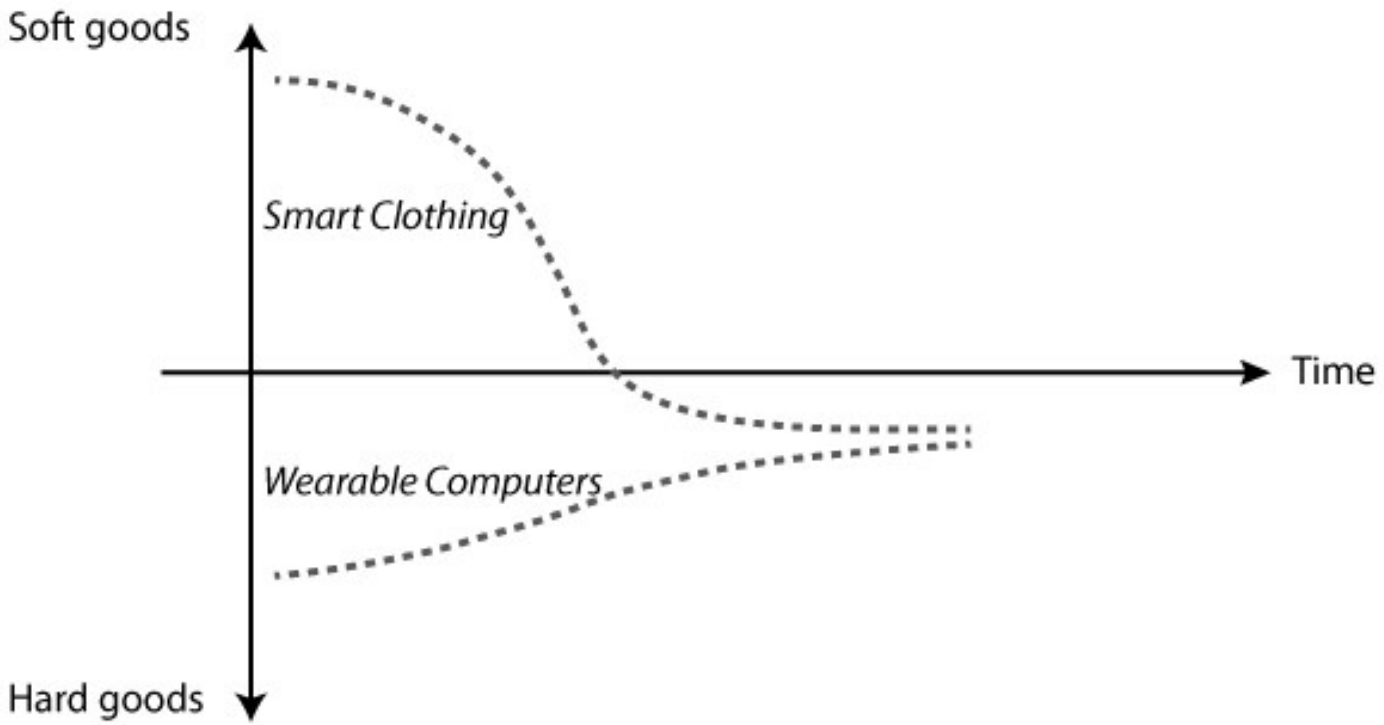
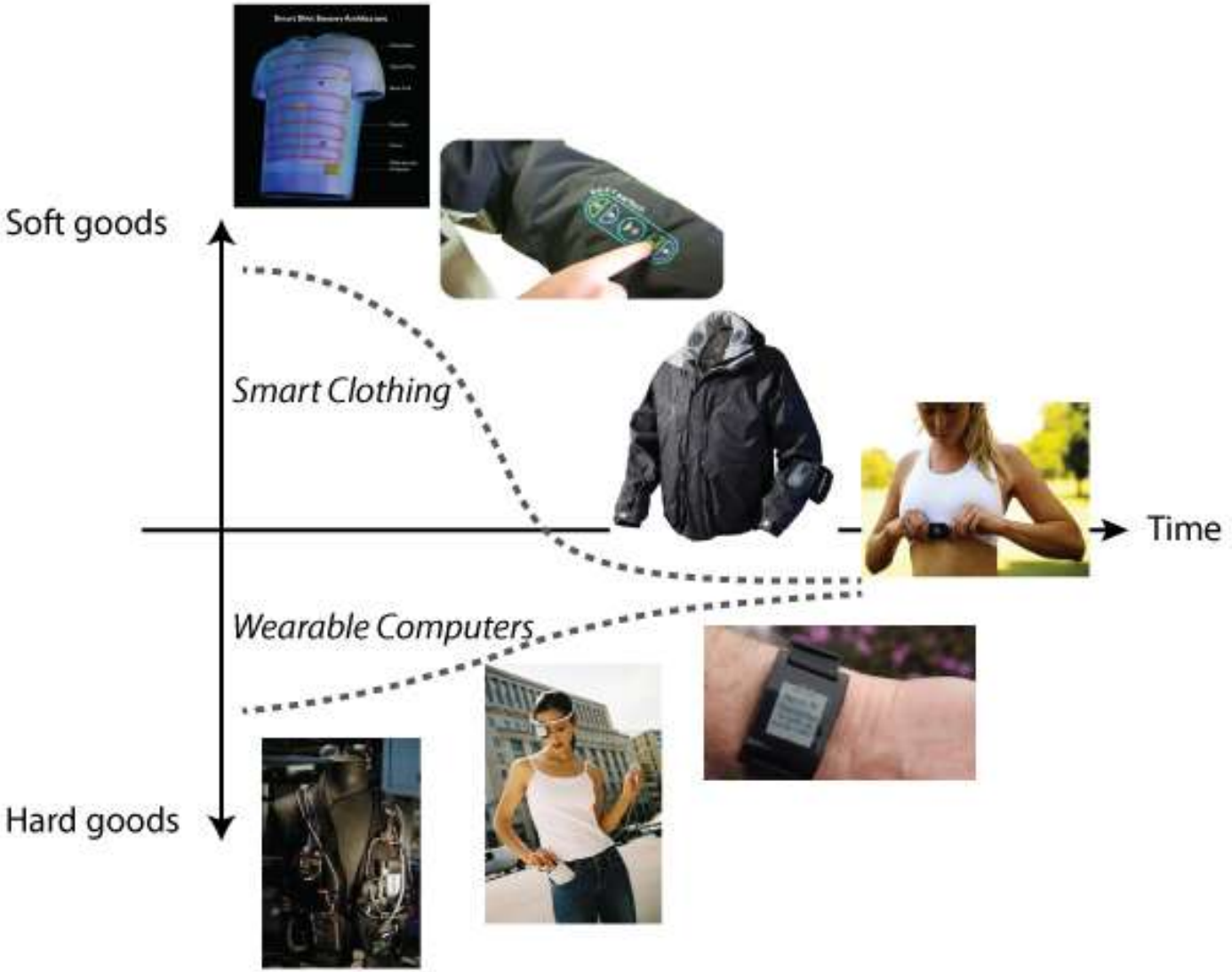
One Shirt to Rule Them All: Pursuing the Vision of a Garment-Based Wearable Technology Platform

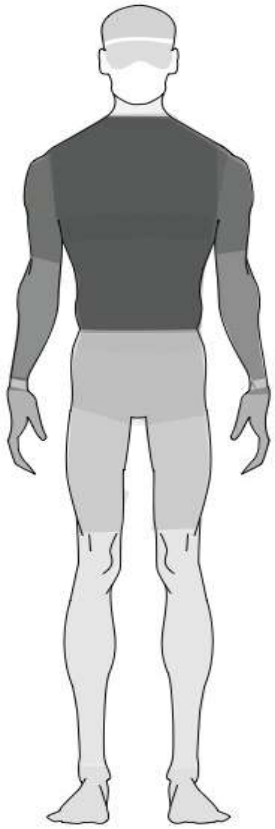
Lucy Dunne

University of Minnesota

Award #125358 – CNS: CAREER: Toward Pervasive Wearable Technology: A Cut-and-Sewn, Textile-Integrated Smart Clothing Platform

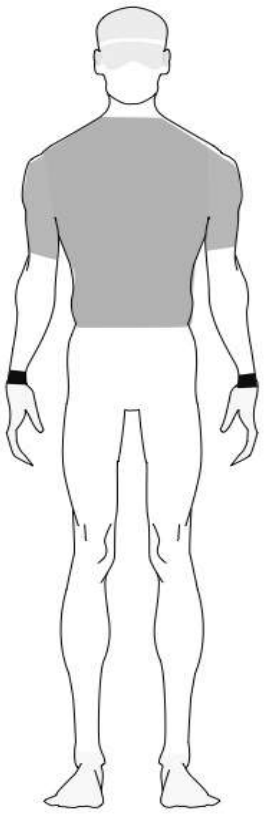

Soft goods
Smart Clothing
Time
Wearable Computers
Hard goods


Soft goods
Smart Clothing
Wearable Computers
Hard goods
Time



Jacket/Sweatshirt: 16.4%
Accessories - Gloves: 11.3%
Accessories - Watches: 8.7%
Shirt: 8.5%
Accessories - Hats: 6.5%
Accessories - Eyewear: 5.2%
Vest: 5.1%
Bags/Backpacks/Purses: 5%
Footwear: 4.7%
Accessories - Misc: 4.5%
Dress/Skirt: 4.2%
Accessories - Jewelry: 3.4%
Pants: 2.9%
Undergarments/Swimsuit: 2.7%
Accessories - Badge/Patch/Clip: 2.2%
Clothing: 2.2%
Accessories - Chest Strap: 2%
Accessories - Scarves : 1.7%
Bodysuit: 1%
Accessories - Earpiece/Headphone: 0.8%
Accessories - Belt/Strap: 0.6%
Accessories - Armband: 0.4%

