ASB40

founded 1977

Raleigh, NC • NCState
August 2-5, 2016

Quantifying Human Augmentation

State-of-the-Art & Future Challenges





Human augmentation: an exciting few years

Human augmentation: an exciting few years

ReWalk

2014

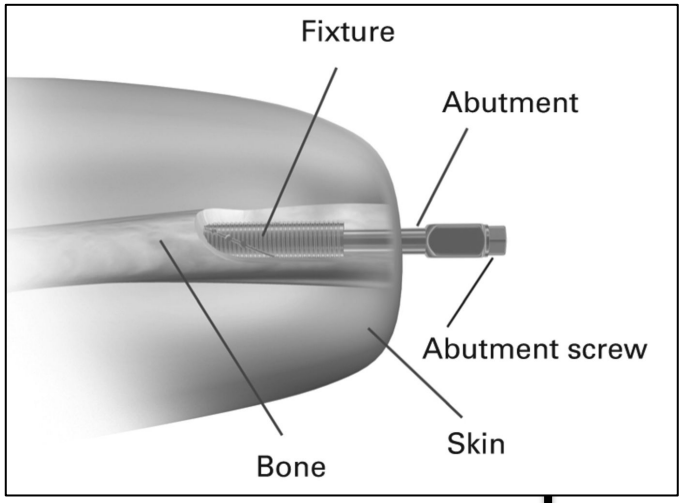
2015

2016

DEKA

Human augmentation: an exciting few years

ReWalk



Osseointegration

2014

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Human augmentation: an exciting few years

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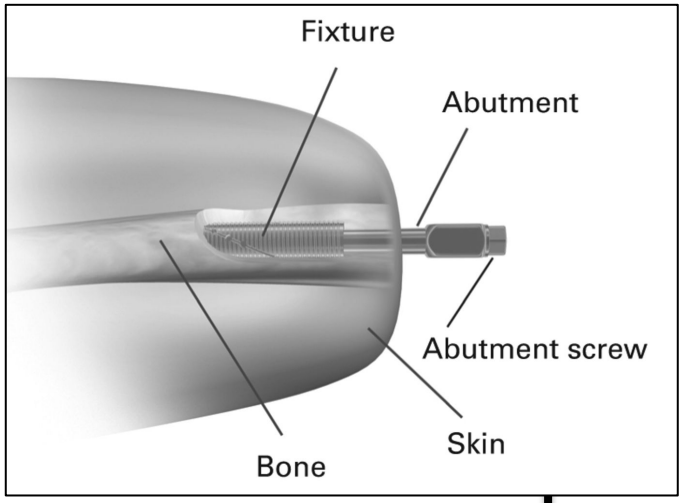


