

Woven Electronic Textiles: An Enabling Technology for Health-Care Monitoring in Clothing

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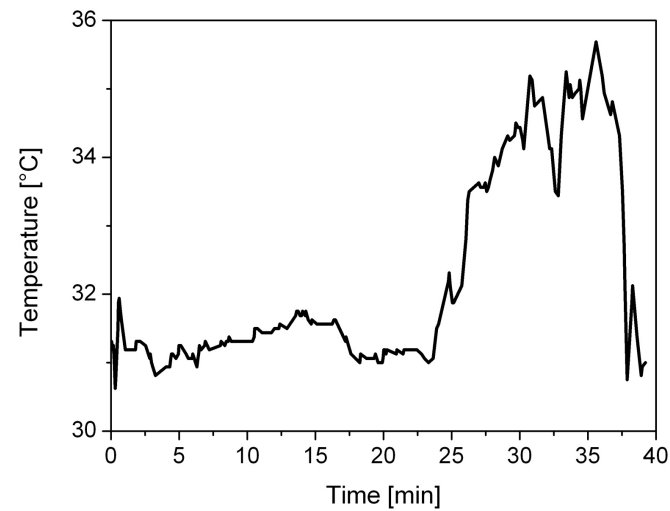




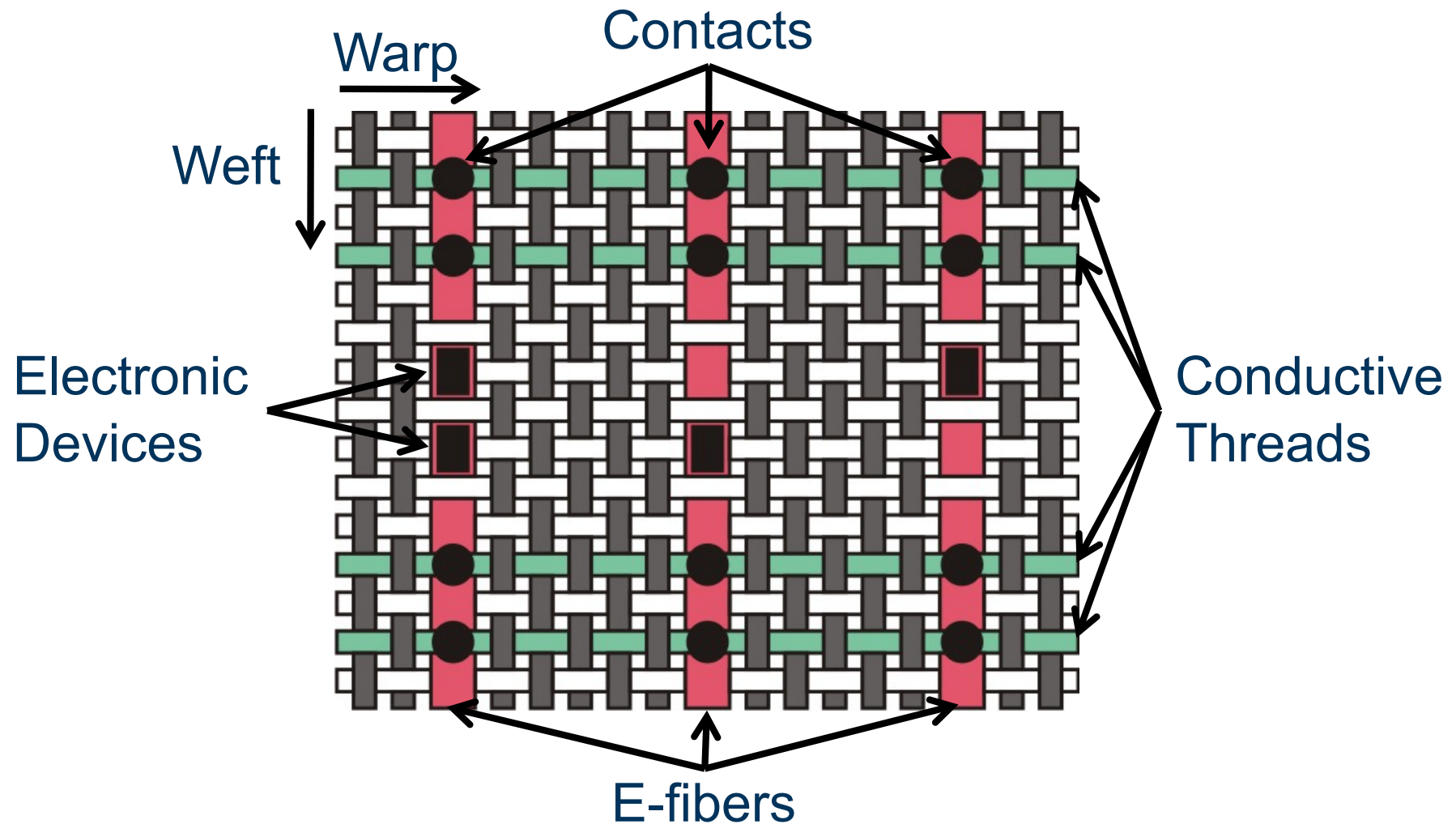
Textile Integration



Case Study



Textile Integration I

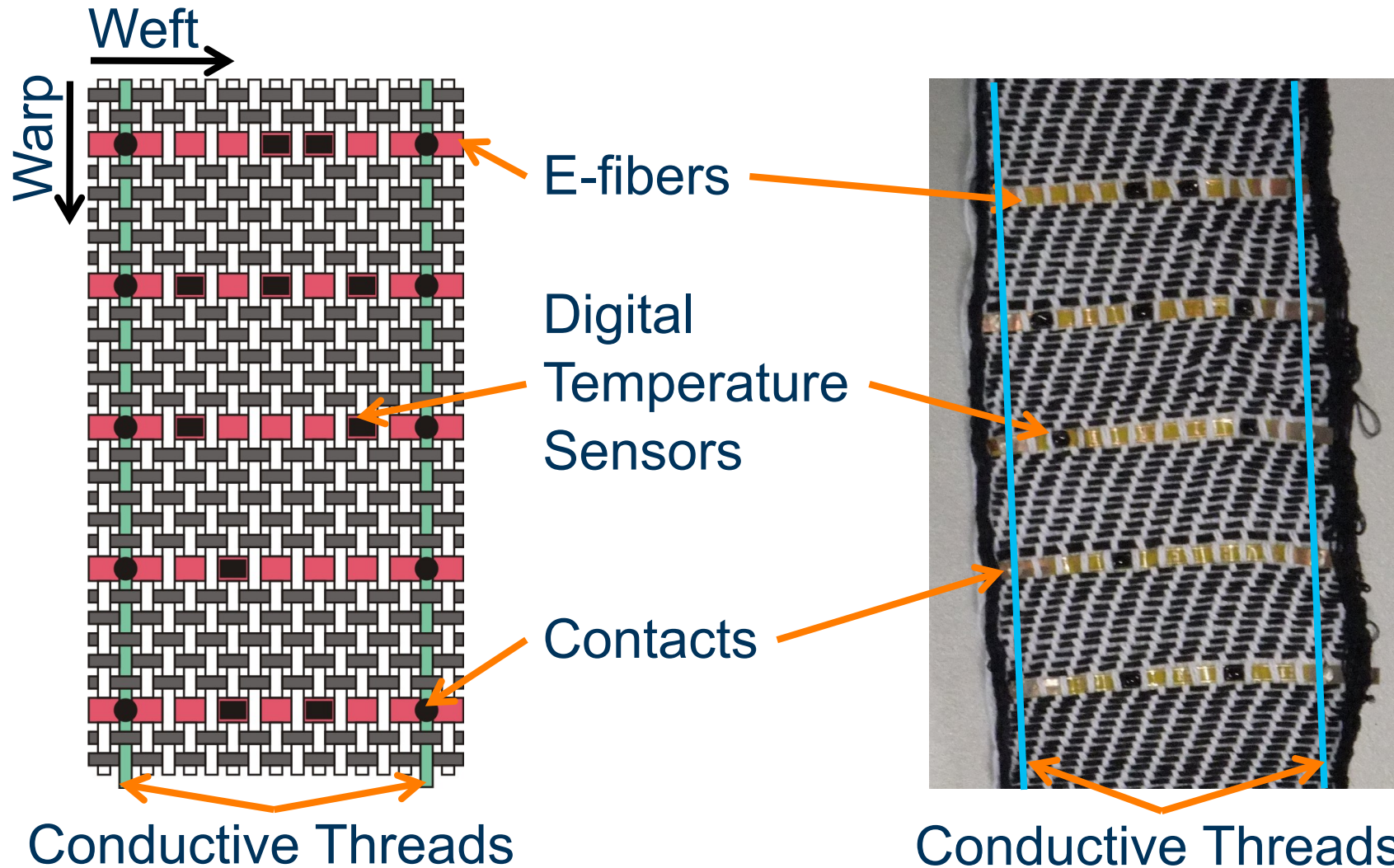


Textile Integration II

- E-fiber fabrication
- Weaving on band weaving machine