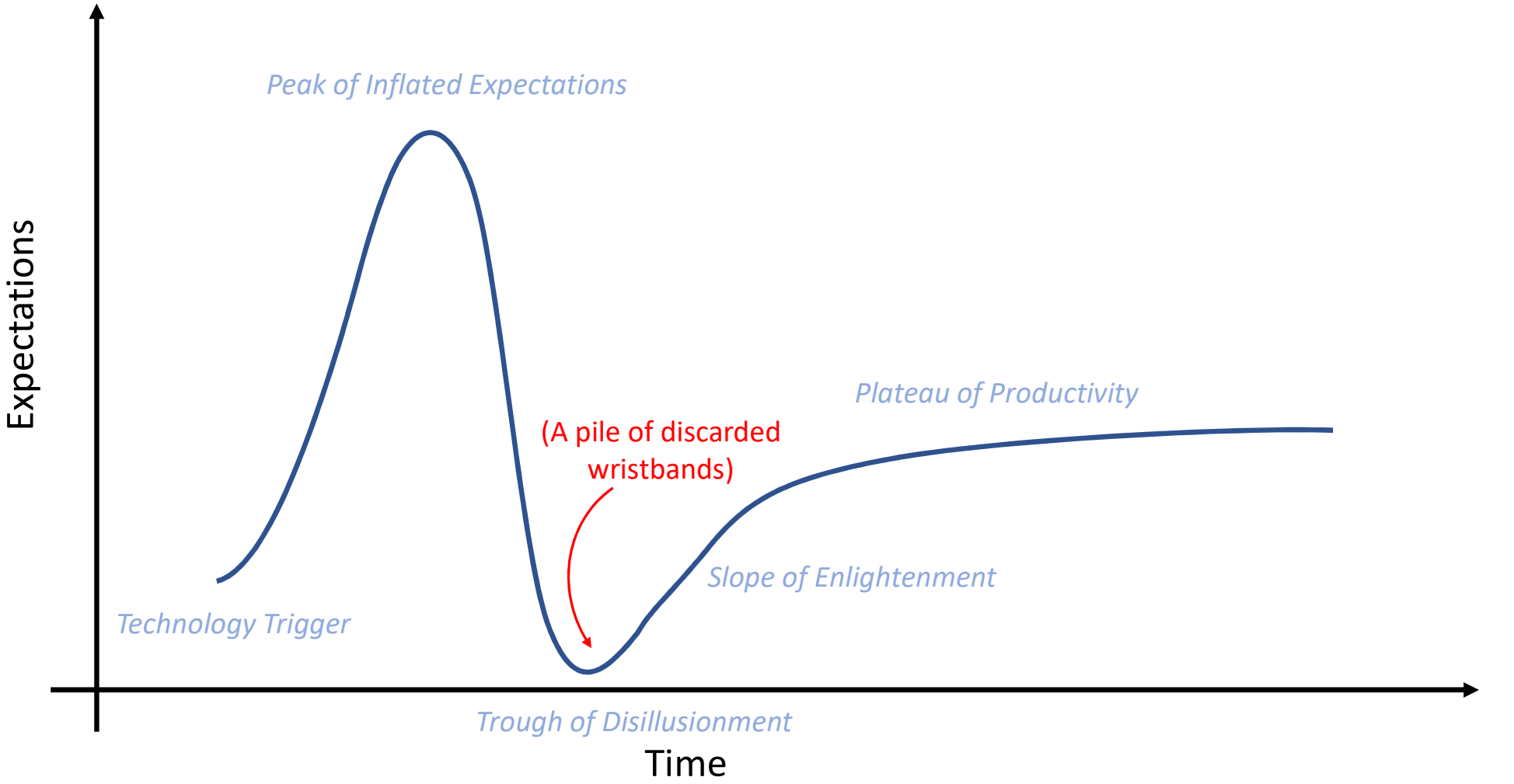
Prior to 2014



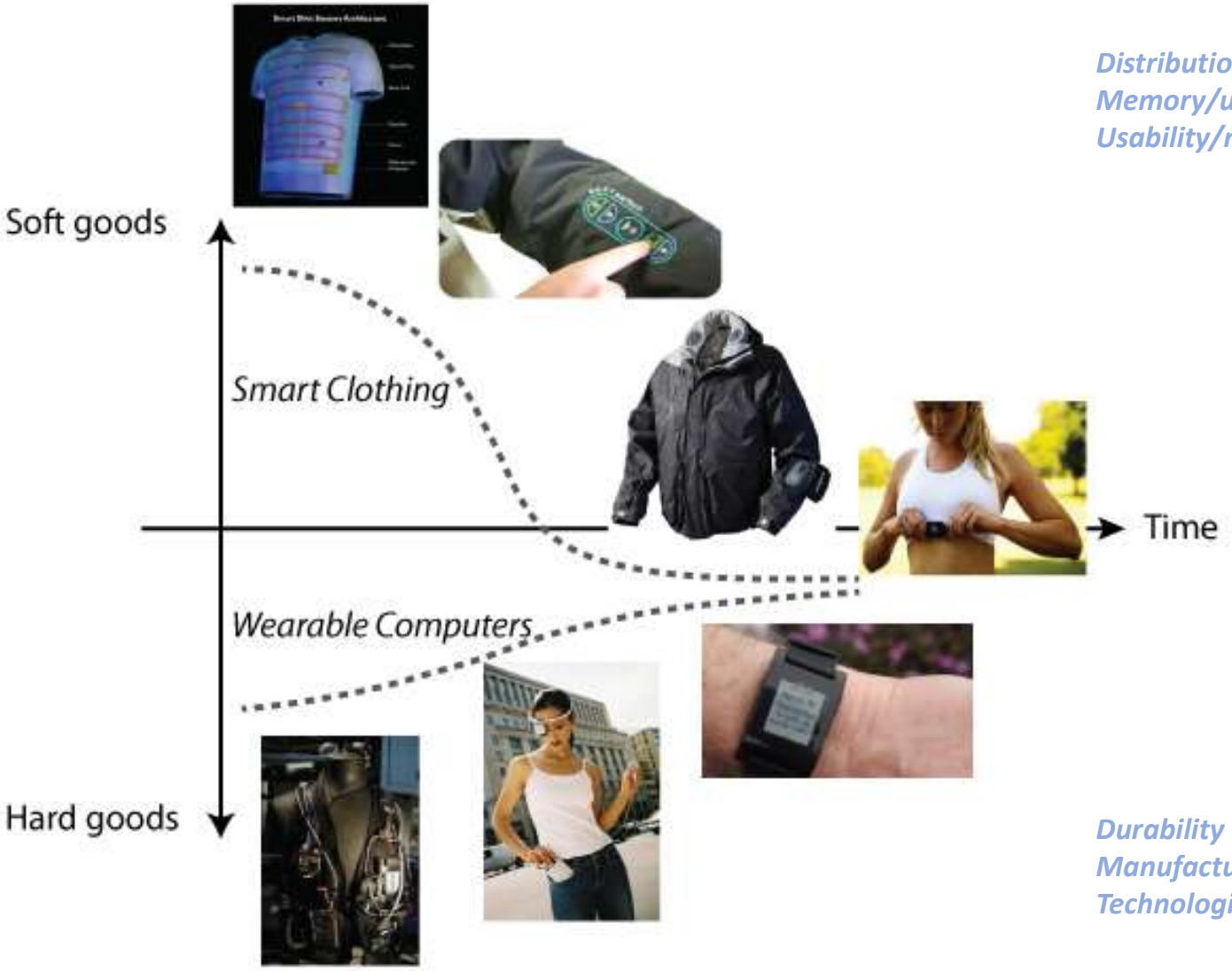
Accessories - Watches: 35%
Accessories - Jewelry: 29.1%
Shirt: 10.7%
Accessories - Misc.: 7.8%
Accessories - Badge/Patch/Clip: 4.9%
Accessories - Earpieces/Headphones: 3.9%
Accessories - Eyewear: 2.9%
Accessories - Hats: 2.9%
Accessories - Glovesr: 1%
Vest: 1%
Footwear: 1%
Jackets/Sweatshirts: 0%
Accessories - Scarves: 0%
Accessories - Belt/Strap: 0%
Accessories - Chest Strap: 0%
Accessories - Armband: 0%
Bags/Backpacks/Purses: 0%
Pants: 0%
Clothing: 0%
Bodysuit: 0%
Dress/Skirt: 0%
Undergarments/Swimsuits 0%

2014-2015

Berglund et al., ISWC 2016



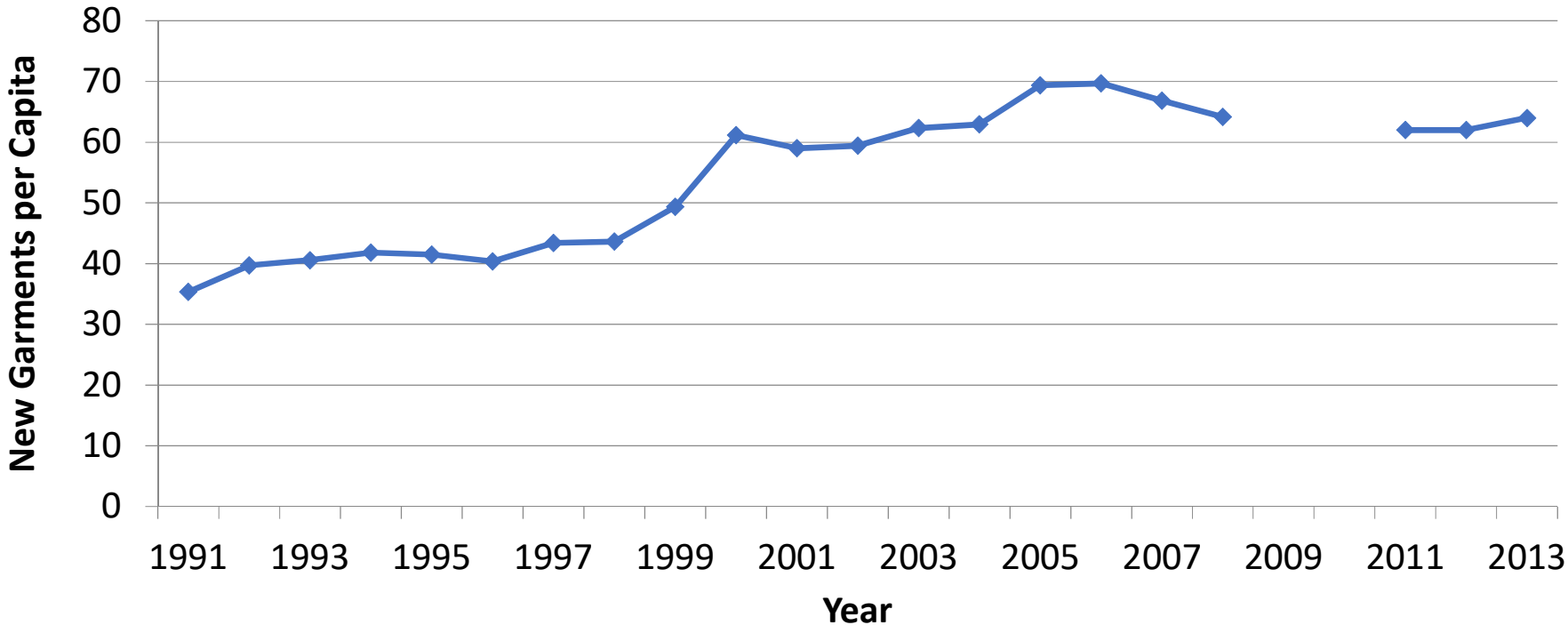
Derived from Gartner, Inc



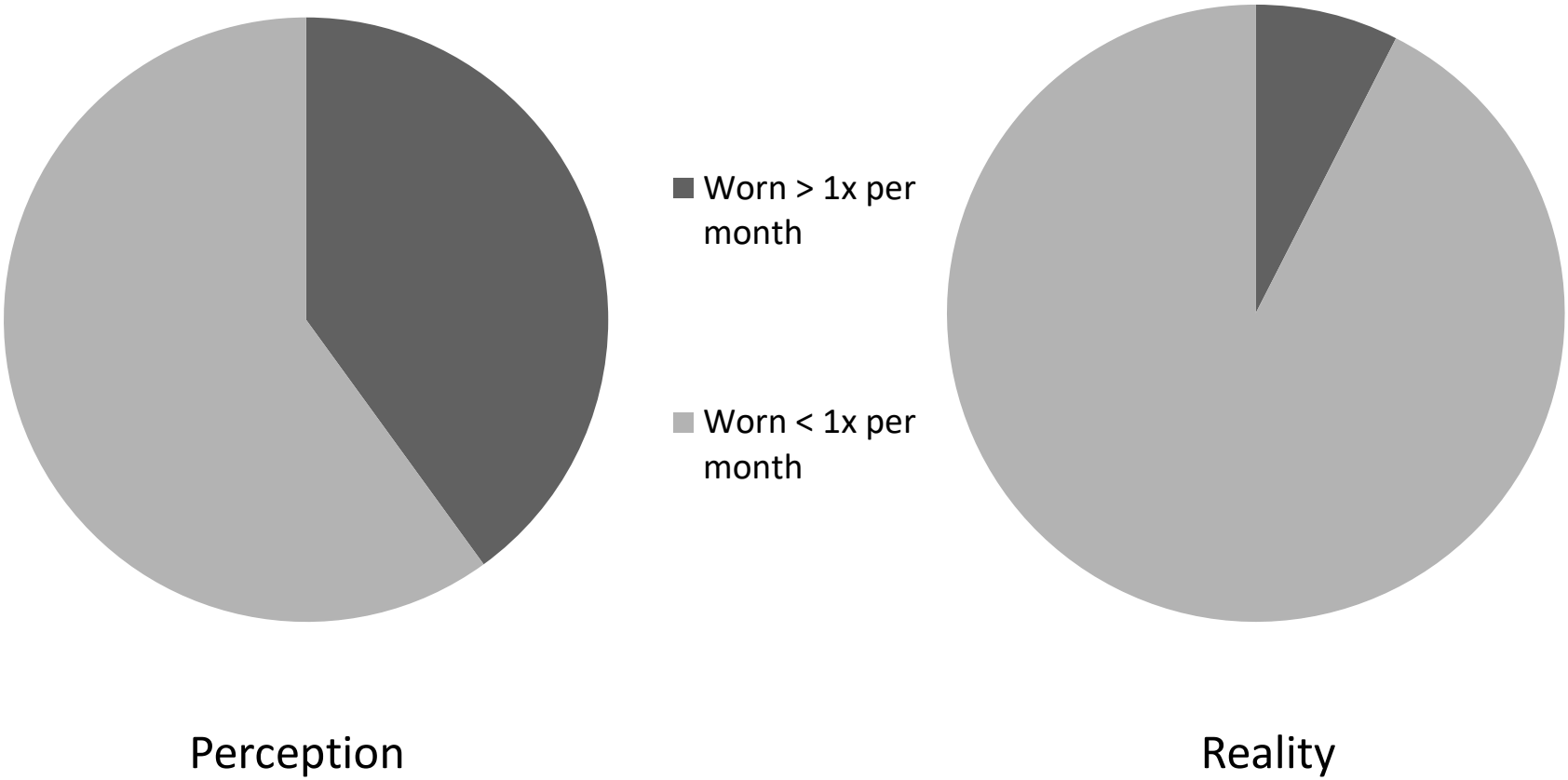
Distribution/body access
Memory/ubiquity
Usability/maintenance

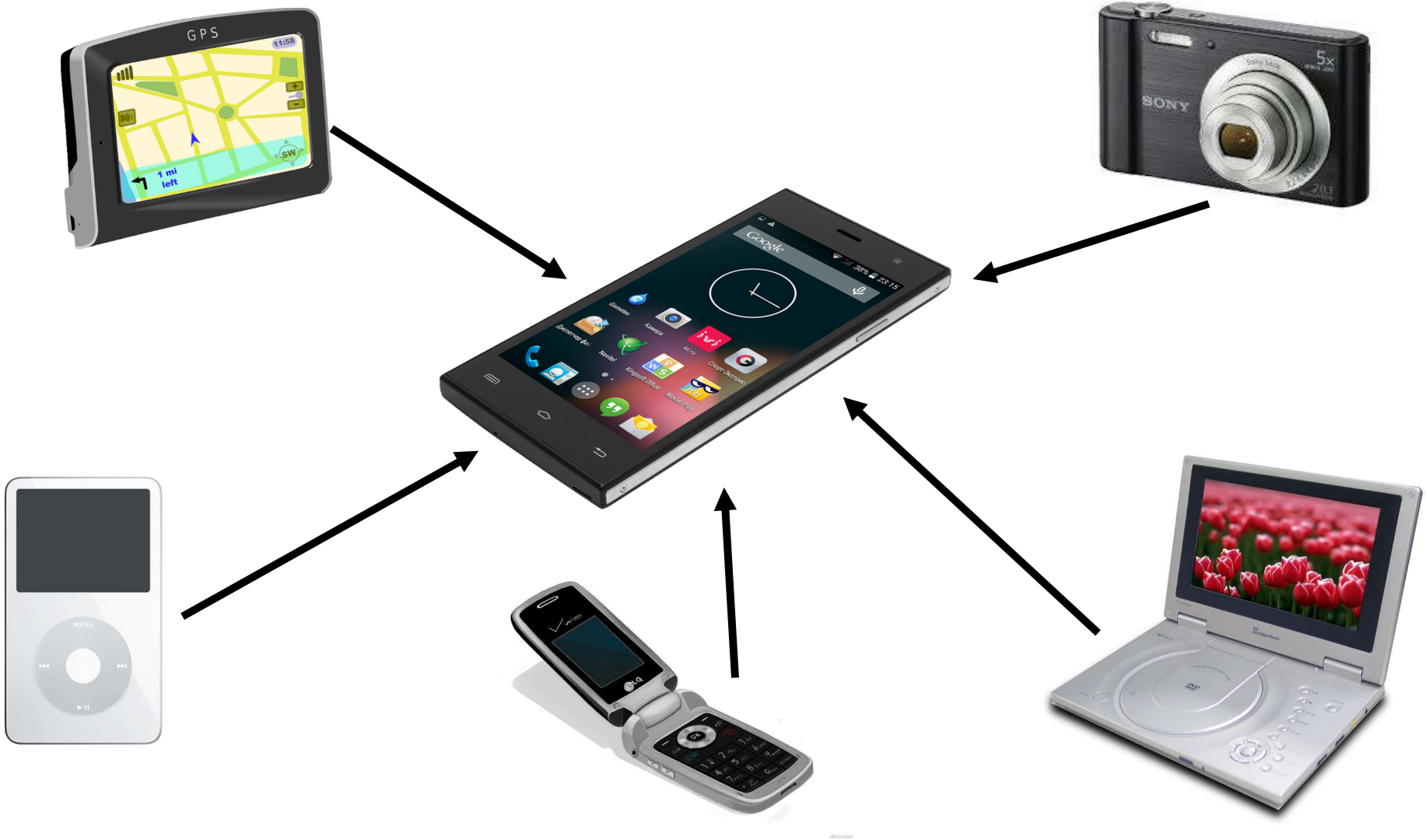
Durability
Manufacturability
Technological maturity