Osseointegration

Parker Indego

2014

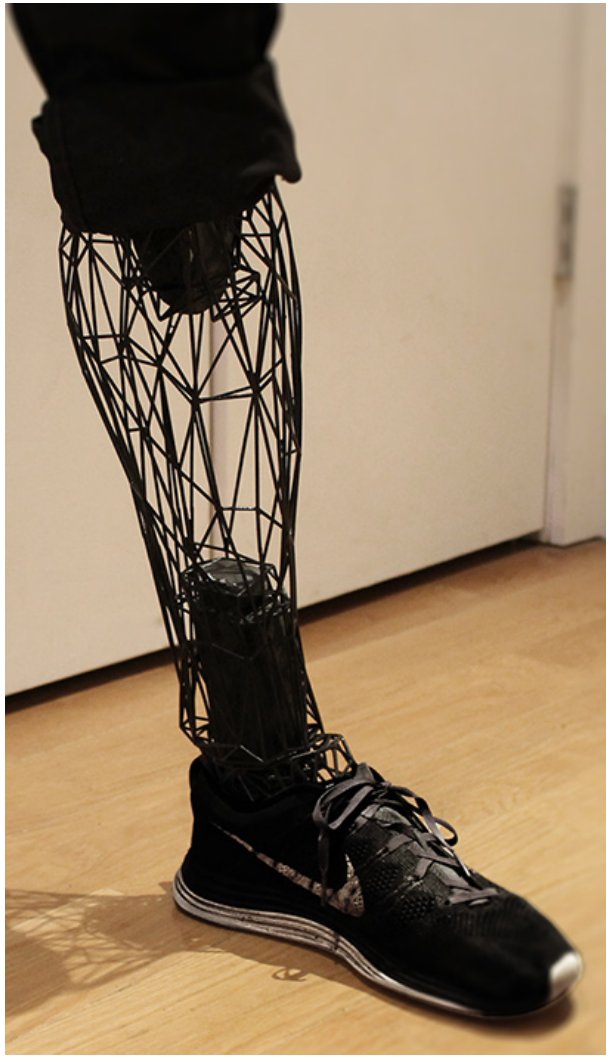
2015

2016

DEKA

Ekso GT

New fabrication methods & compliant mechanisms



Exoskeletons: $68 million worth sold in 2014

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x 40% CAGR

(compounded annual growth rate)

ABI Research Report 2015

Exoskeletons: $1.8 billion projected for 2025

2014

2025

ABI Research Report 2015

What does this mean for biomechanics community?

2014

2025

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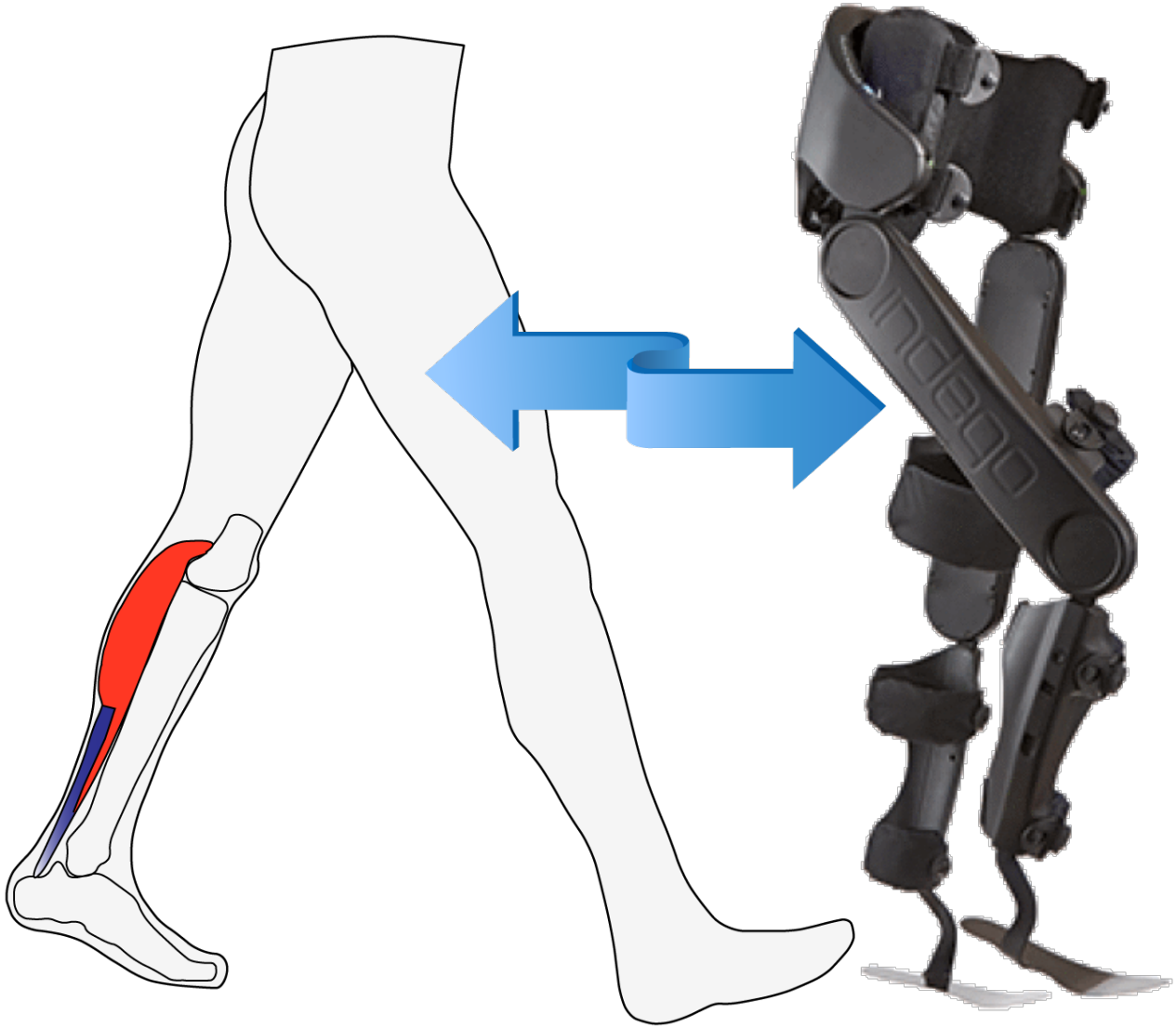

