1 Original Object

2 Object is Digitized in CAD



3 Software "Slices" Objects into Layers
The thinner the layer, the more detailed the object

OPTICAL COMPONENTS



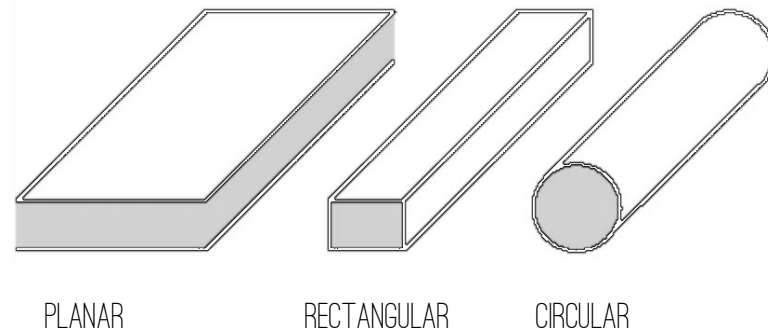
	3D PRINTED	THORLABS
beam splitter	air = free!!!	\$147 (5 mm)
light pipe	<\$5	\$100 (5 mm)
plano-concave	<\$10	\$22.10 (6 mm)
plano-convex	<\$10	\$32.00 (6 mm)

UNSCRAMBLING TERMINOLOGY



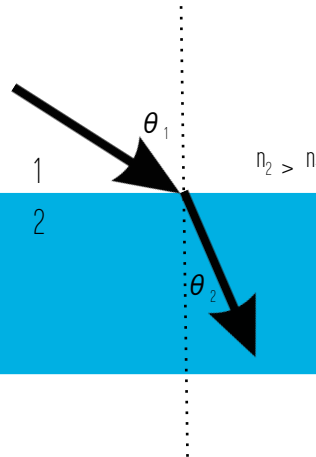
"3D PRINTED OPTICS" WAVEGUIDES

- **A waveguide** is a structure that guides waves, enabling a signal to propagate with minimal loss of energy by restricting expansion.
Waveguides mostly have rectangular, circular, or elliptical cross-sections.