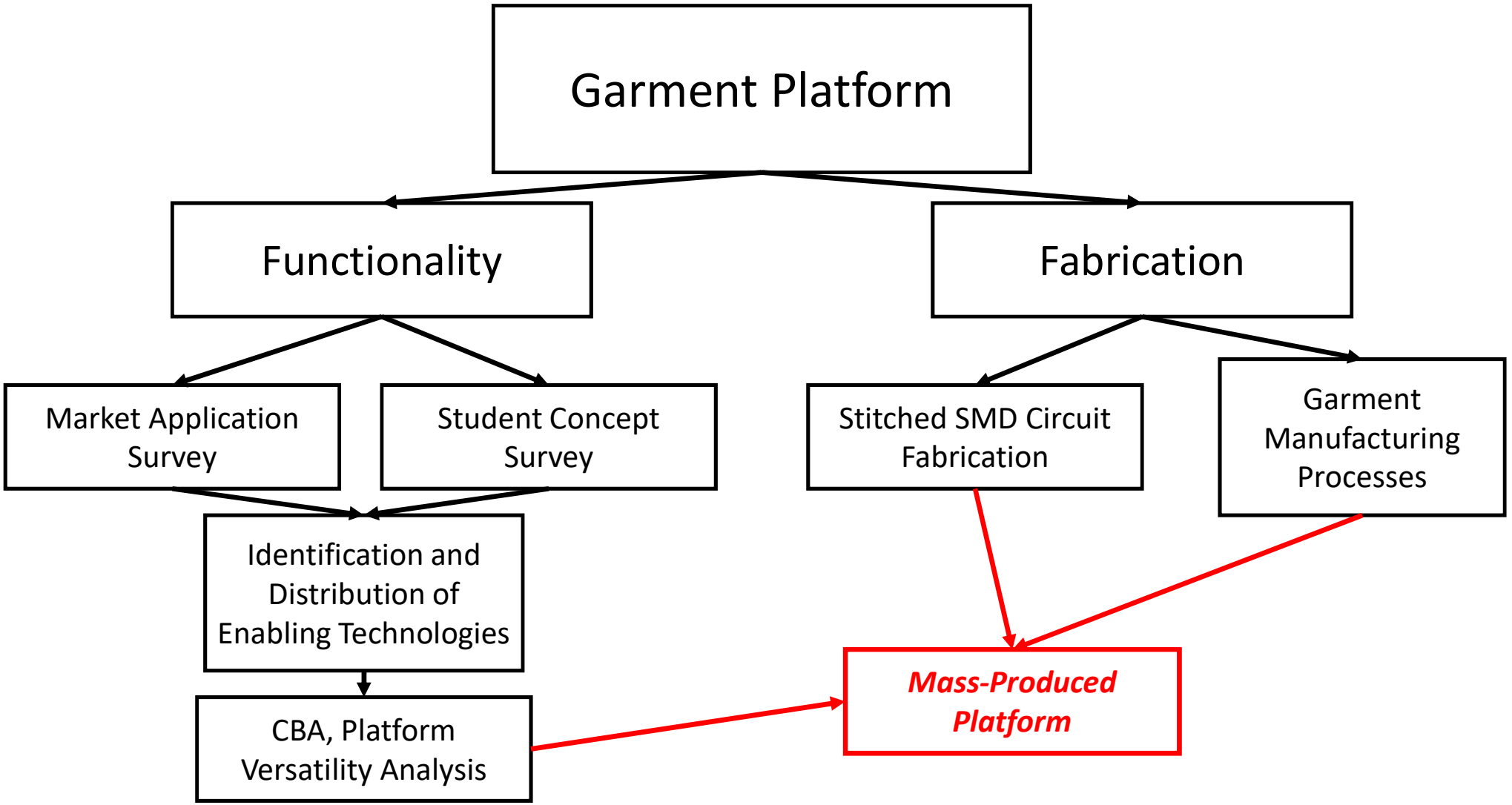
US Apparel Consumption per Capita

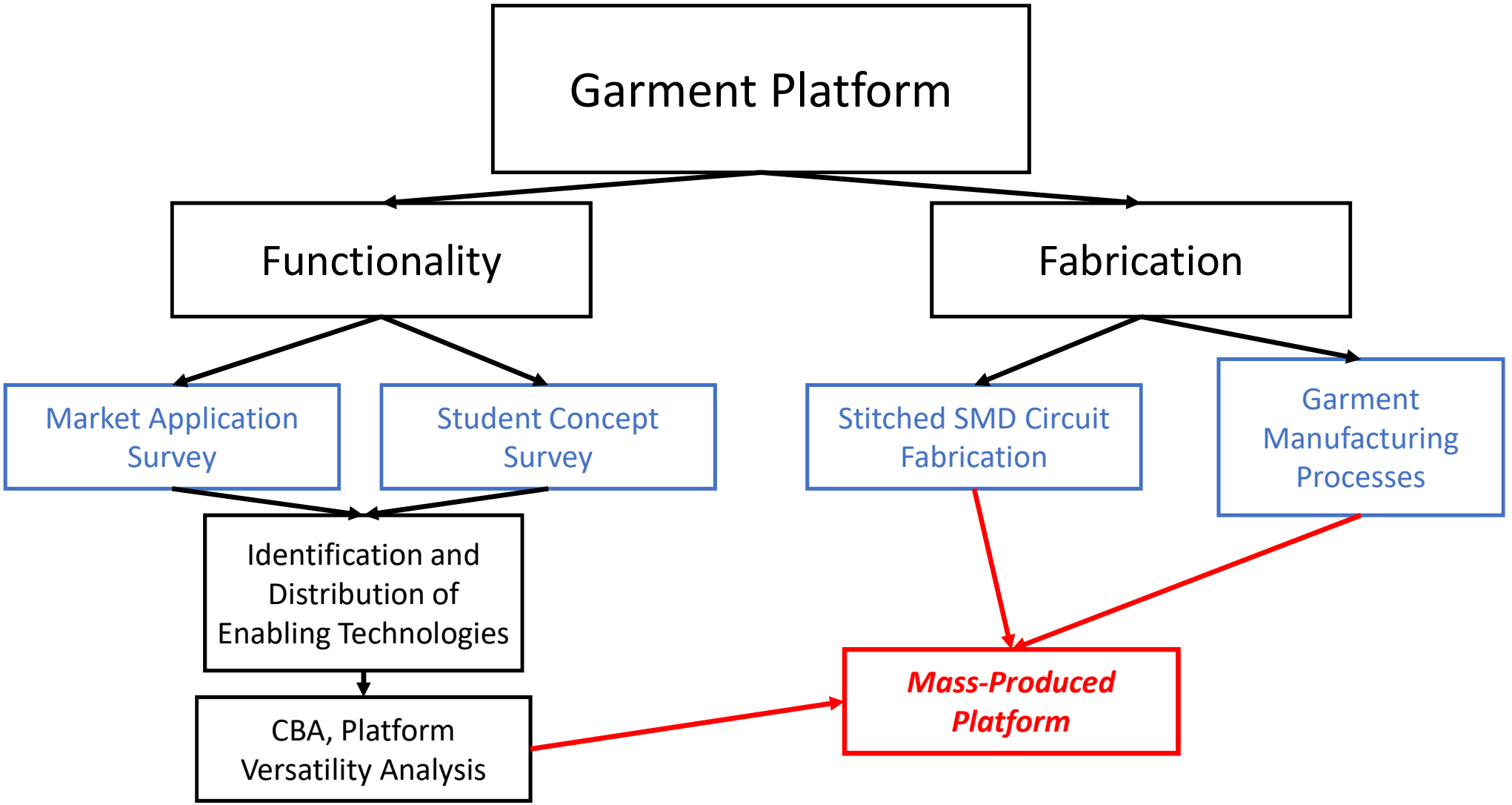


Source: AAFA ApparelStats, US Census


Worn > 1x per month
Worn < 1x per month
Perception
Reality


GPS
11:58
1 mi
left
SW
SONY
5x
Google
MENU


Garment Platform
Functionality
Fabrication
Market Application Survey
Student Concept Survey
Stitched SMD Circuit Fabrication
Garment Manufacturing Processes
Identification and Distribution of Enabling Technologies
CBA, Platform Versatility Analysis
Mass-Produced Platform

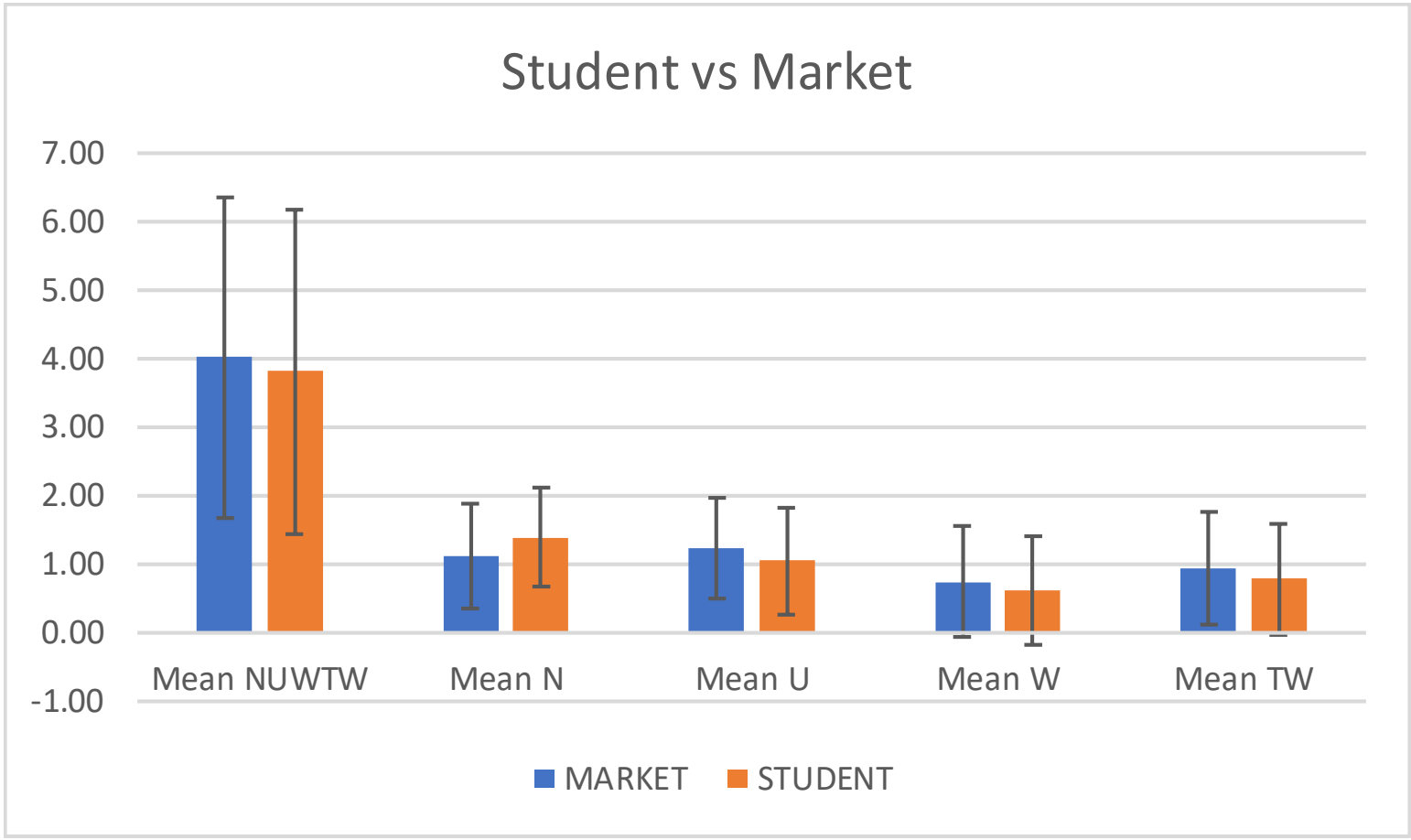

Garment Platform
Functionality
Fabrication
Market Application Survey
Student Concept Survey
Stitched SMD Circuit Fabrication
Garment Manufacturing Processes
Identification and Distribution of Enabling Technologies
CBA, Platform Versatility Analysis
Mass-Produced Platform

