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Advanced Textiles

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# A 3D Scanning Approach to Understanding Clothing Microclimate and Thermal Comfort in Winter Wear

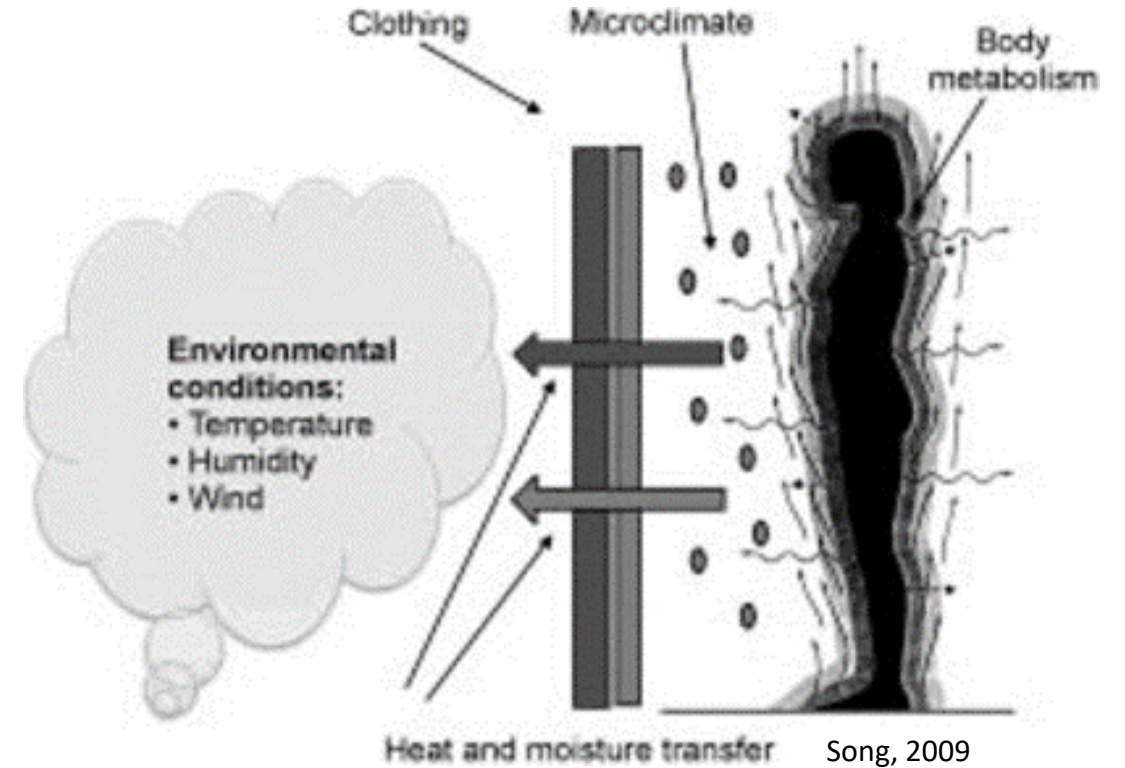
Dr. Marika Walker and Ike Dosch



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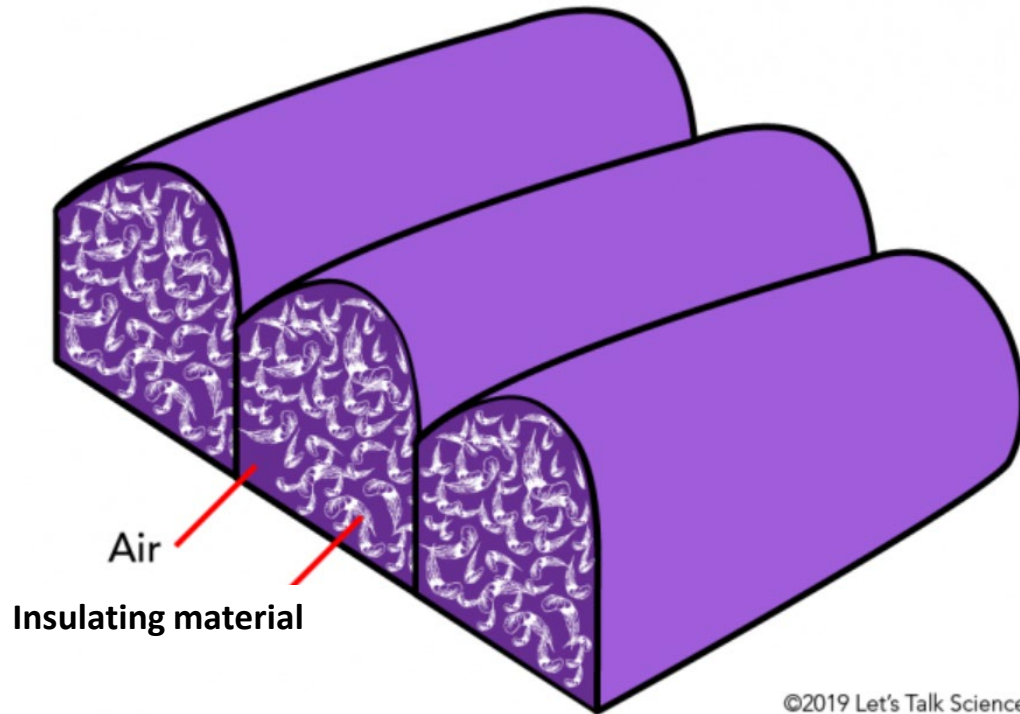
# Clothing Microclimate

- The area between the innermost layer of clothing and the skin.