How do we quantify human augmentation?

Device Performance

Utility: verification, system identification

Metrics: torque, power, bandwidth

Knowledge: excellent

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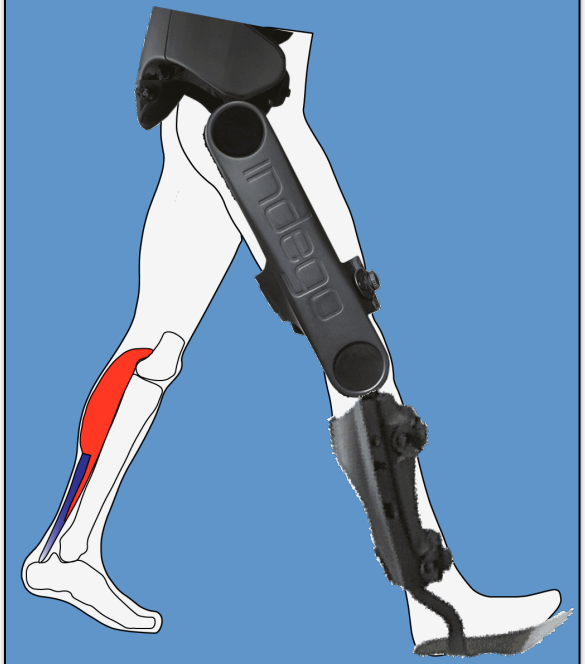
Human-Device Performance



Utility: validation, prescription, advertising

Metrics: metabolic cost, functional outcomes

Knowledge: good

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Device Performance

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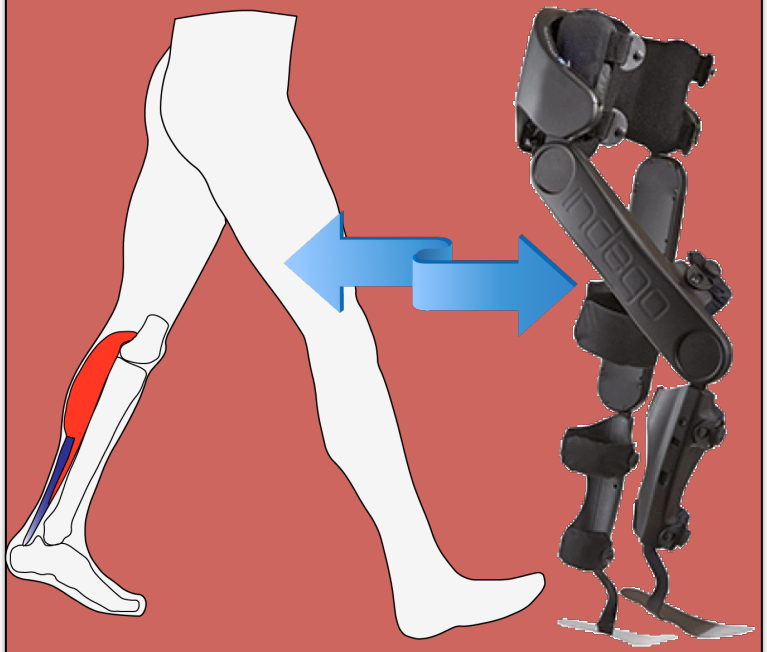
Human-Device Interaction