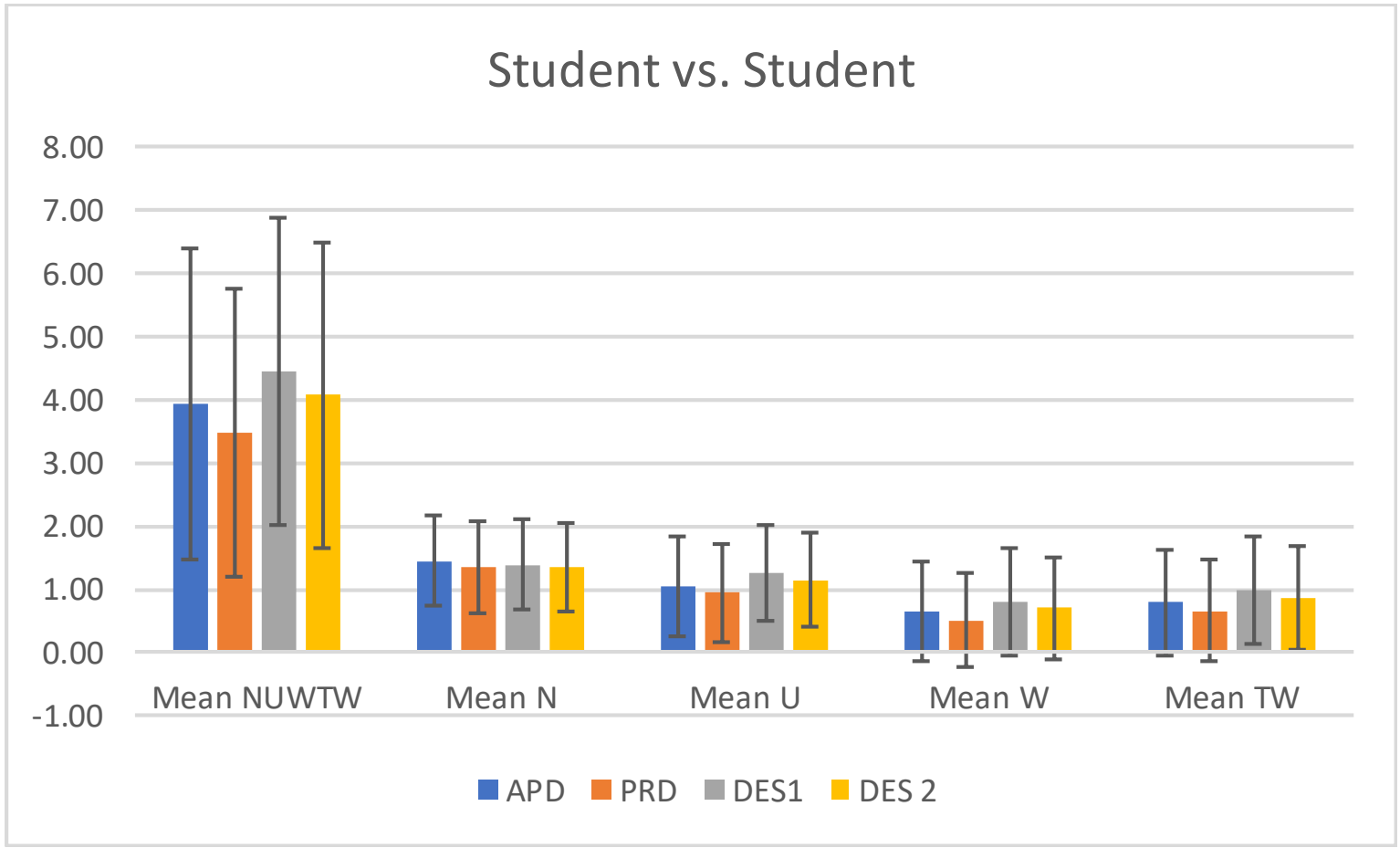
Functionality

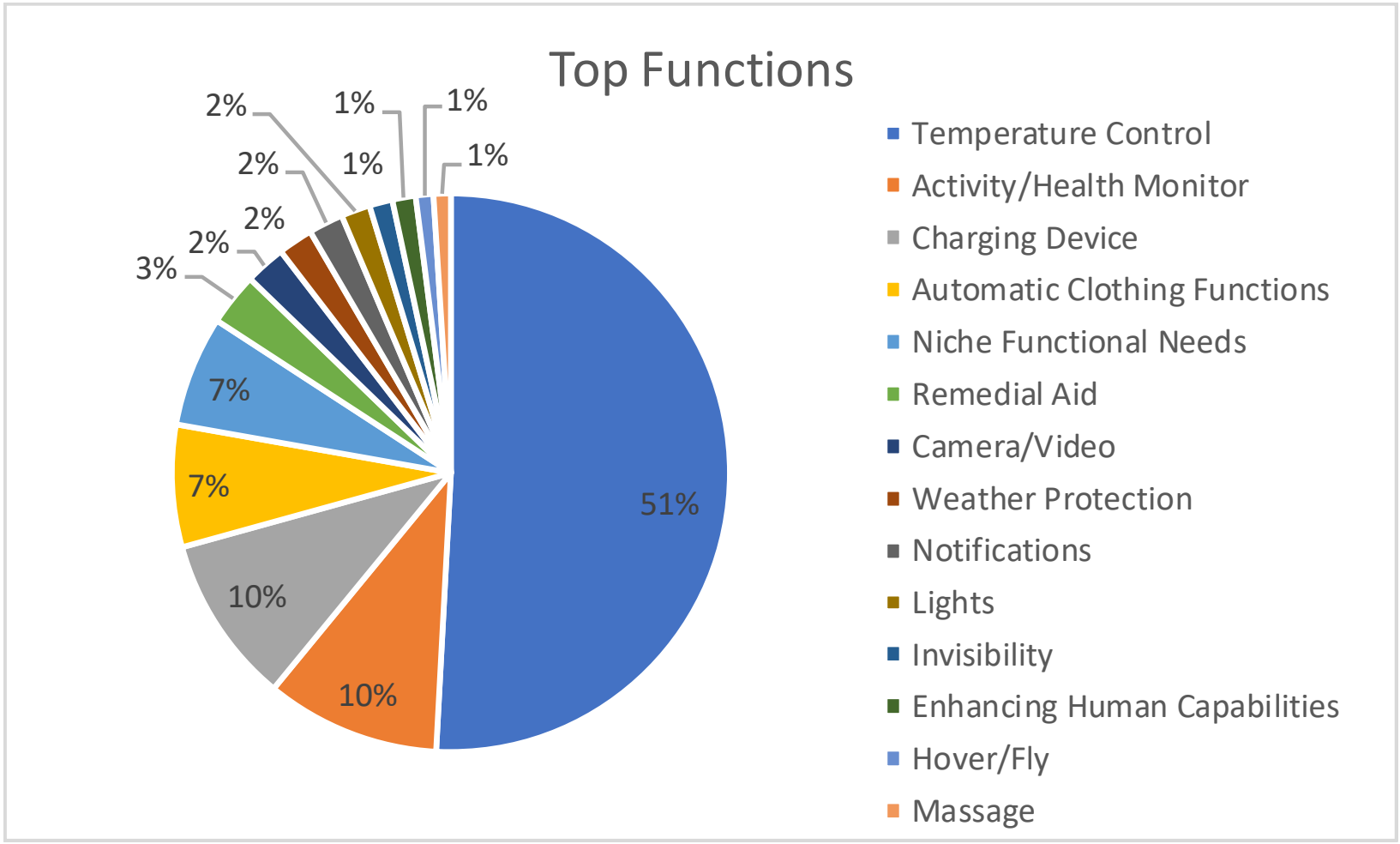
What *does* smart clothing/wearable technology do?

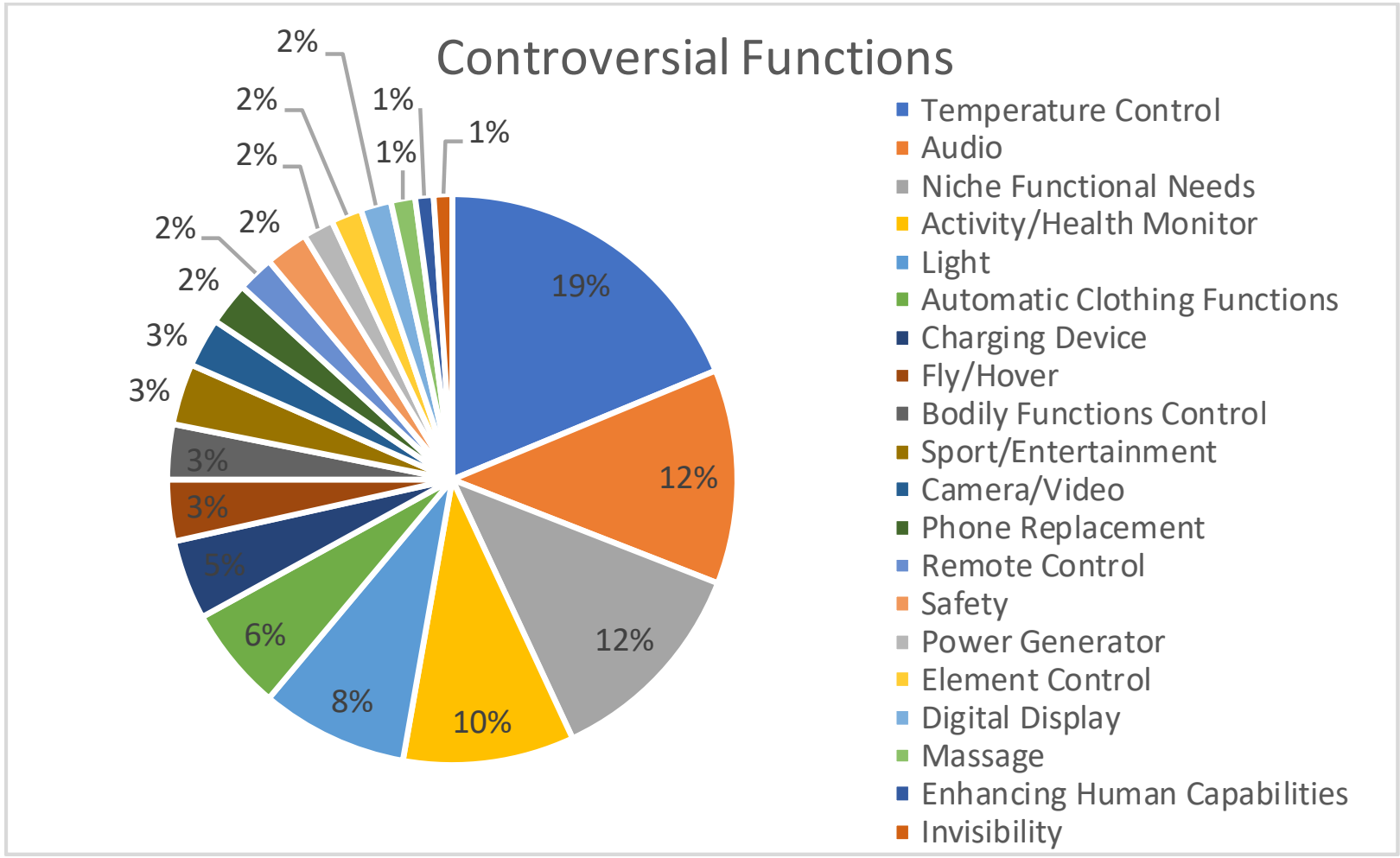
What *could* smart clothing/wearable technology do?

What *should* smart clothing/wearable technology do?


Student vs Market
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
Mean NUWTW
Mean N
Mean U
Mean W
Mean TW
MARKET
STUDENT


Student vs. Student
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
Mean NUWTW
Mean N
Mean U
Mean W
Mean TW
APD
PRD
DES1
DES 2


Top Functions
51%
10%
10%
7%
7%
3%
2%
2%
2%
1%
1%
1%
Temperature Control
Activity/Health Monitor
Charging Device
Automatic Clothing Functions
Niche Functional Needs
Remedial Aid
Camera/Video
Weather Protection
Notifications
Lights
Invisibility
Enhancing Human Capabilities
Hover/Fly
Massage

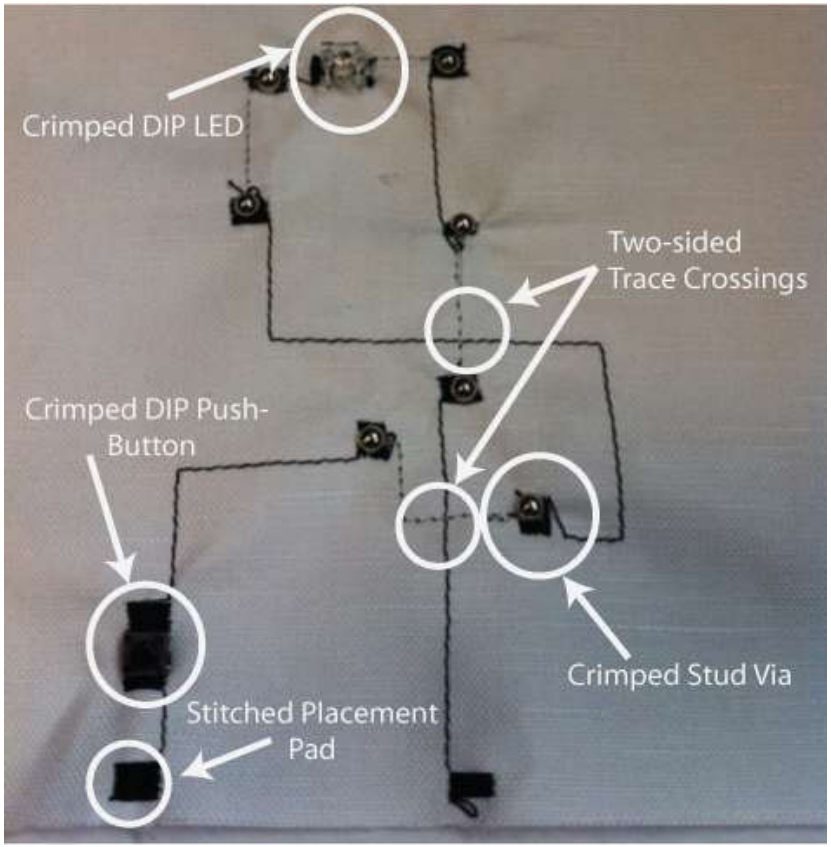

Controversial Functions
19%
12%
12%
10%
8%
6%
5%
3%
3%
3%
3%
2%
2%
2%
2%
2%
1%
1%
1%
Temperature Control
Audio
Niche Functional Needs
Activity/Health Monitor
Light
Automatic Clothing Functions
Charging Device
Fly/Hover
Bodily Functions Control
Sport/Entertainment
Camera/Video
Phone Replacement
Remote Control
Safety
Power Generator
Element Control
Digital Display
Massage
Enhancing Human Capabilities
Invisibility