Textile Integration III



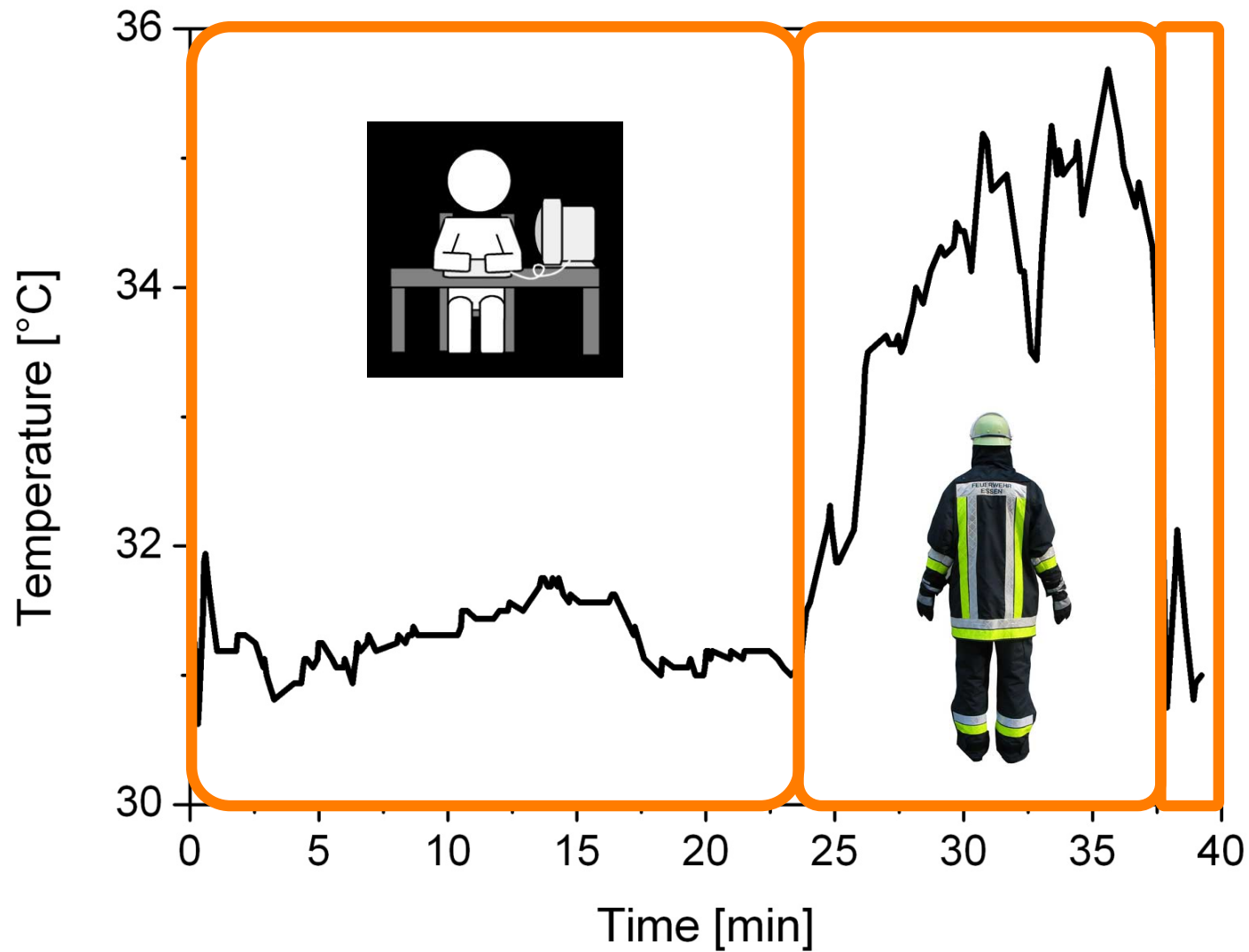
Case Study I

- Measure temperature between skin and clothing layers
- Indicator for heat stress / undercooling