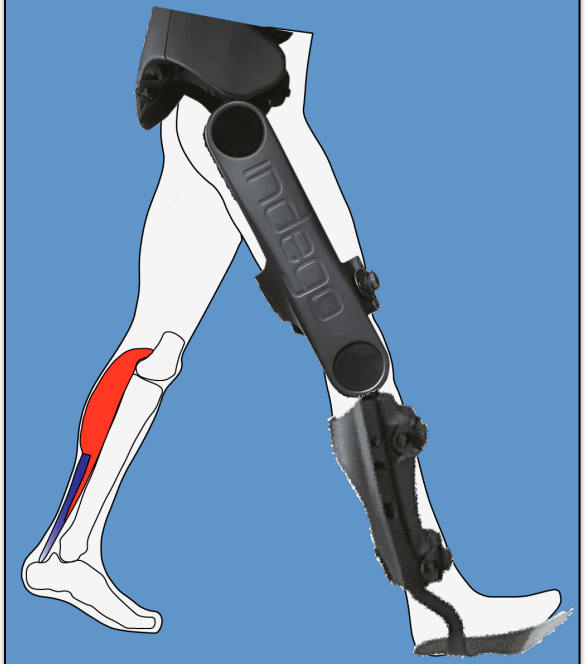


Utility: inform science, device design & control

Metrics: relative motion & power contributions, adaptation

Knowledge: lacking

Human-Device Performance



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1. Quantifying contribution of non-biomimetic technologies

Steven Stanhope
(Delaware)

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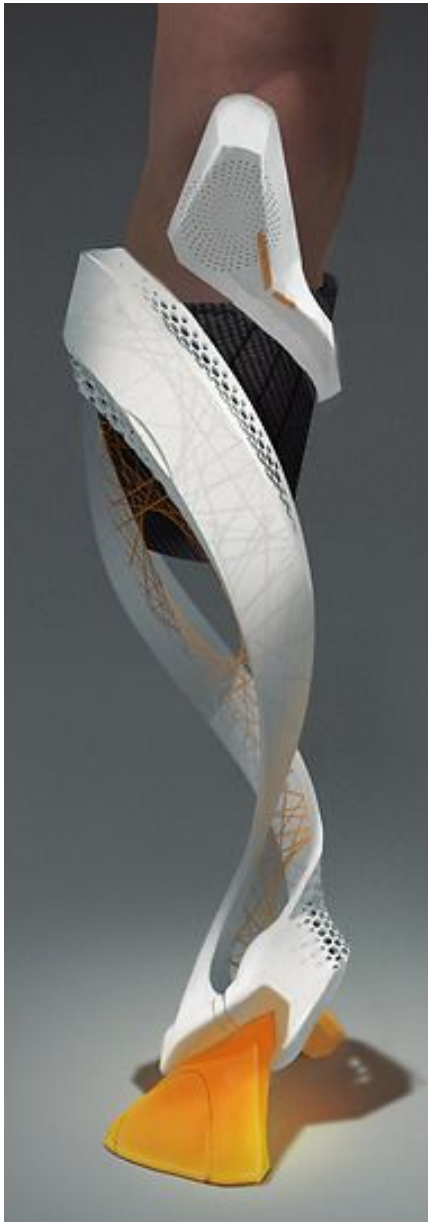
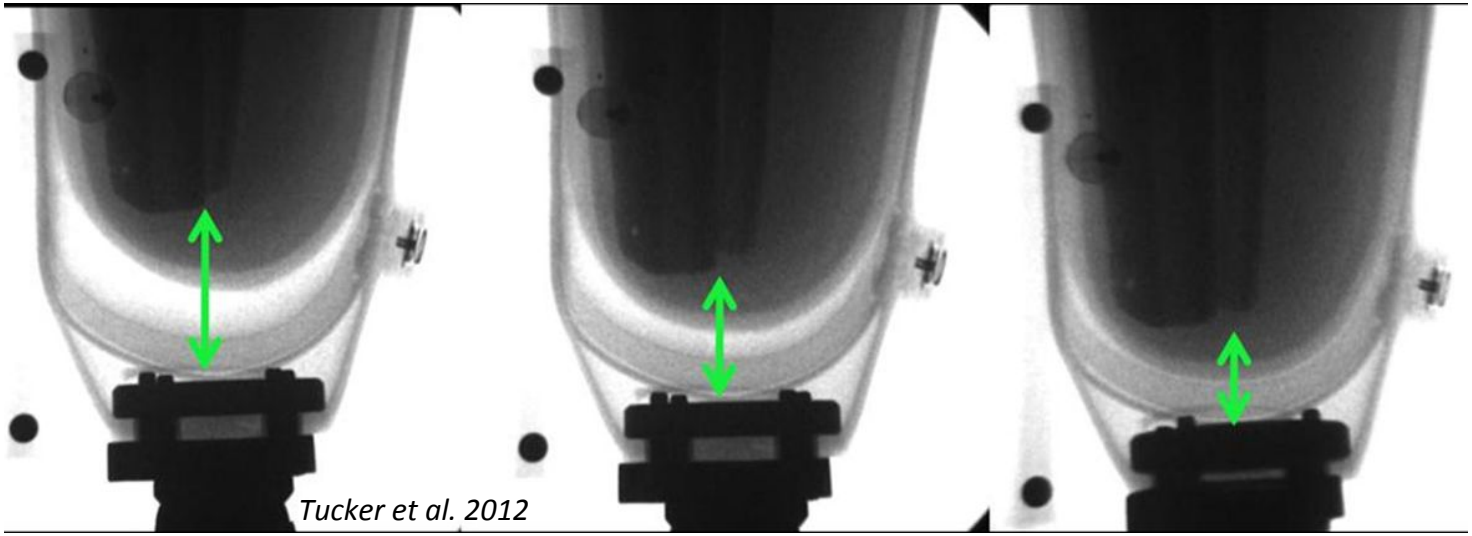