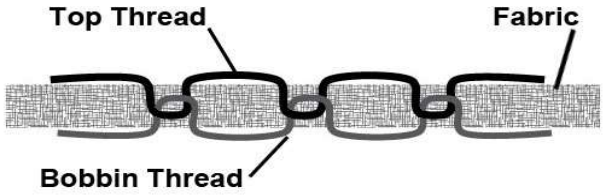
Fabrication

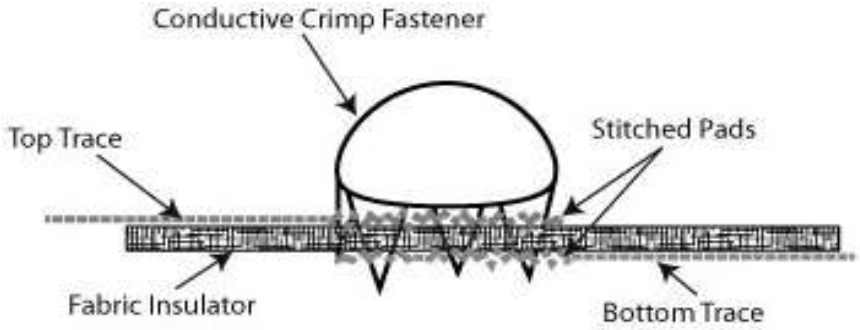
Leveraging CMT (cut-make-trim) manufacturing

Adapting CMT technologies

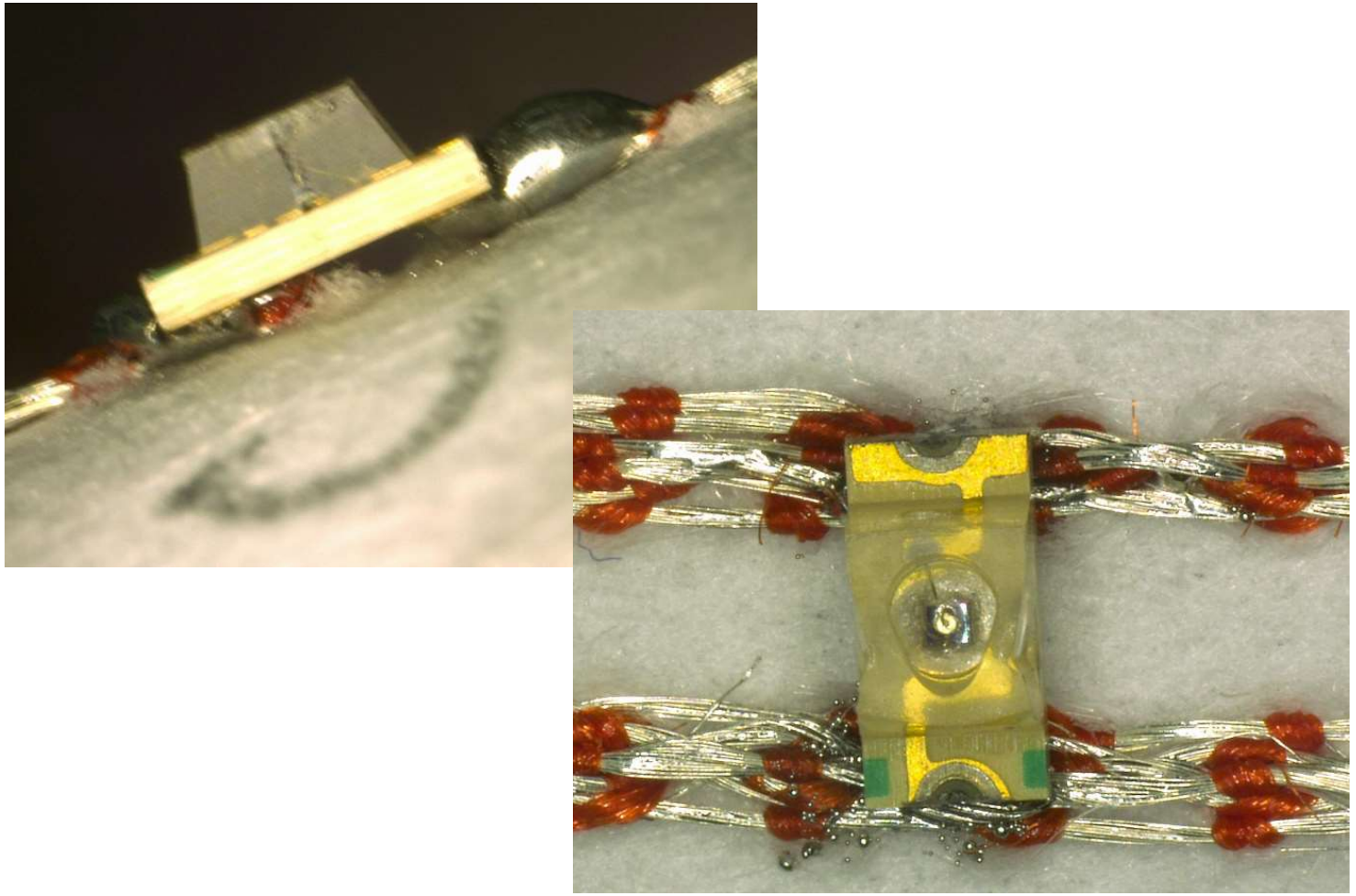
Developing (domestic) production workflows



