Welcome to

Advanced Textiles EXPO

ORGANIZED BY ATA

Low-Cost High-Volume Wearables

It took ~~ten years~~ 200 years, and we're finally here.

Greg Nevolo
Product Innovation

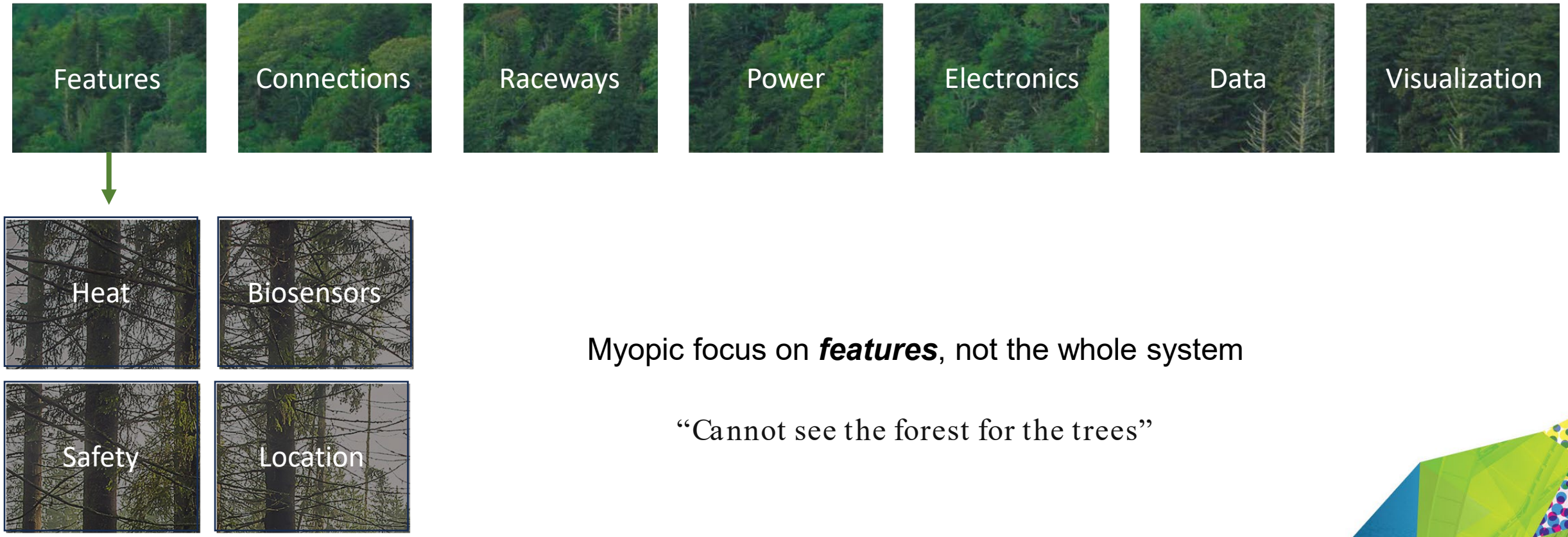
Wearables have been around a long time

1810. The First Watch by Abraham-Louis Breguet, designed for the Queen of Naples
1910. The first Aviation “Pilot” watch by Cartier
1920s. The first heated jacket was made by an electrical engineer named George Endress.
1960s. 1961, Thorp and Shannon created a tiny four-button computer for a shoe.
1970s. The first calculator wristwatch was released in 1975 by Pulsar.
1980s. 1979 Sony released the Walkman; 1987 Healthcare first digital hearing aids.
1990s. 1994 Wearable wireless webcam invented by Steve Mann.
2000s. Introduction of Bluetooth headsets, Fitbits, Wearable power, heat, and iPods.
2010s. True “wearable technology” with Apple Watch, Google Glass, Oculus Rift Headset