- Microclimate temperature, humidity, and volume impact thermal comfort
- Static air layers contribute to increased insulation



# Typical Winter Wear Design

- Utilizes trapped still air to increase insulation while minimizing material (and added weight)



# Volume of Material



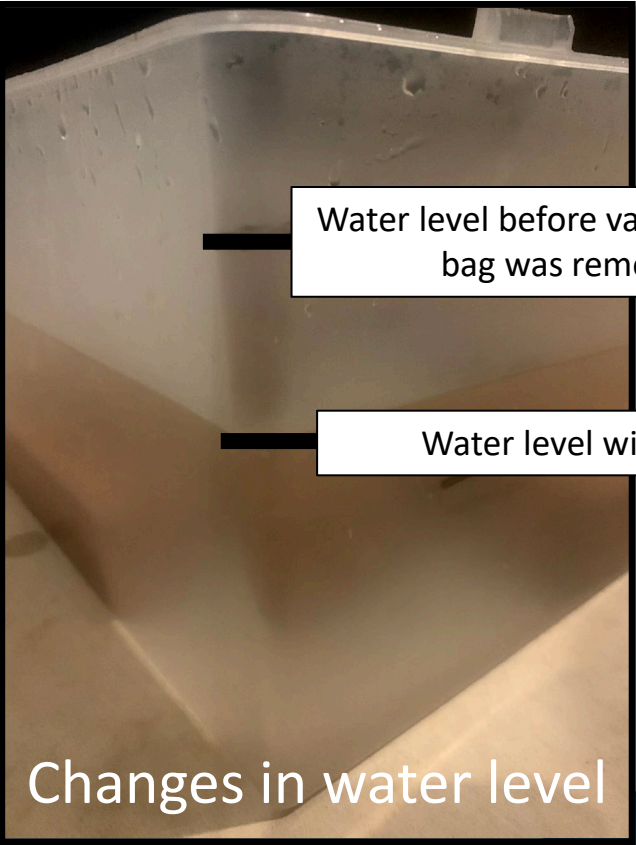
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# Volume of Material