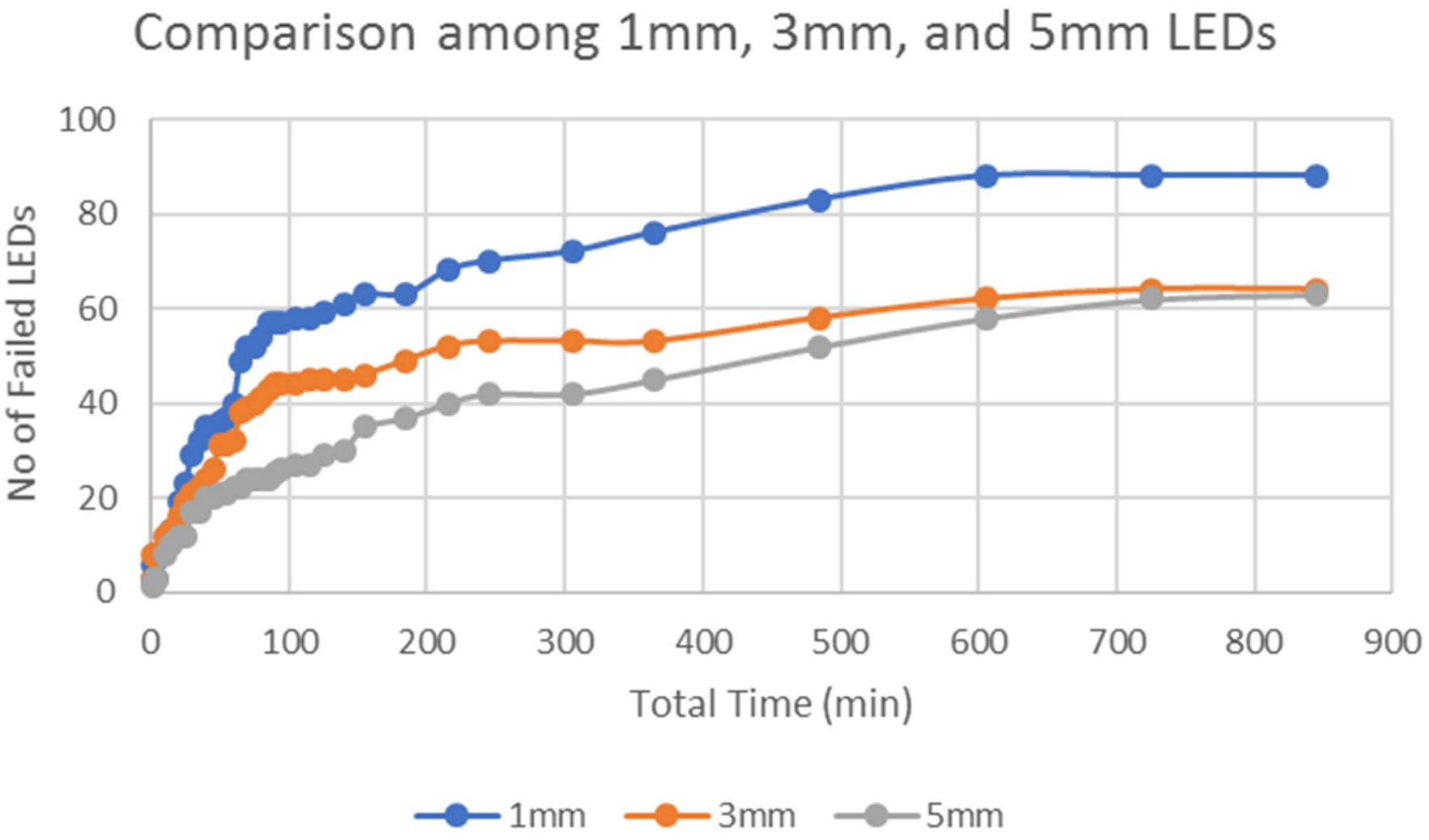




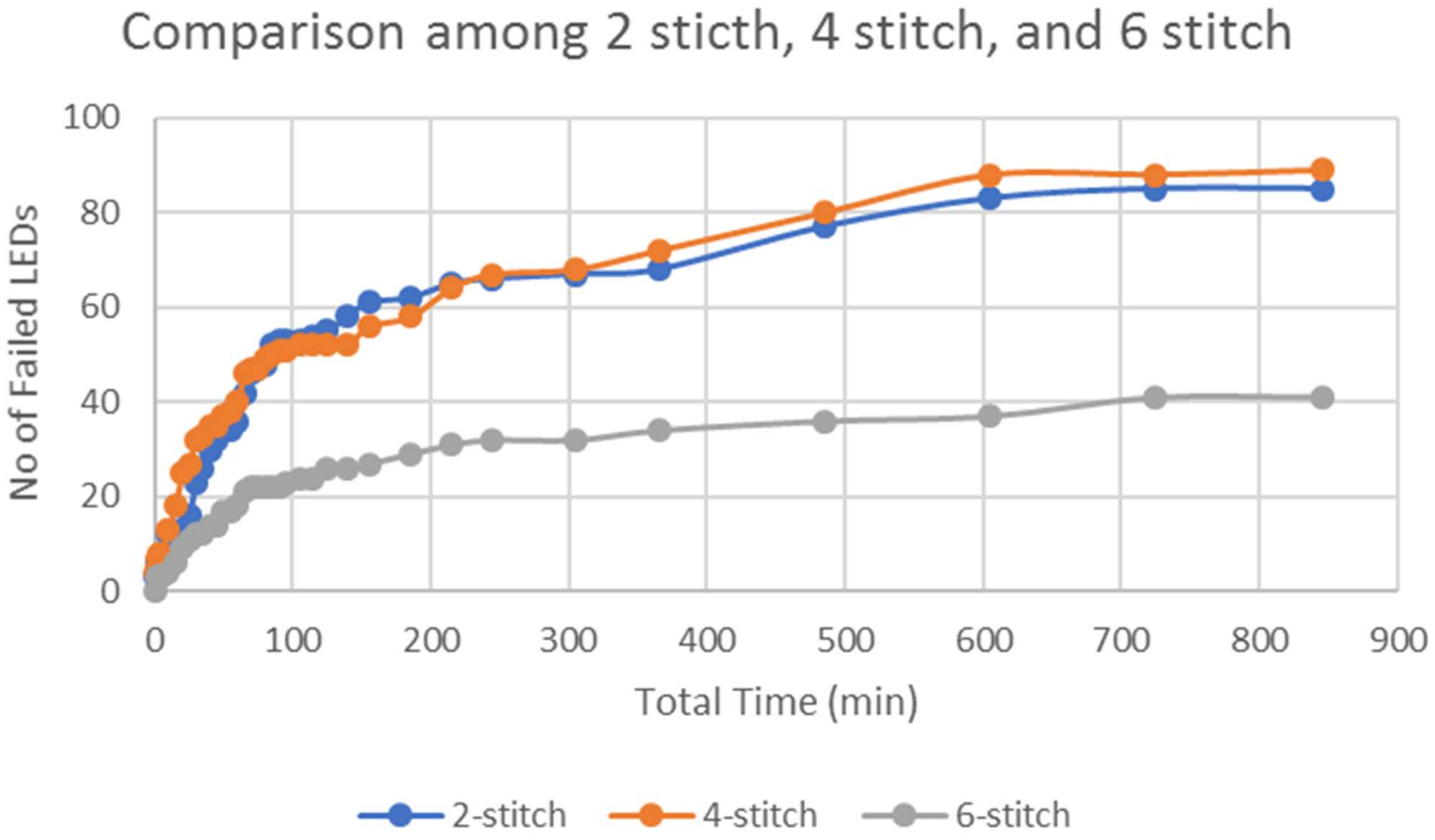
Dunne et al., UbiComp 2012



Berglund et al., ISWC 2015



Islam Molla et al., ISWC 2017



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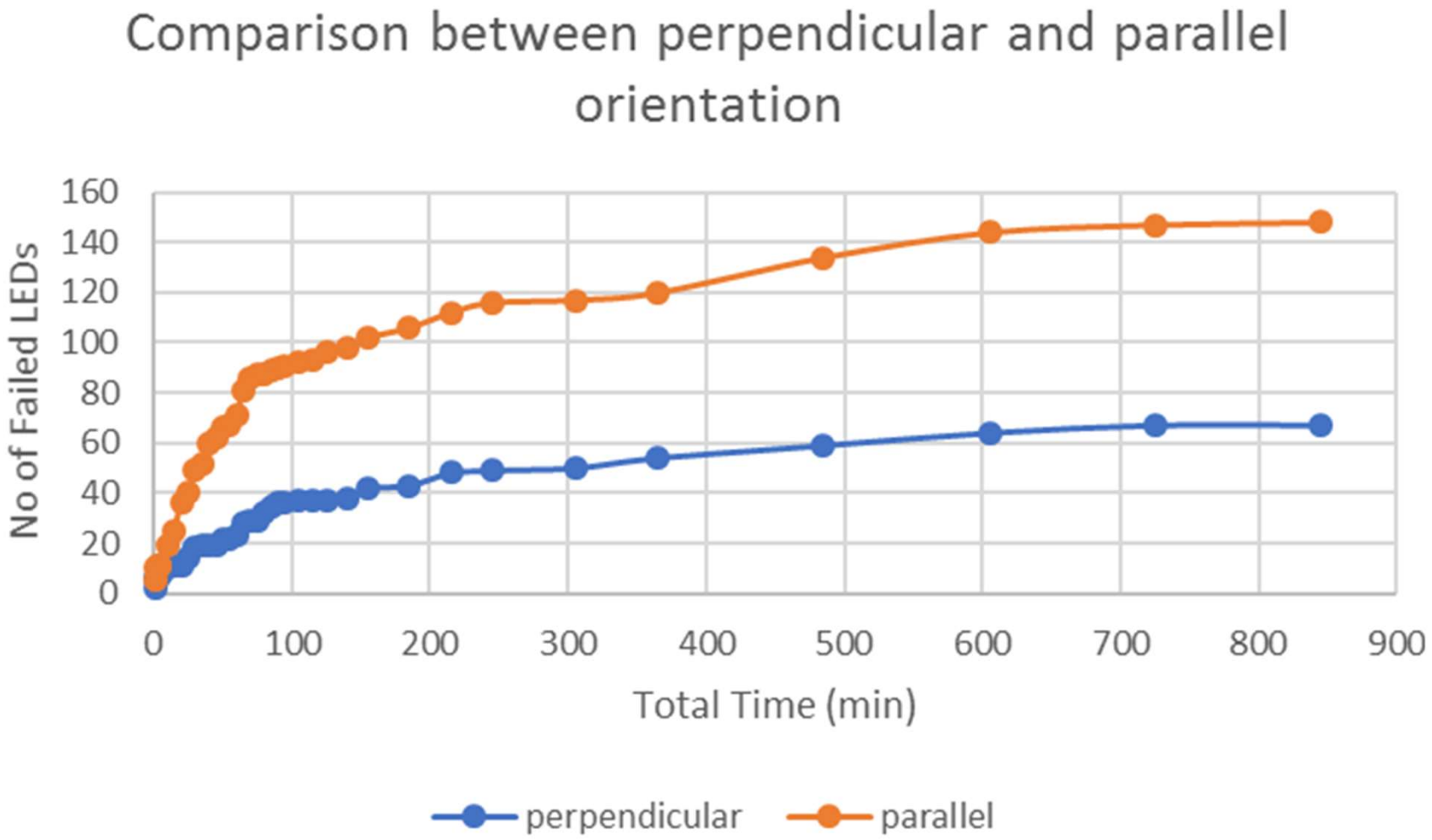

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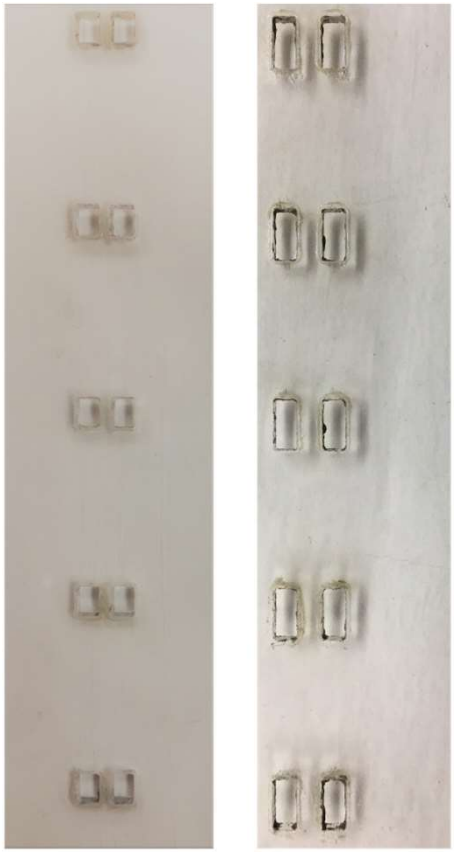
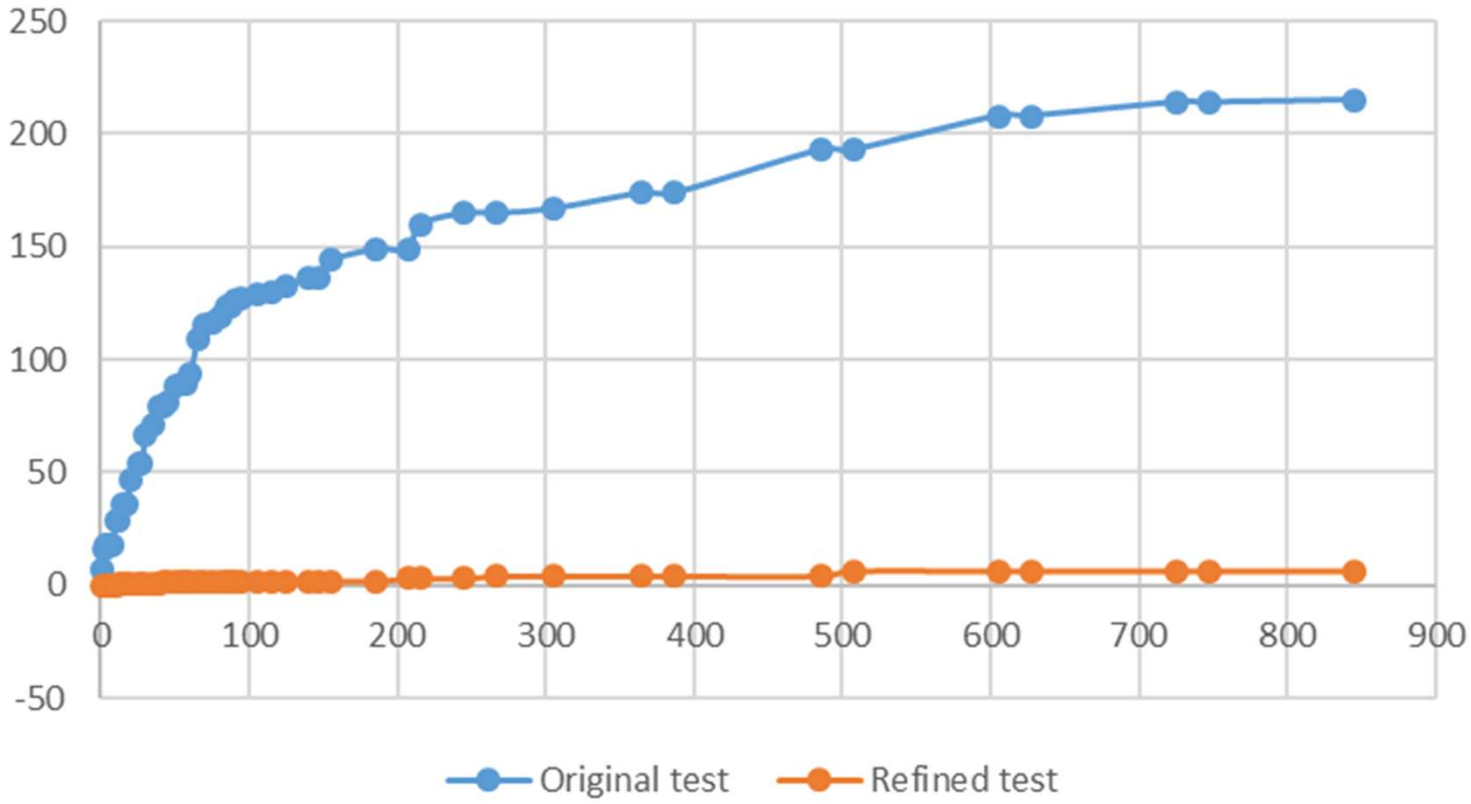
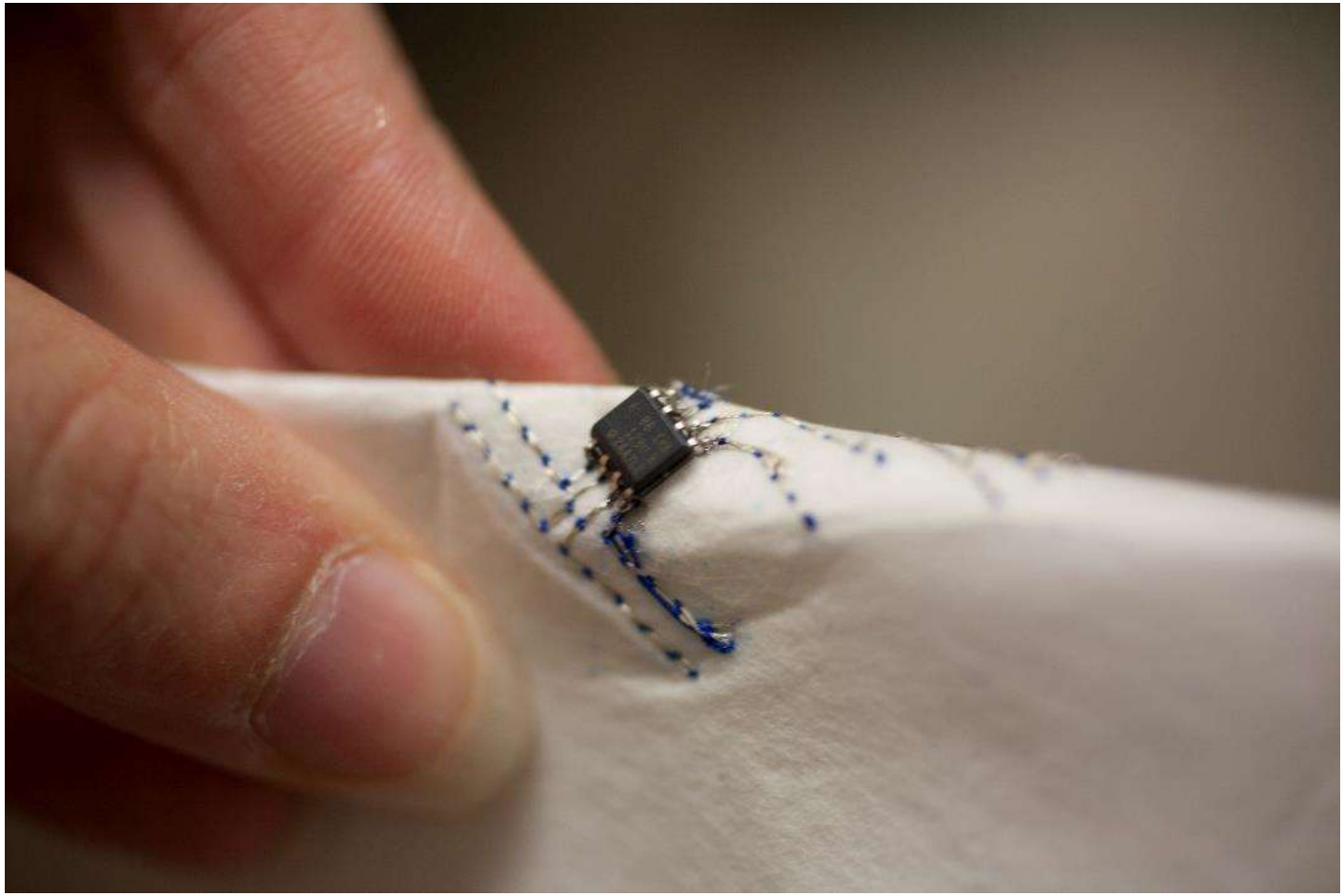