Greg Nevolo | Product Innovation | Oct. 31, 2023

Endless form factors

A Wearable product is **complex**



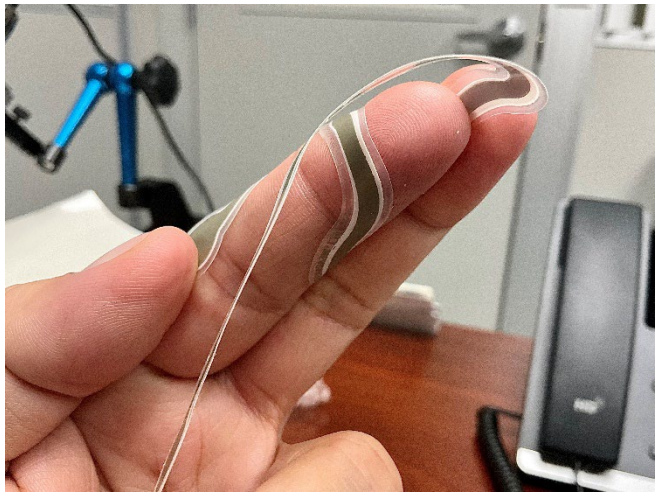
Myopic focus on ***features***, not the whole system

"Cannot see the forest for the trees"

Greg Nevolo | Product Innovation | Oct. 31, 2023

Advanced Textiles EXPO

What drives ***every*** new class of wearables?




Material Science **+ Imagination**

Conformable Stretchable Inks, Flexible Hybrid Electronics, Woven Fabrics & Yarns

These new solutions require extensive learning curves.

Greg Nevolo | Product Innovation | Oct. 31, 2023

Advanced Textiles EXPO

Imagination is where it all starts

Back of the Napkin. Wearable Fuel Cell & Heat
September 2003

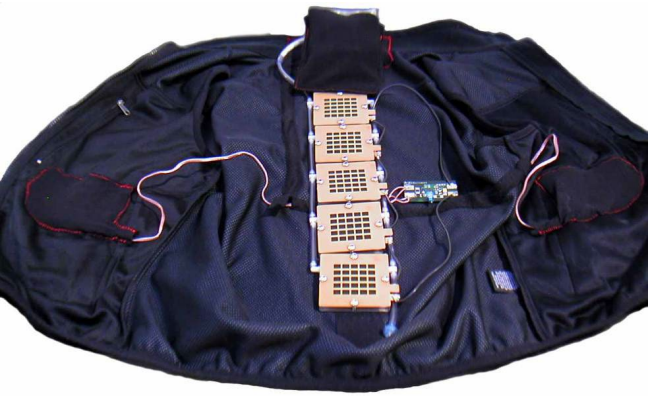
First Consumer Production Model
September 2008

Greg Nevolo | Product Innovation | Oct. 31, 2023

Advanced Textiles EXPO

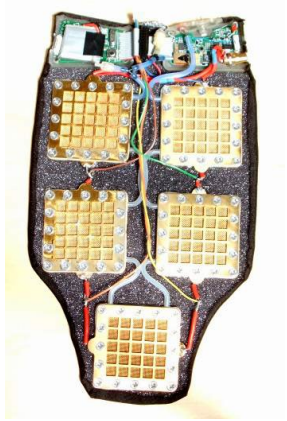
Evolution of Features: ***Power and Heat***