Steven Stanhope
(Delaware)

2. Quantifying motion between device & human

and implications for motor control

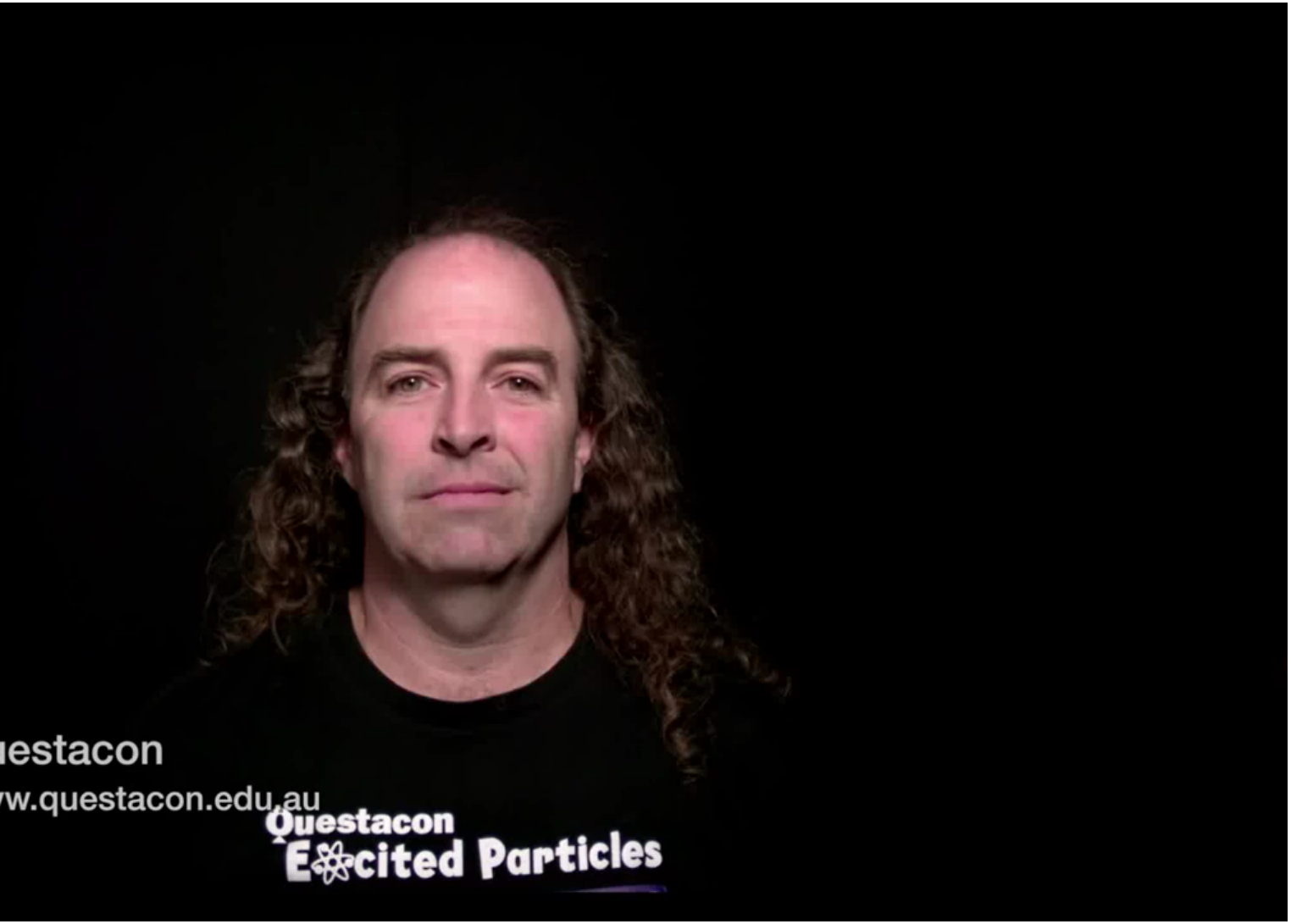


prosthetic socket pistoning