Material = 462 cubic inches



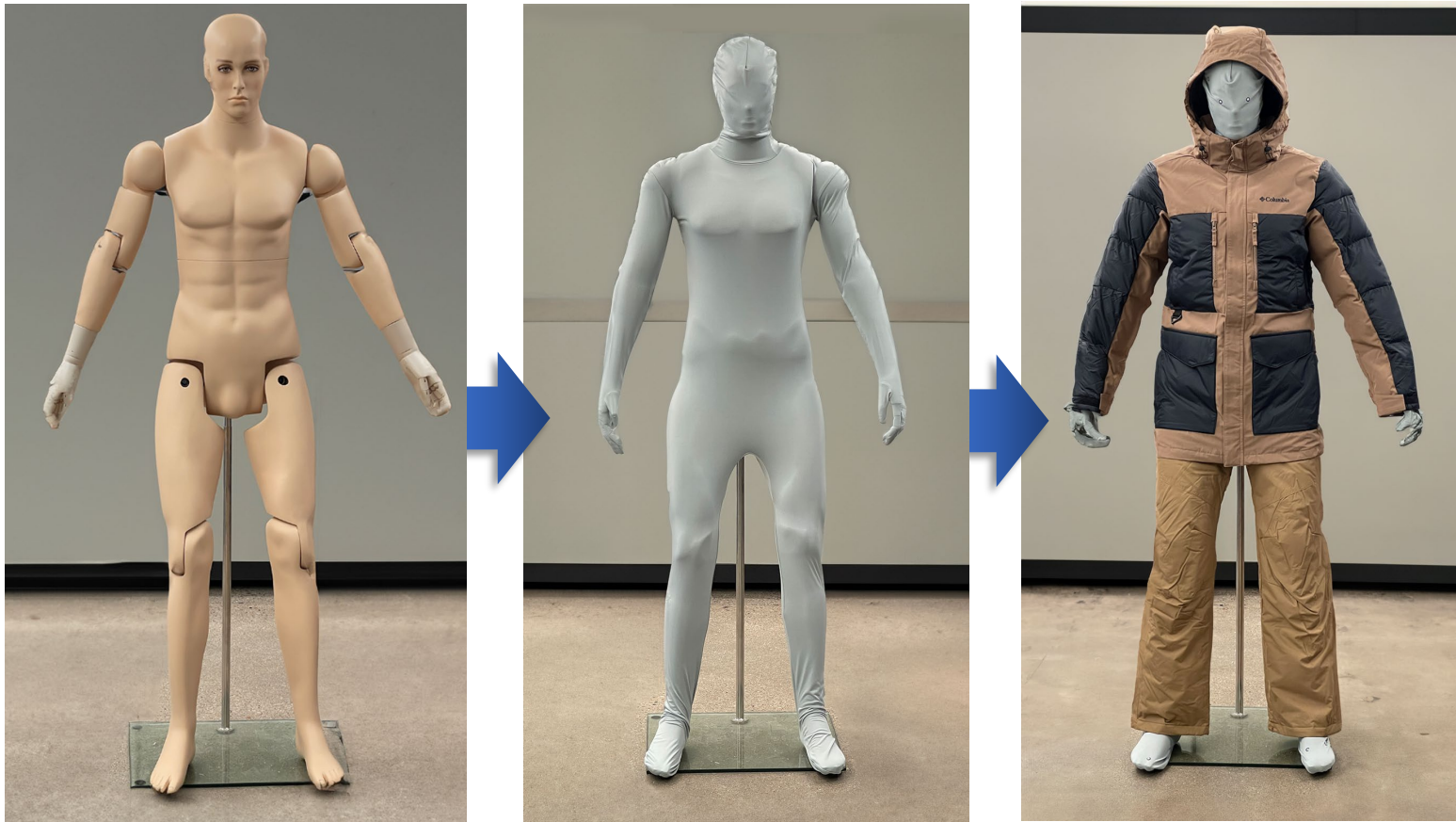
# Structured Light 3D Scanning

- Non-Contact Measurement
- High Accuracy
- Fast
- Simple
- Safe



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# Using 3D Scanning with Winter Wear



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# Using 3D Scanning with Winter Wear