2004



Hydrogen Fuel Cell
Military Prototype

2006



Removable
Form Factor

2007

1st Gen iPhone
Launch

Market Pull
Novel Tech

Pivot

2008

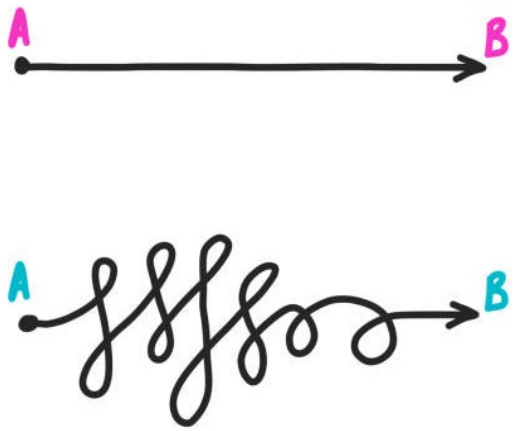
Military to Consumer
Conversion

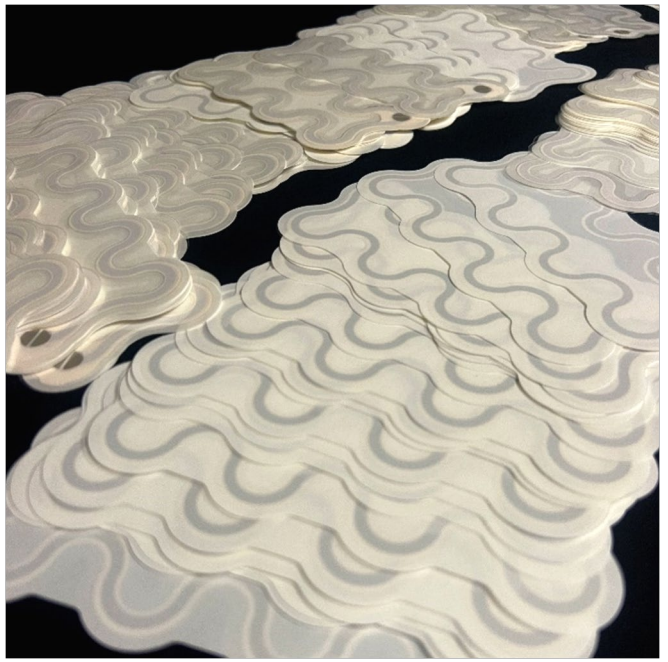
2009

Hugo Boss Jadon We Jacket
Power + Heat

Greg Nevolo | Product Innovation | Oct. 31, 2023

Big Challenge: Lab to Production

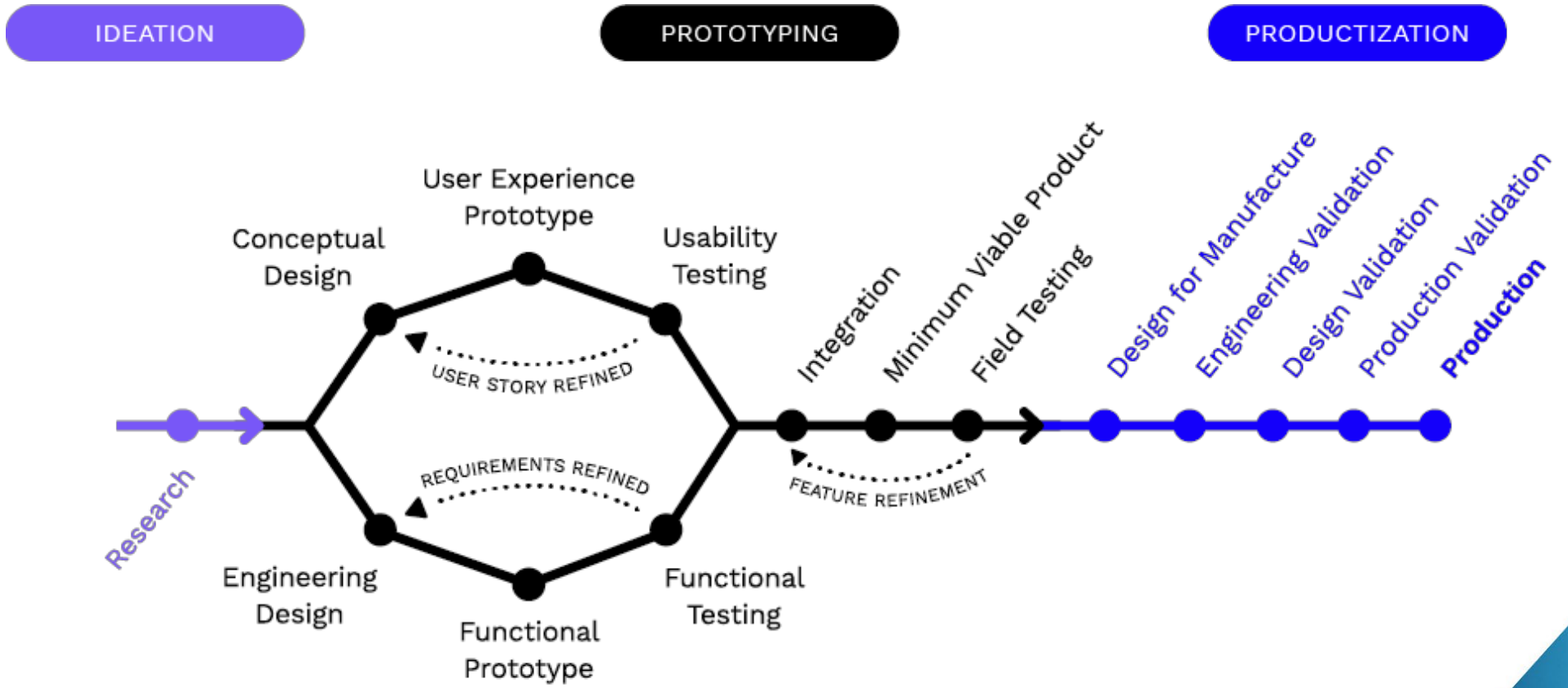




Greg Nevolo | Product Innovation | Oct. 31, 2023

Advanced Textiles EXPO

The ***Journey***