Lee Childers
(Georgia Tech)

8 Minutes

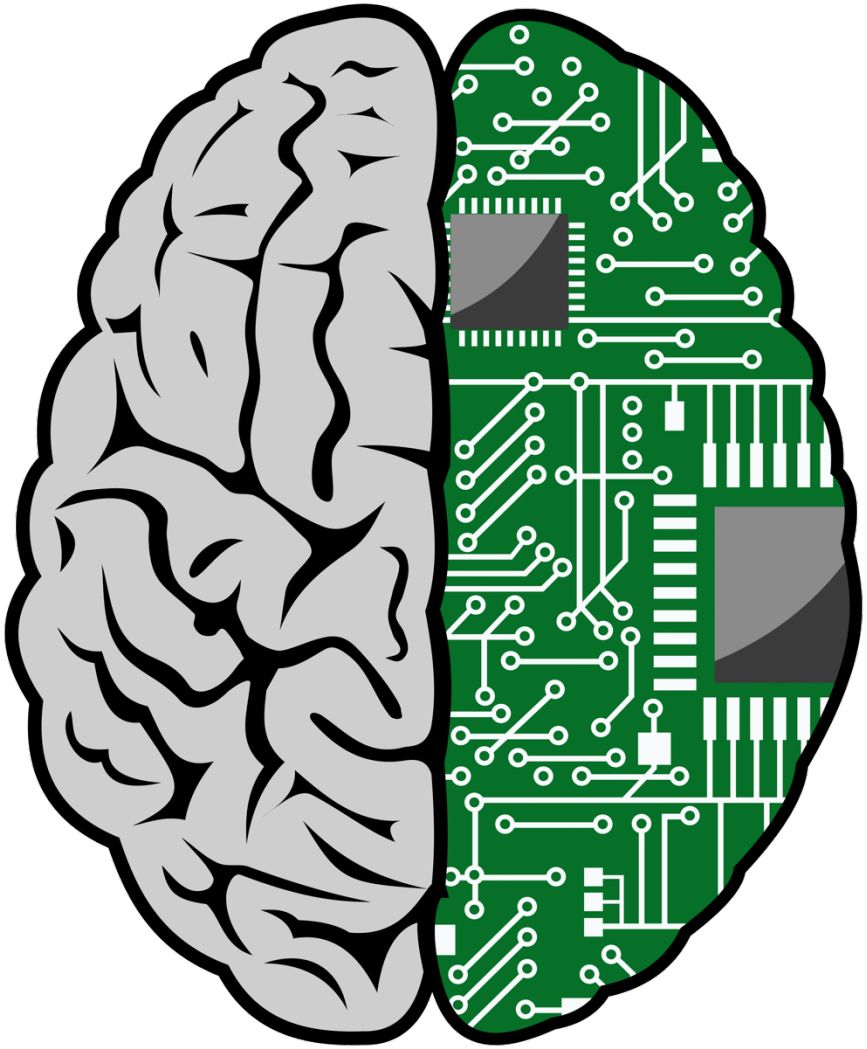
3. Quantifying power transfer between device & human



Karl Zelik
(Vanderbilt)