## LIVE DEMONSTRATION

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4746.9 cubic inches

8238.5 cubic inches

3622.5 cubic inches

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# Surface to Surface Analysis

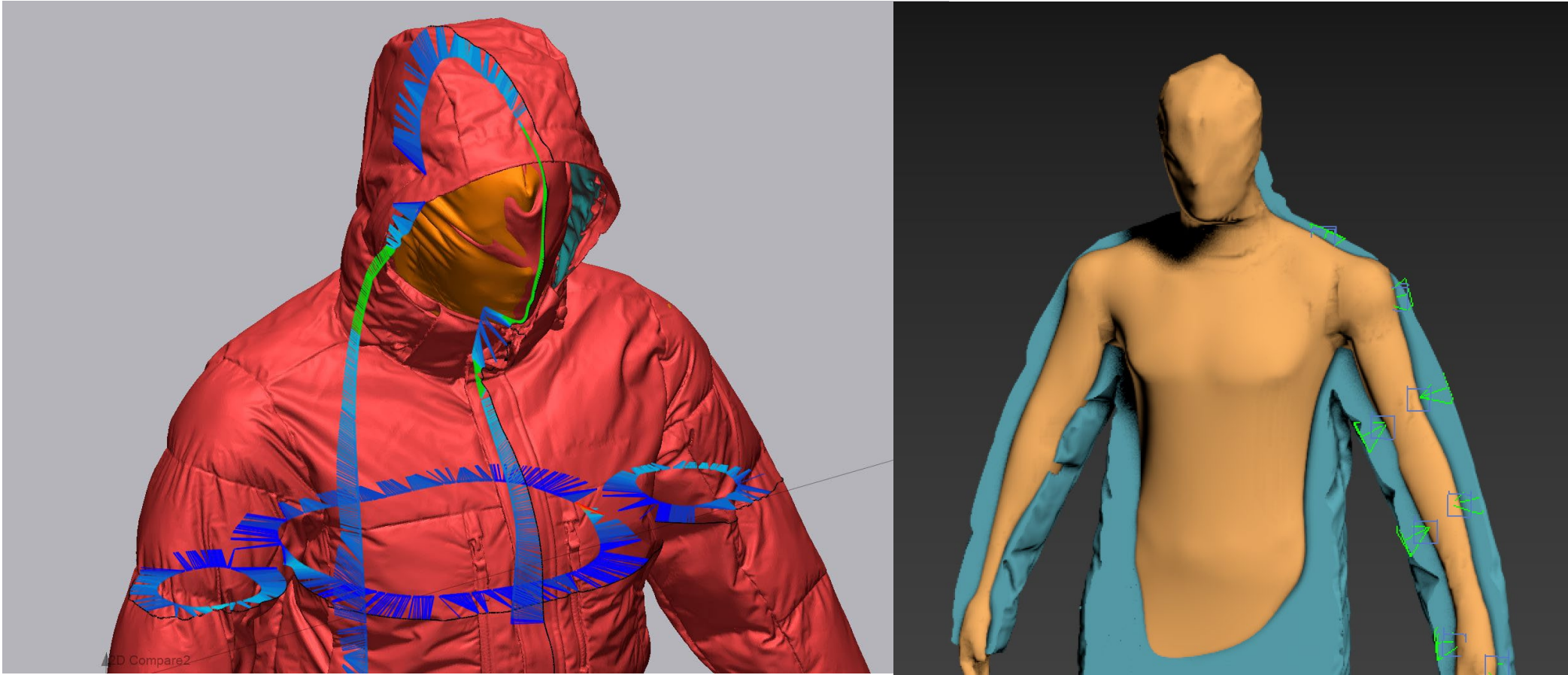


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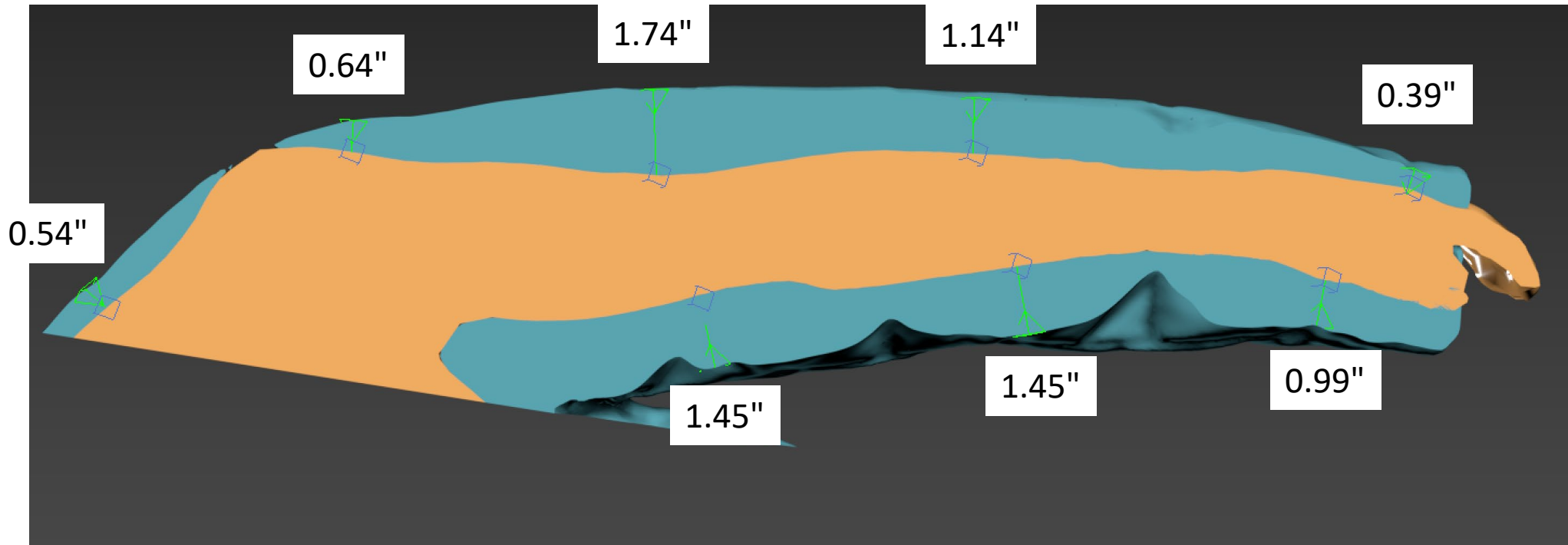


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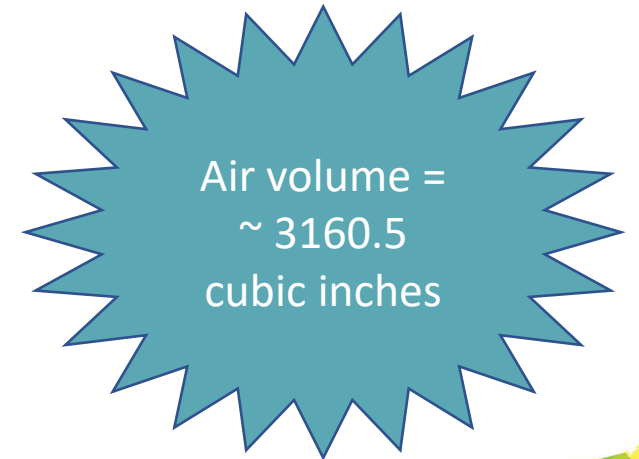