Greg Nevolo | Product Innovation | Oct. 31, 2023

Advanced Textiles EXPO

Challenges for Wearables

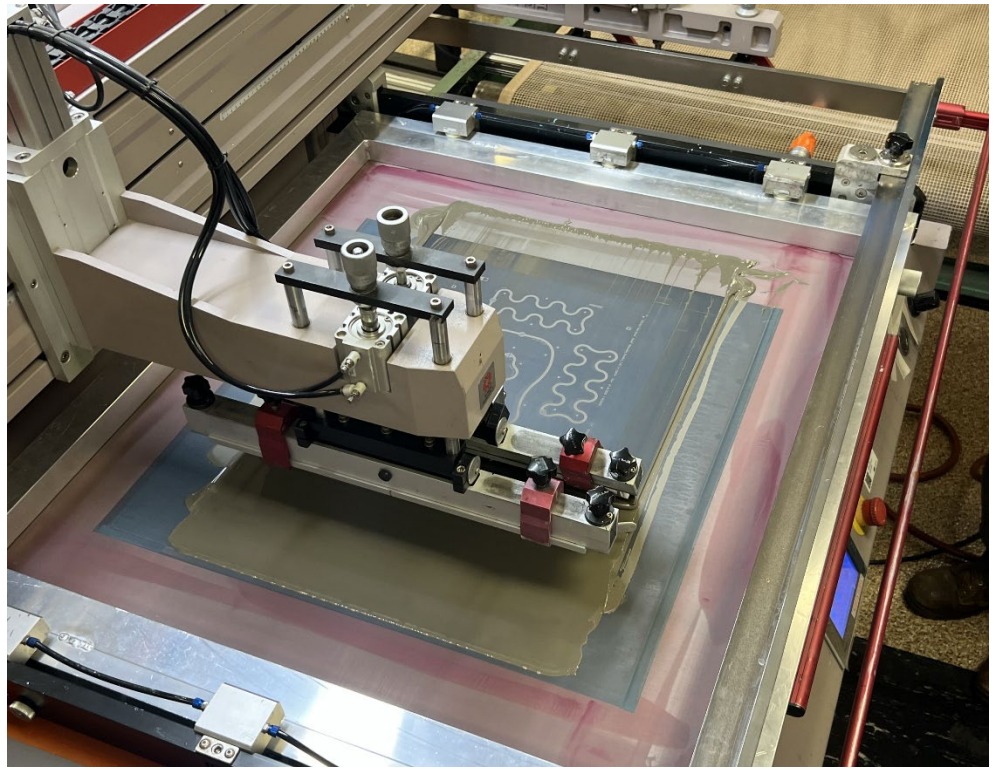
Manufacturing
How do you make it in volume?

Connectivity
How do you connect anything to it?

Integration
How/Where does it get into a product?

Greg Nevolo | Product Innovation | Oct. 31, 2023

Can ***the product*** be made?



The Ultimate Litmus Test

- Cost-effective / ease of setup
- High-Volume Low-Cost production
- Variety of Substrates

Screen Printing is the best method for inks.
…BUT it's not without its challenges!