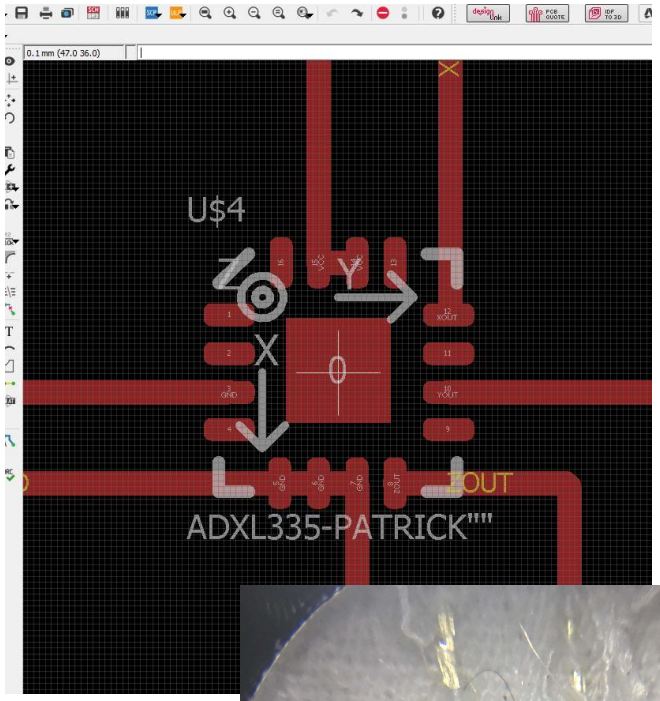
CAUTION
HOT

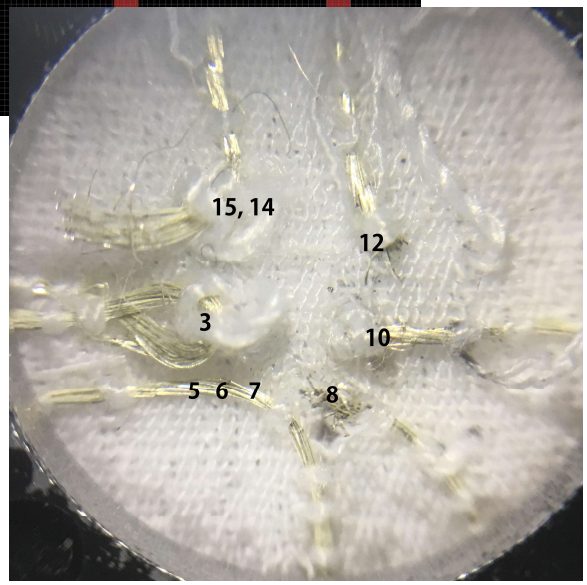
Method comparison

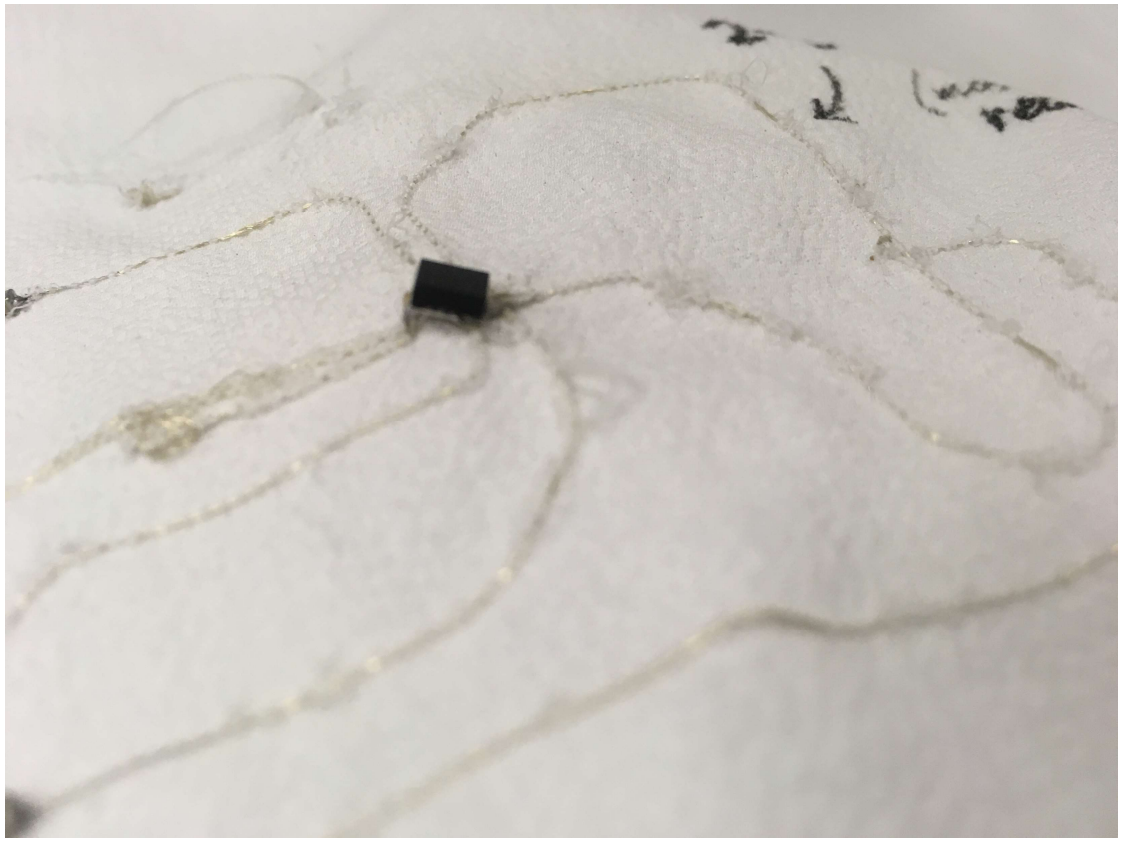


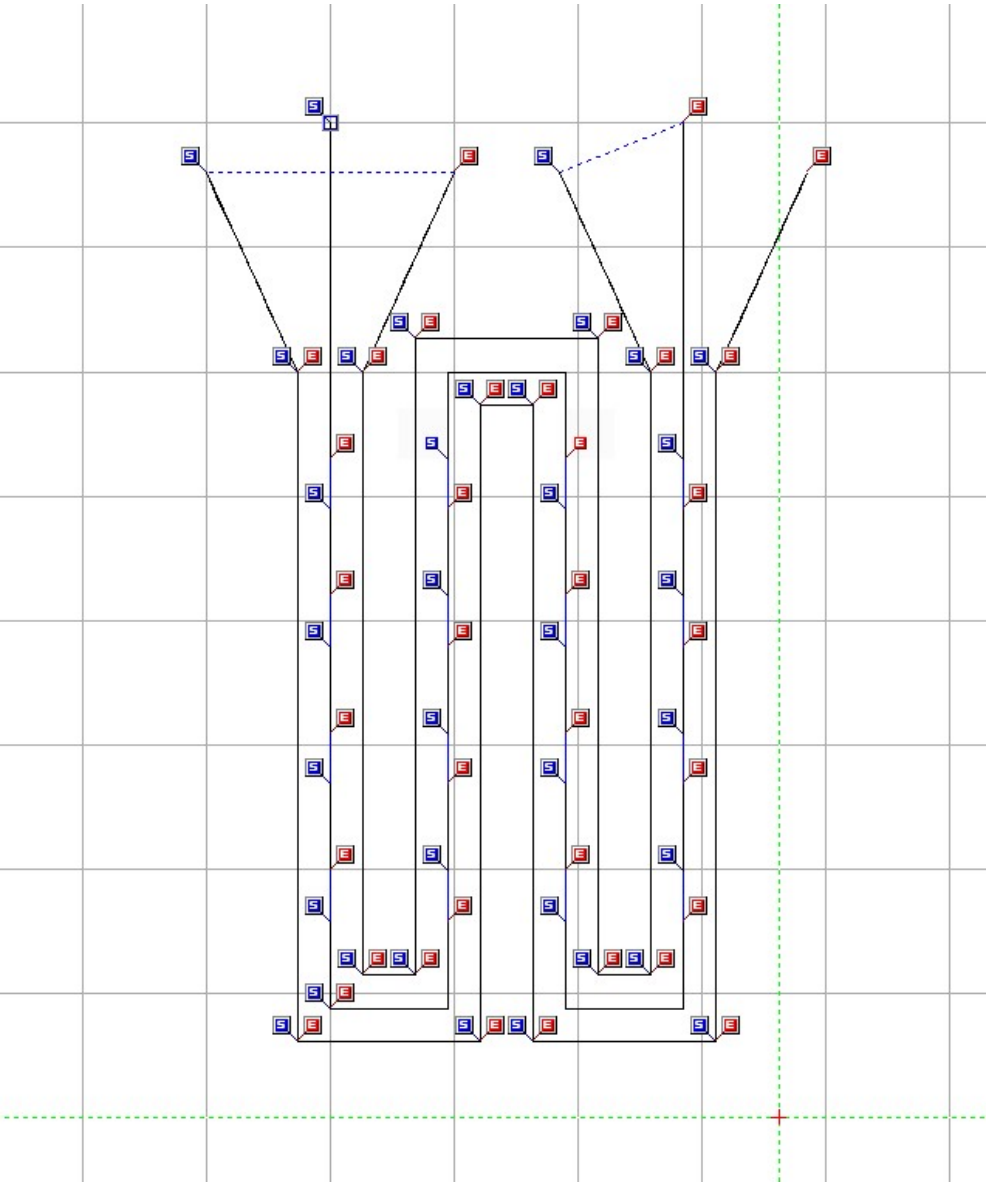
Islam Molla et al., ISWC 2017

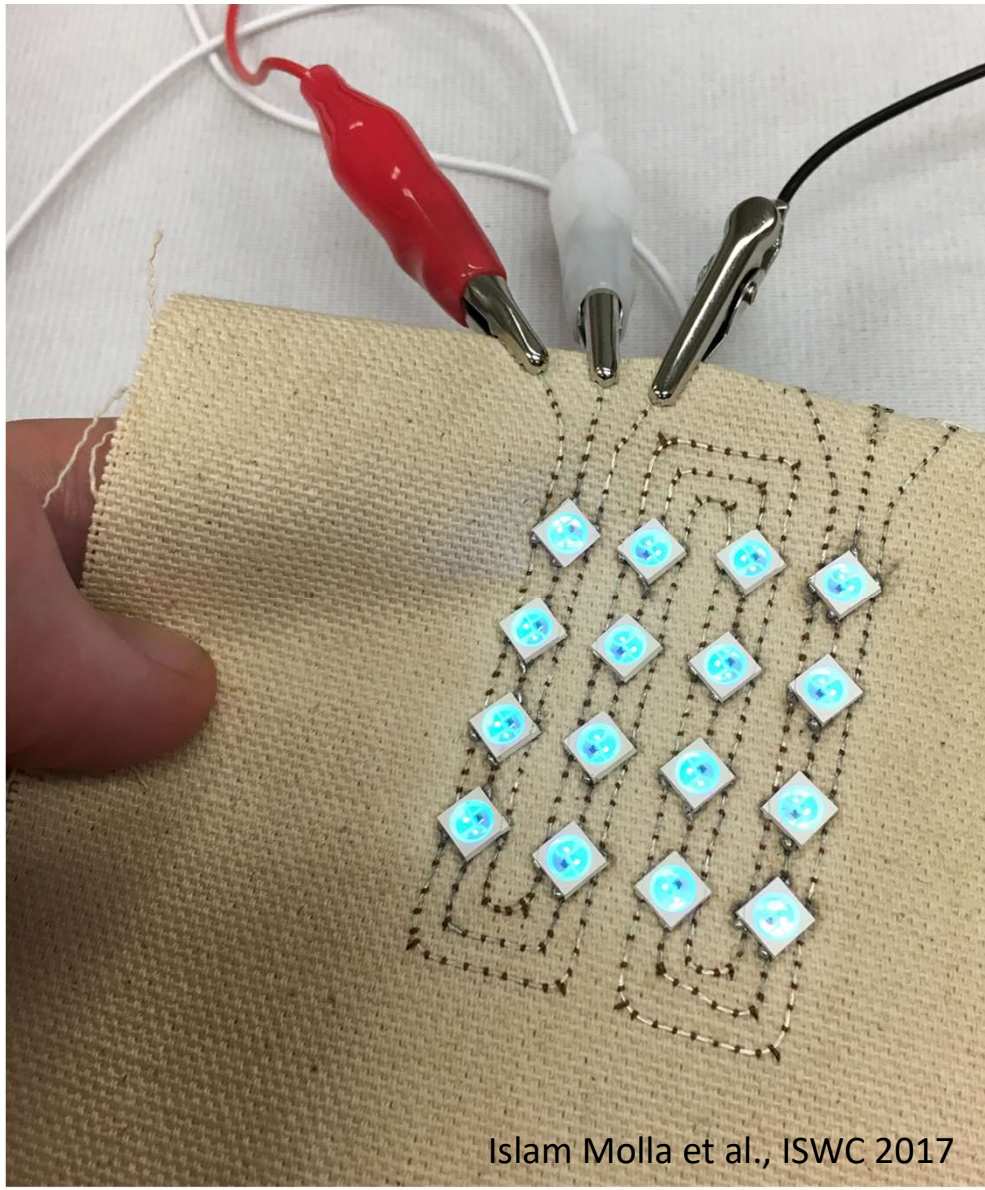



U$4
Y
X
0
ADXL335-PATRICK""