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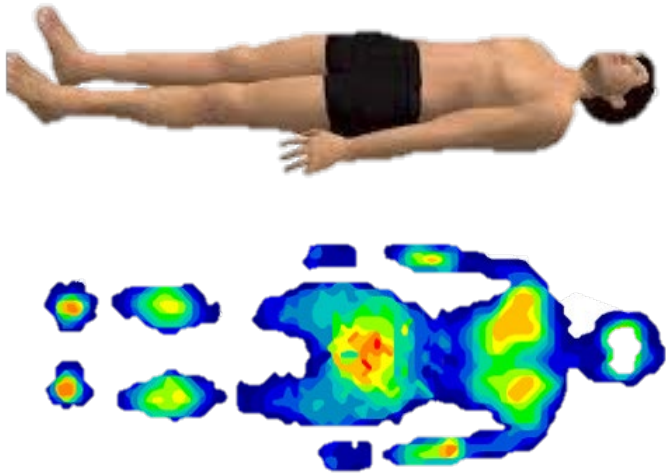
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# Microclimate volume



# Applications in relation to body position



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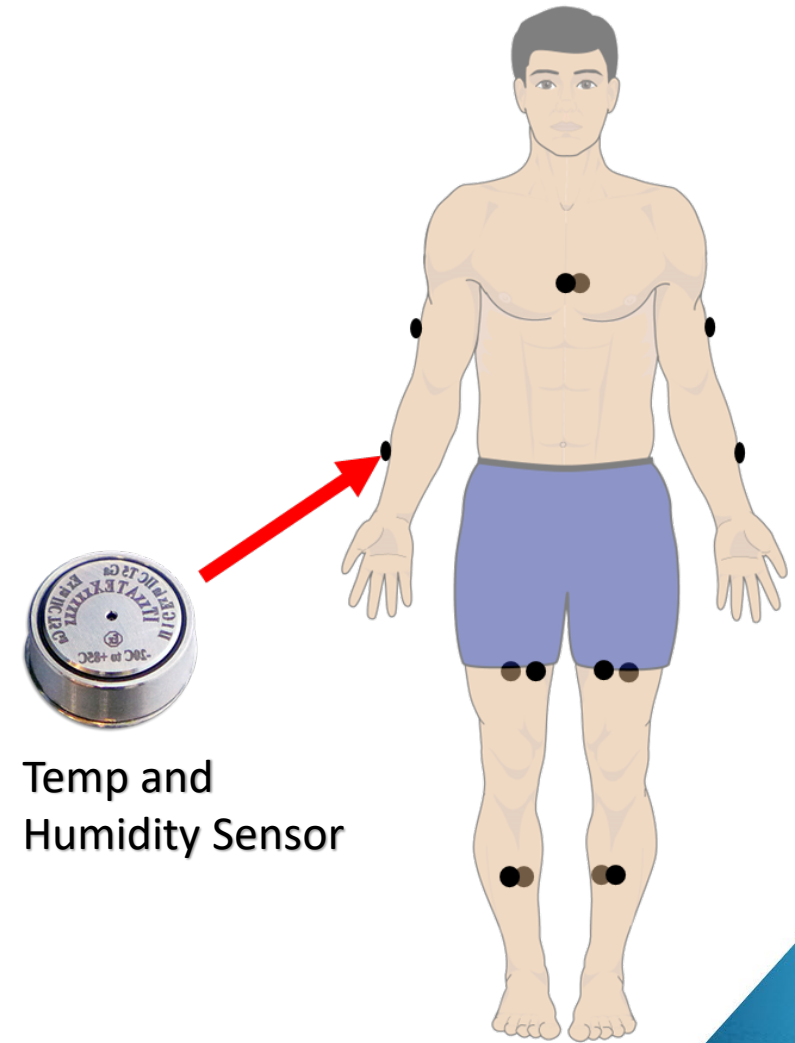
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# Limitations of this Method

- Only able to estimate where air vs insulative material is located
  - Insulation can move throughout the garment
  - Thickness measurements will vary
  - Volume of the clothing vs air is an estimate
- The alignment of the models within the garment may not be exact
  - Accuracy of the scanner: 0.03mm
  - Resolution of the meshes: 2-4mm



# Future research



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# Questions?



Marika Walker, PhD



Ike Dosch

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*Anaheim, California*

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