**Other materials will face similar hurdles for production.*

Greg Nevolo | Product Innovation | Oct. 31, 2023

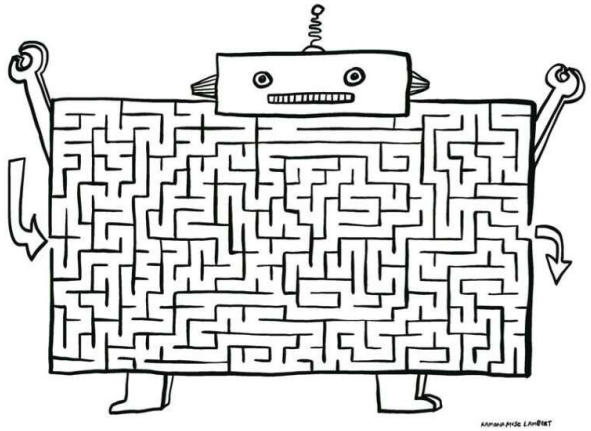
Advanced Textiles EXPO

Focusing on Manufacturability ***drives innovation***

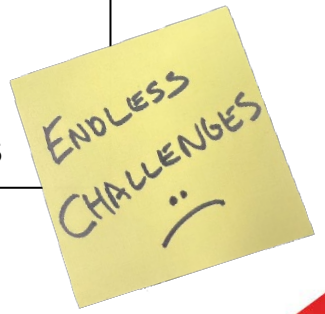
100+ year old technology

- Labor Intensive
- Lower materials cost
- High assembly cost
- Low throughput

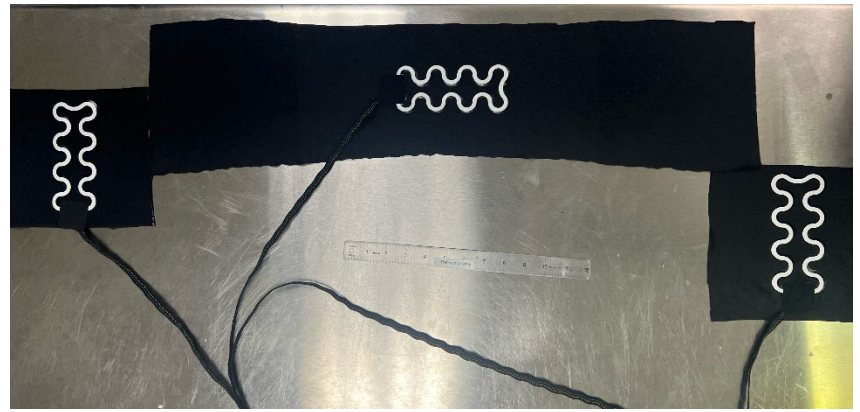
Innovation



Special Substrates Made
Ink Formulations
Ink Dispersion
Printing Methods
Interconnects
Transfer Methods