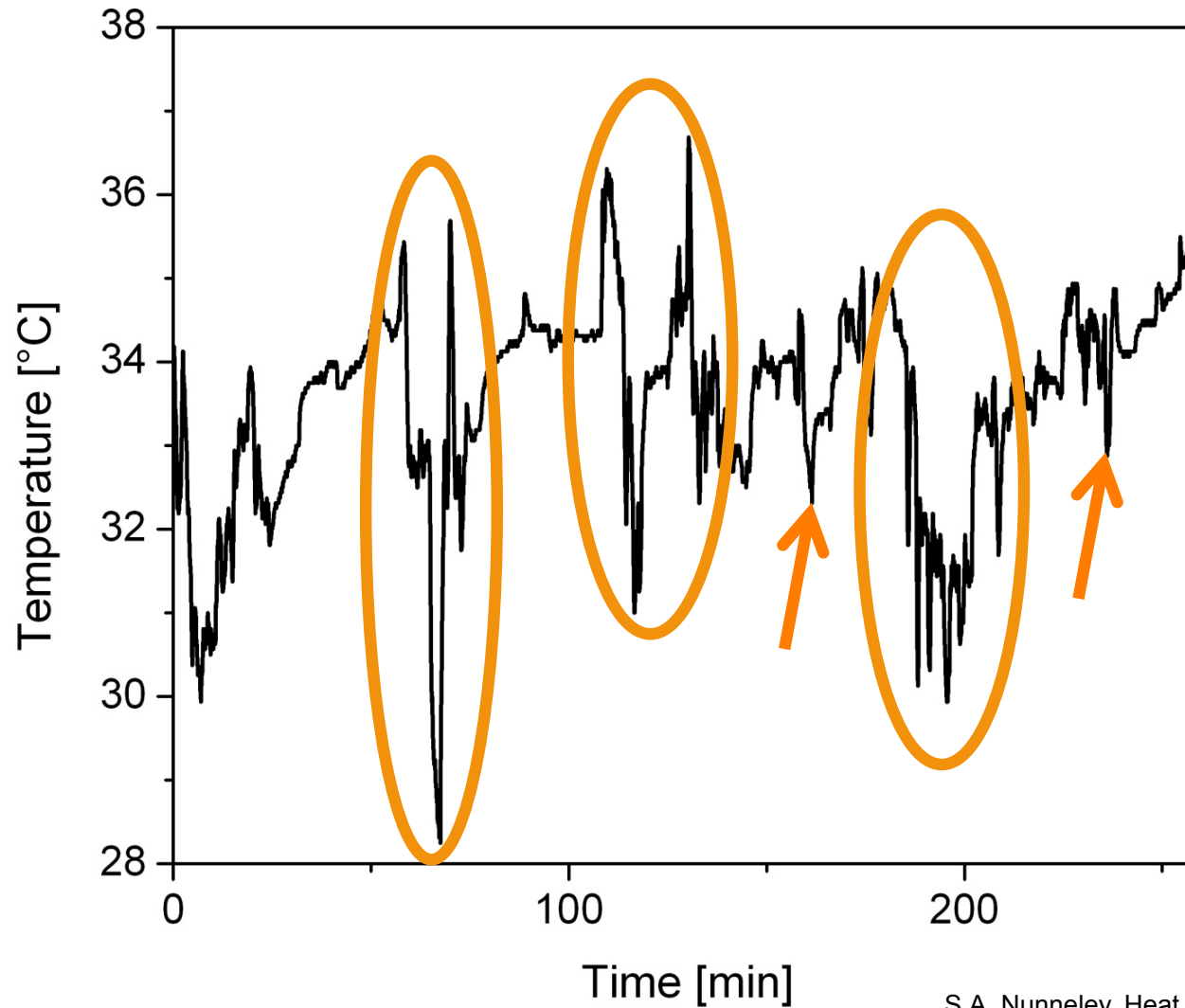


T.M. McLellan and G.A. Selkirk. Heat stress while wearing long pants or shorts under firefighting protective clothing.

Case Study II



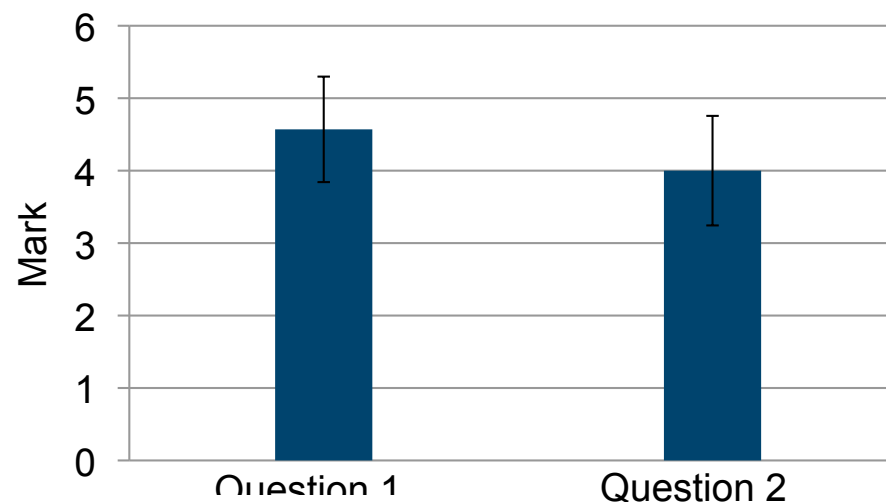
Case Study III



S.A. Nuneley. Heat stress in protective clothing

Case Study IV

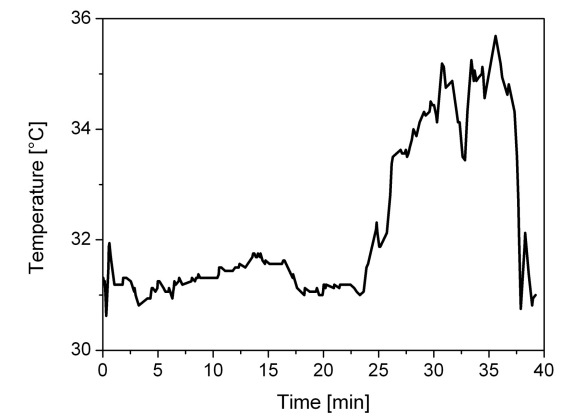
- 7 Subjects (6 male, 1 female, age between 25 and 28)
- Questionnaire
 1. On a scale from 1 to 5: Does the shirt hinder you in your freedom to move? 1 stands for “I cannot move anymore” and 5 “I can move as freely as with normal clothing”
 2. On a scale from 1 to 5: Does the shirt feel uncomfortable? 1 stands for “it feels totally uncomfortable” and 5 “I do not feel any discomfort”