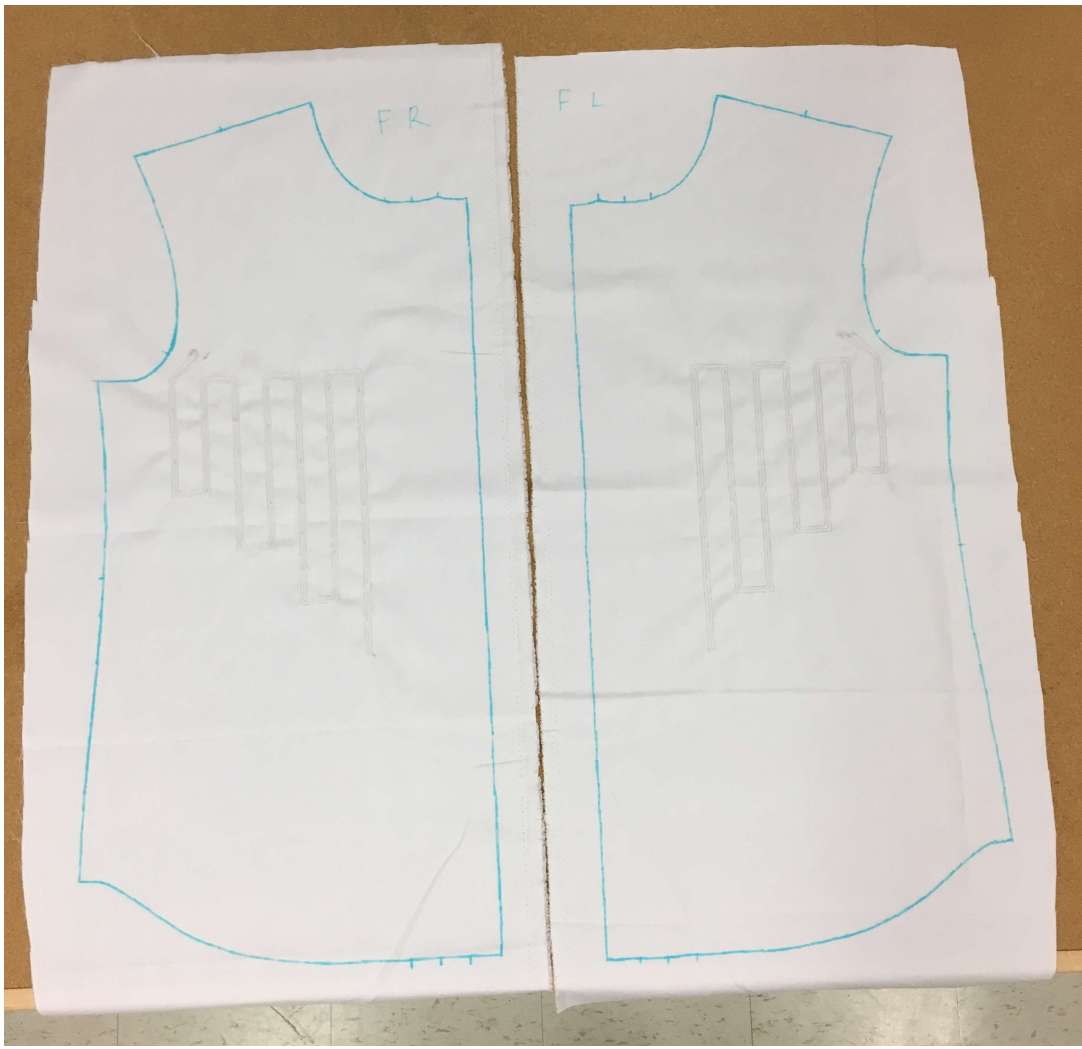

15, 14
12
3
10
5 6 7
8

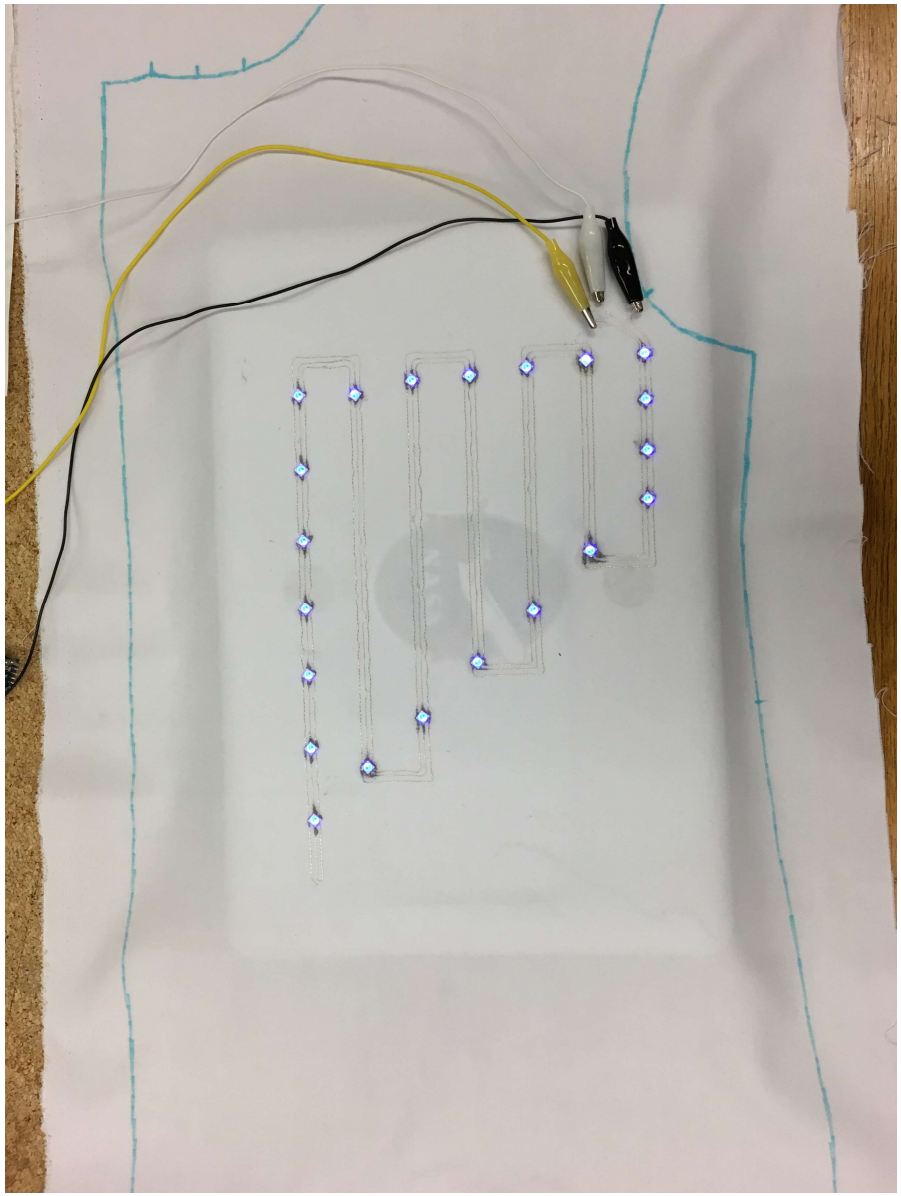


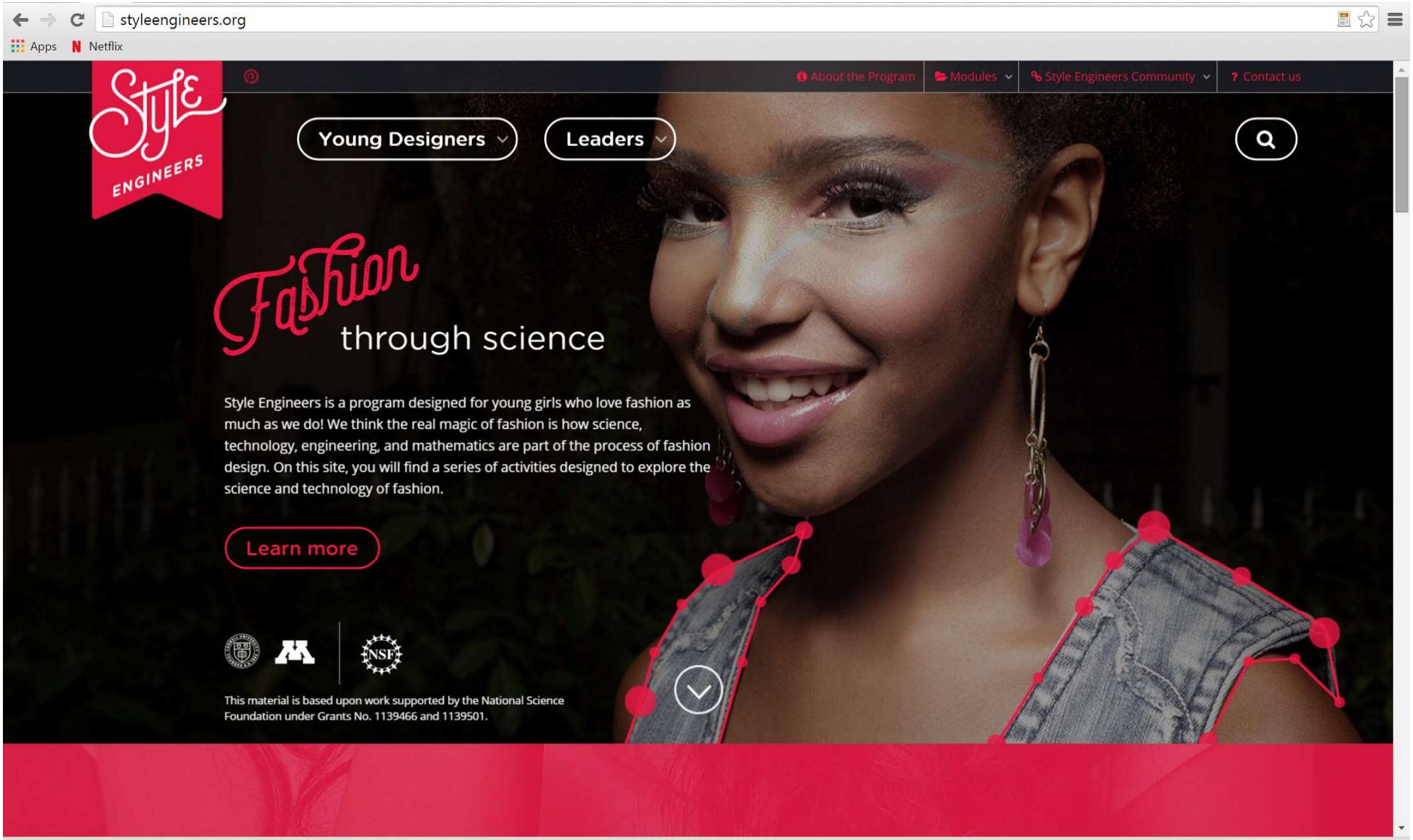



Islam Molla et al., ISWC 2017

brother
950
400


FR
FL

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Style Engineers Community
Contact us
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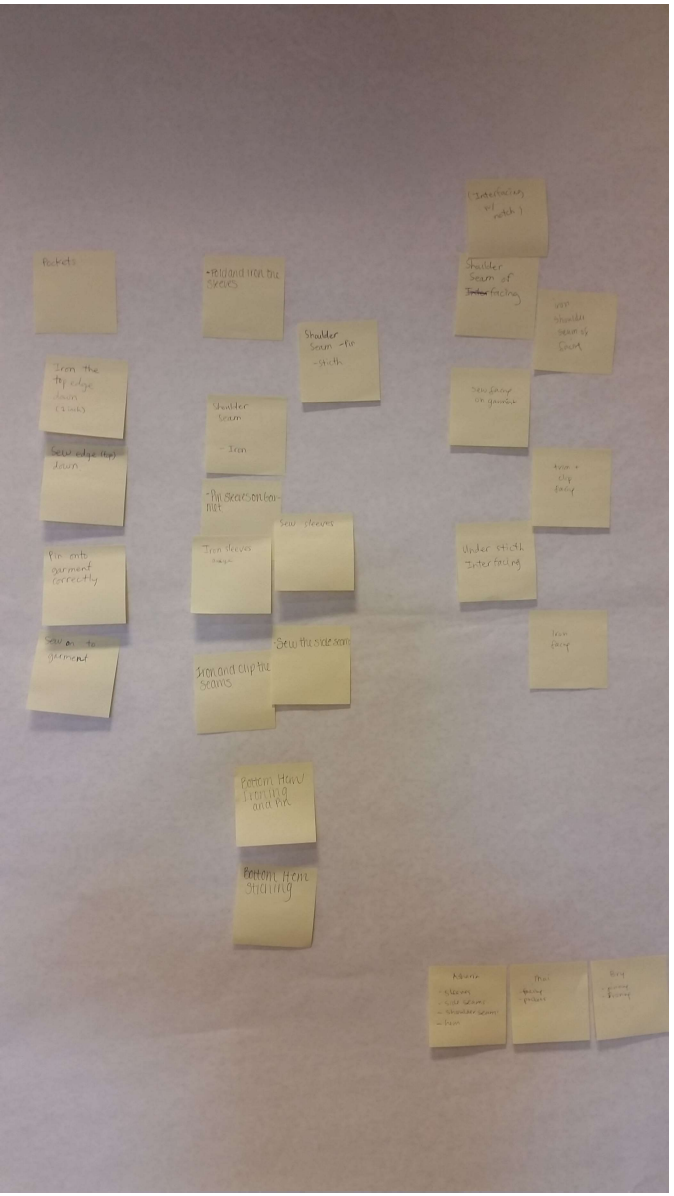
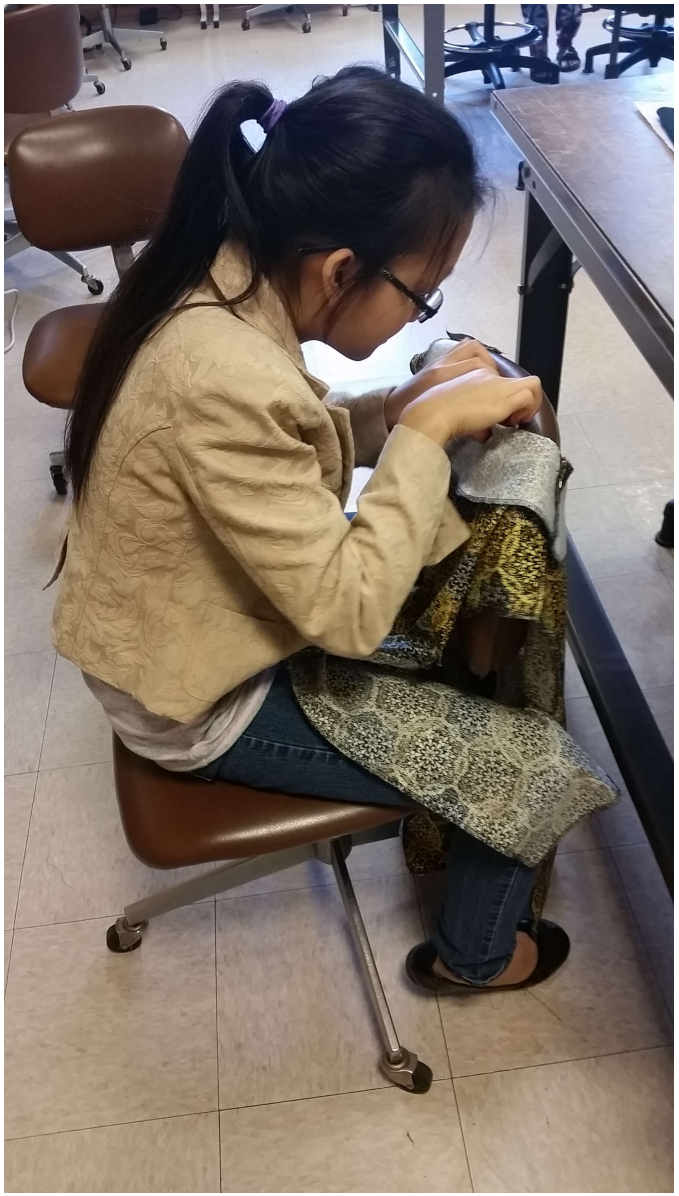
Young Designers
Leaders
Fashion
through science
Style Engineers is a program designed for young girls who love fashion as much as we do! We think the real magic of fashion is how science, technology, engineering, and mathematics are part of the process of fashion design. On this site, you will find a series of activities designed to explore the science and technology of fashion.
Learn more
NSF
This material is based upon work supported by the National Science Foundation under Grants No. 1139466 and 1139501.


Pockets
Iron the top edge down (2 sets)
Sew edge (top) down
Pin onto garment correctly
Sew on to garment
Iron and clip the seams
Bottom Hem Ironing and Pin
Bottom Hem Stiching
Shoulder Seam - Pin - Stich
Shoulder Seam - Iron
Sew sleeves
Under stich Interfacing
Iron facing

Front



18

alvaform
by alvanon
MISSY
8
2004

Thanks!

ldunne@umn.edu

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