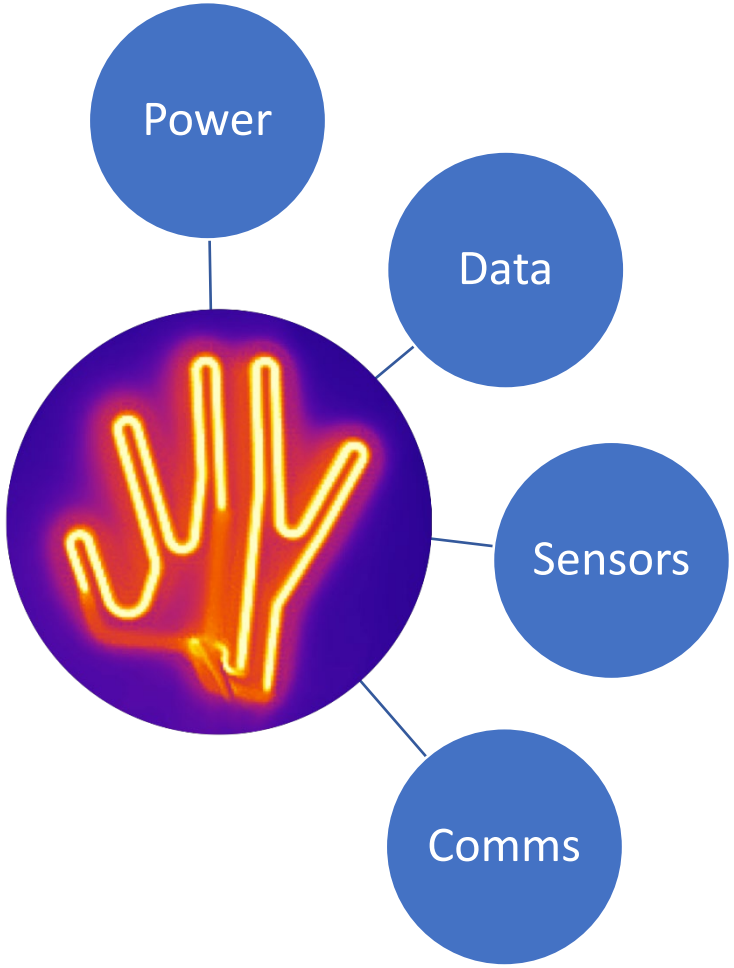
Current technology



- Easy to Assemble
- Higher materials cost
- Lower unit cost
- High Volume

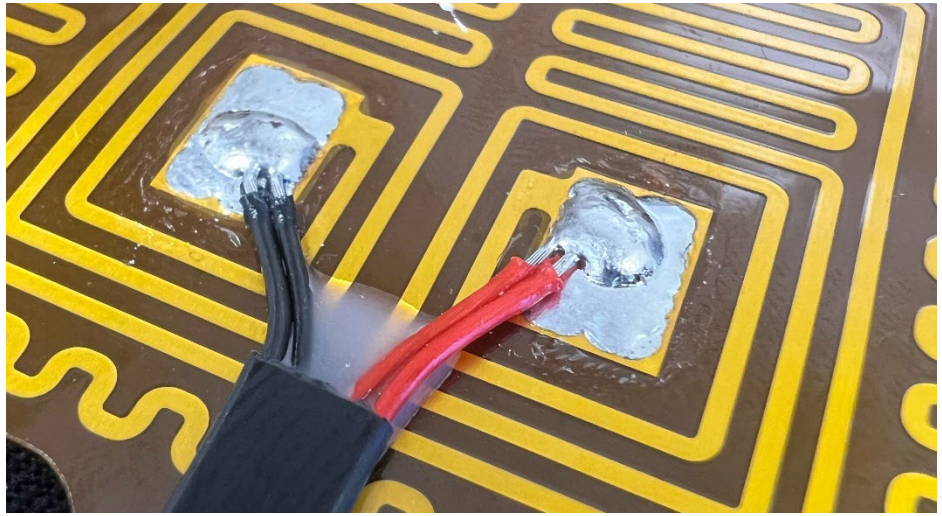
Greg Nevolo | Product Innovation | Oct. 31, 2023

How do you ***connect*** to anything?



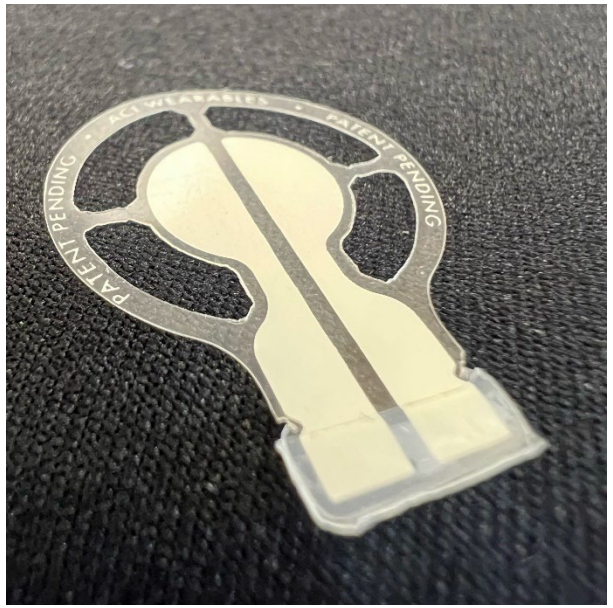
CONNECTIONS ARE PROBLEMATIC

- The single biggest issue for **inks or *fabrics***.
- Rigid to soft interfaces are the failure points.



Do you even solder, bro?

Greg Nevolo | Product Innovation | Oct. 31, 2023



*Hidden **Challenges** in plain sight.*

The hard part wasn't the novel material; it was finding a way to connect to it…

… in a low cost, high volume, easy to assemble method

- **IMHO, Connections are the most challenging component**
- **One Solution:** "Intimate Contact" Connector
- No Solder required - Heat Pressed
- Checked all the boxes for parameters
- 9 months of development across 2 teams
- 17 Steps to manufacture

Key learning: Everyone thought it would be easy. It wasn't. lol.