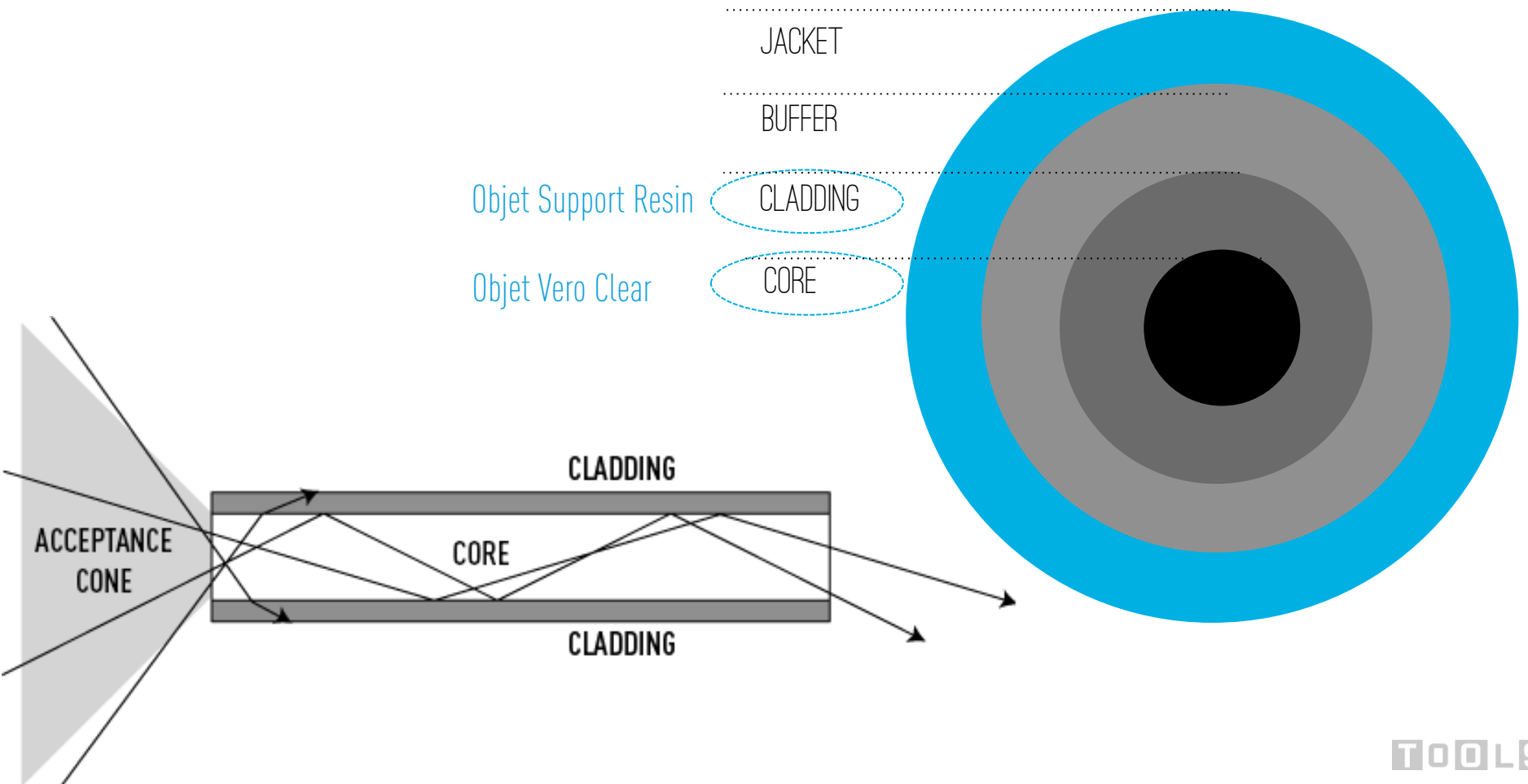


TERMS

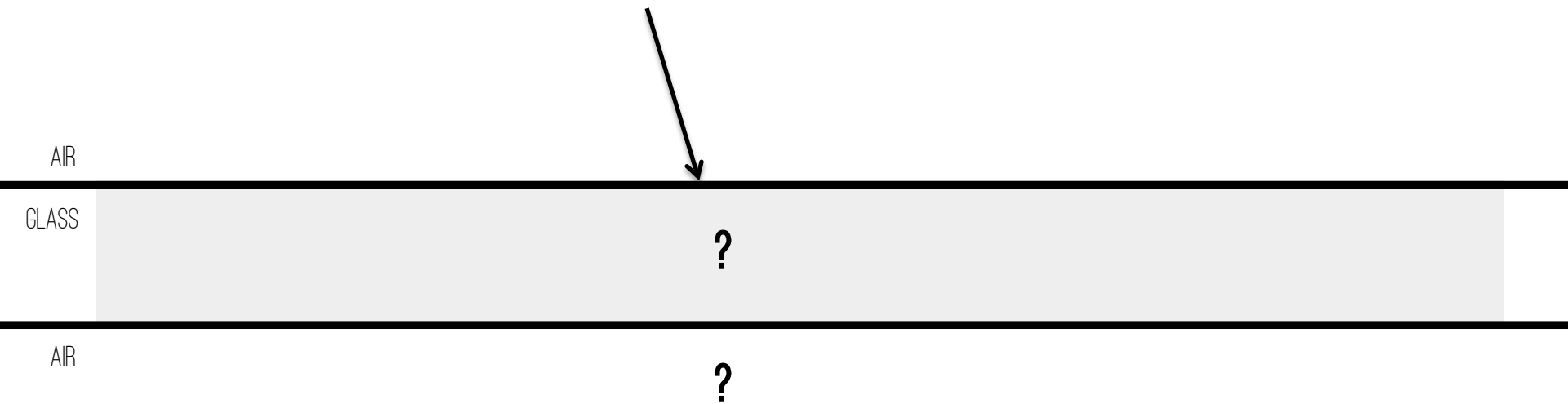
- **The refractive index (n)** is a number describing light propagation through a medium
- **A numerical aperture (NA)** represents the range of angles light can be taken and emitted
- **Attenuation (α)** is reduction in intensity of the light beam with respect to distance traveled through the medium



OPTICAL FIBER



ASSESSMENT



INDIVIDUAL
1 minute

DISCUSSION

- LOOKING AT THE CEILING MOUNTED PROJECTOR, DRAW THE TYPES OF WAVEGUIDES AND OPTICAL ELEMENTS THAT ONE MIGHT FIND INSIDE.



GROUPS of 2-3
3 minutes

LIMITATIONS

- 1 ONLY 2 PRINTED MATERIALS
- 2 ATTENUATION (LIGHT LOSS WITH DISTANCE)
- 3 UNFINISHED SURFACES
- 4 OPAQUENESS (VIEWING ANGLE, THICKNESS)
- 5 GRAVITY INHIBITS ARBITRARILY SHAPED HOLLOW AREAS

DISCUSSION

- HOW SIGNIFICANT DO YOU CONSIDER THESE PRINTING LIMITATIONS?
ARE THESE INSURMOUNTABLE HURDLES? OR TEMPORARY OBSTACLES?
- CAN YOU THINK OF WAYS TO OVERCOME THESE LIMITATIONS?

GROUPS of 2-3
2 minutes

APPLICATIONS IN 3D PRINTING

LIGHT PIPES



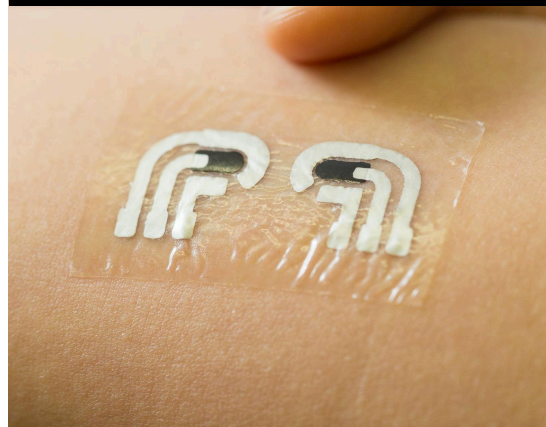
INTERNAL ILLUMINATION



SENSING MECHANICAL MOVEMENT



EMBEDDED COMPONENTS



DISCUSSION

- HOW DO YOU ENVISION A FUTURE WITH 3D PRINTED DEVICES?
- HOW CAN THIS REVOLUTIONIZE THE WAY IN WHICH HUMAN-COMPUTER INTERACTION IS APPROACHED?

GROUPS of 2-3
3 minutes



“ If the last Industrial Revolution brought mass production and economies and scale—the digital 3D printing revolution could bring mass manufacturing back to full circle—to an era of mass personalization and a return to individual craftsmanship. ”