Conclusion

- Textile Integration
 - Fabrication process
 - Textile integrated digital temperature sensors

- Case Study
 - Measure temperature between skin and clothing layers
 - Response to heat retaining jacket
 - Long term measurement



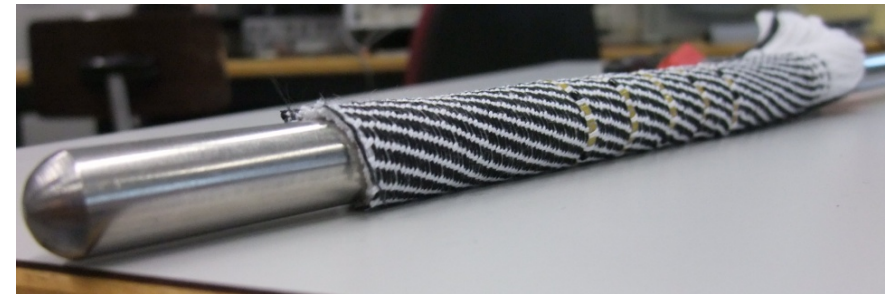
Discussion

- Large scale fabrication
- Smart skin communicating with cell-phone
- Other sensor modalities

Textile Flexibility

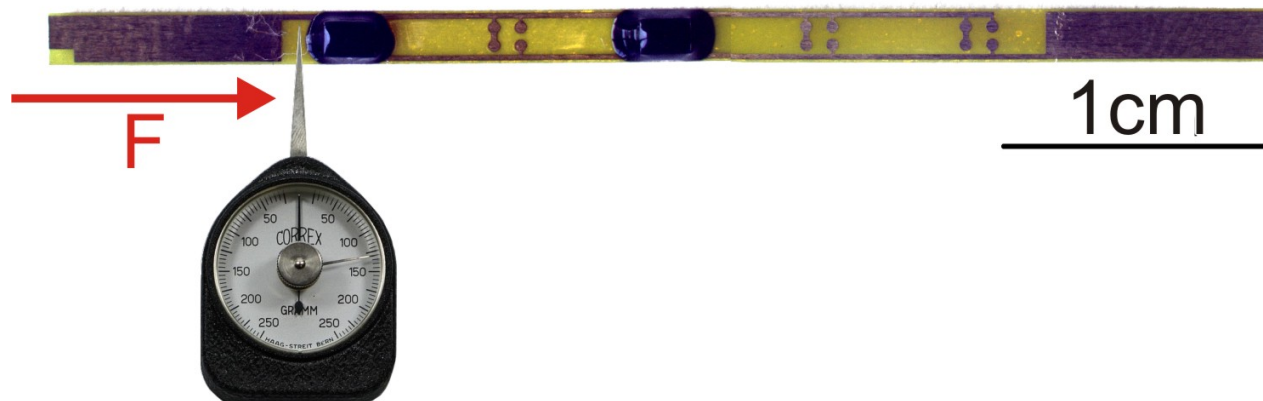
- Textile bending
 - Minimal bending radius of at least 0.75 mm
 - Folding the textile can cause errors

- Drapability decreased by 30 % due to integrated electronics



Mechanical Stability

- Contacts and attached temperature sensors withstand shear forces of at least 20 N
- A single fingertip exerts shear forces of around 8 N



S.J. Lederman and M.M. Taylor. Fingertip force, surface geometry, and the perception of roughness by active touch