Greg Nevolo | Product Innovation | Oct. 31, 2023

How do you get ***what you need where***?

Traditional Wiring

Textile Power & Data Cables

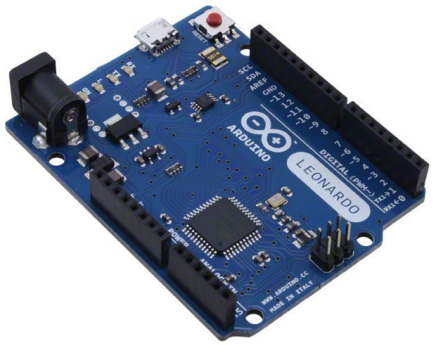
Printed Raceways

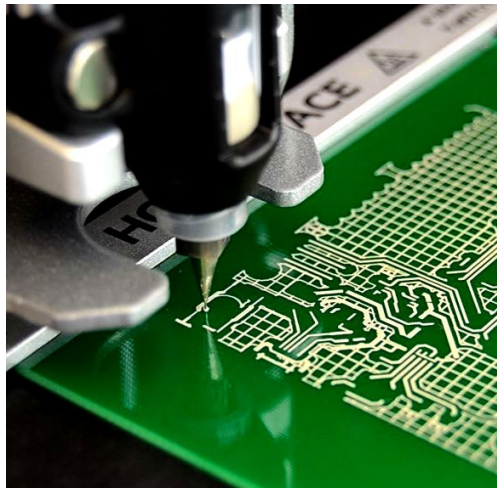
Whether Inks or Fabrics, you need to get ***power and data,*** in & out

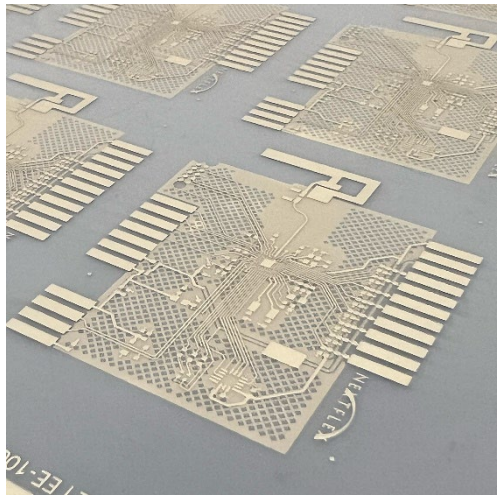
Greg Nevolo | Product Innovation | Oct. 31, 2023

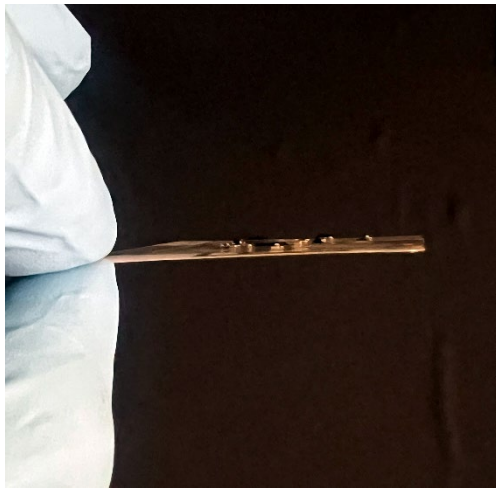
Advanced Textiles EXPO

*How do you **communicate** with your shiny new stuff?*









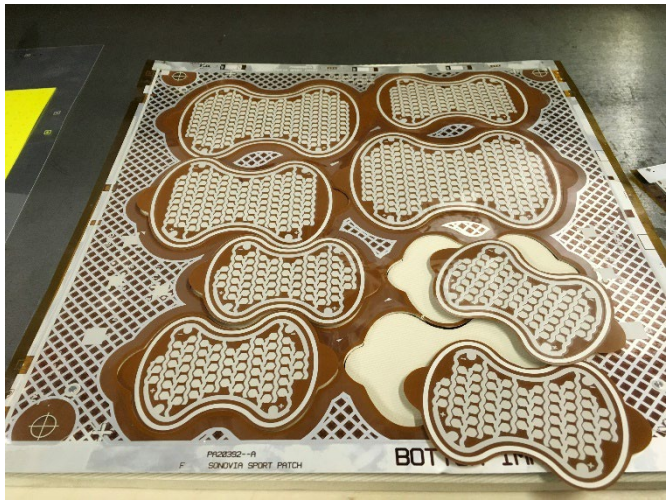
Flexible Hybrid Electronics --> BLE, Power controls, microprocessors
Novel materials + new manufacturing processes are rapidly changing the landscape

- Additive Manufacturing
- Rapid Prototyping
- Roll to Roll, Pick and Place, Reflow Ovens
- Infinite form factors limited only to your **Imagination**

Greg Nevolo | Product Innovation | Oct. 31, 2023

Advanced Textiles EXPO

Integration. How does it get into a product?



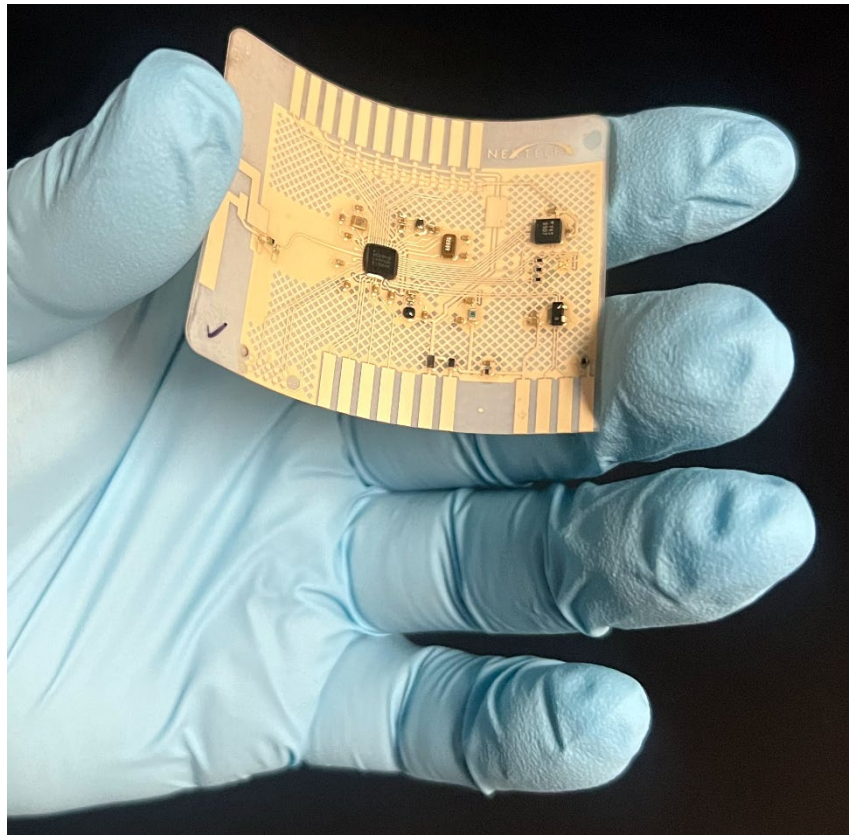
It’s difficult. Full Stop.

- Many moving parts with many suppliers.
- The marriage of all ecosystem components.
- Each step comes with challenges to solve.
- Navigating Asia and other logistics.

Focus on Standardization!

→ Connections, Processes, Materials.

Our Future is here. *Low-Cost High-Volume*



What can you do with:

Inks and Fabrics pushing boundaries
Engineering with the end solution in mind, not just features
Embrace the Challenges
Reimaging connections and substrates
Working with Manufacturers EARLY
Creating new methods of Prototyping & Manufacturing

Unleash your imagination to bring US the products of tomorrow

Greg Nevolo | Product Innovation | Oct. 31, 2023

Advanced Textiles EXPO

Thank you.

Greg Nevolo
Product Innovation Consultant

wearables@acimaterials.com
gn@gregnevolo.com

Big Shout Out to ***Michael LeFebvre @ Duratech*** for the inspiration and imagery

805-845-1763
www.acimaterials.com
44 Castilian Dr., Goleta, CA 93117


Advanced Textiles
EXPO
ORGANIZED BY ATA
See You Next Year
Sept. 24–26, 2024
Anaheim, California

See you next year!

Advanced Textiles EXPO

ORGANIZED BY ATA

Sept. 24–26, 2024 | Anaheim, CA USA