4. Adaptive control of devices & controller errors

and implications for quantifying performance



Helen Huang
(NC State)

15 Minutes

5. Learning to use novel robotic devices

and implications for quantifying performance

Daniel Ferris
(Michigan)

15 Minutes

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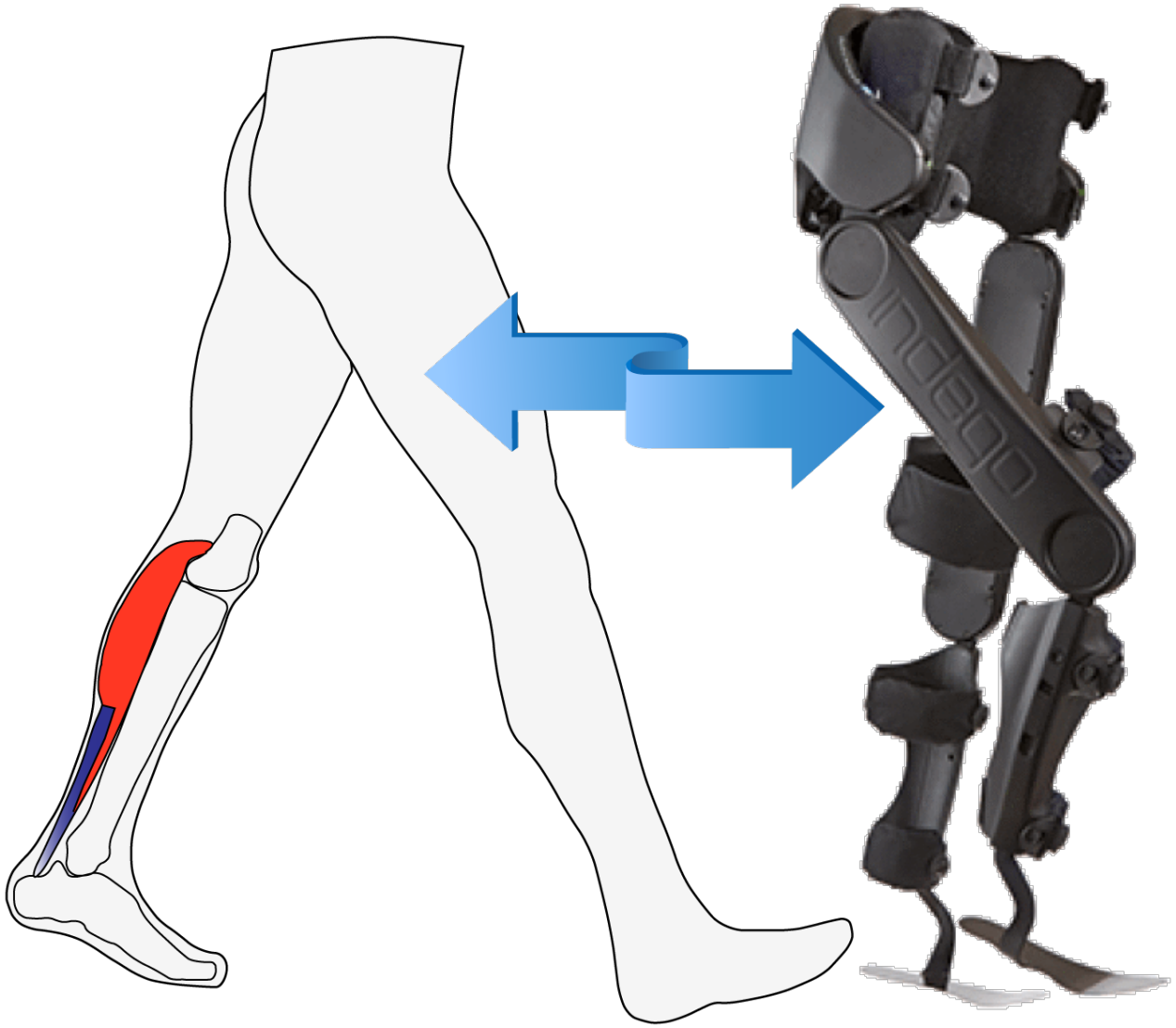
and implications for quantifying performance

Daniel Ferris
(Michigan)

15 Minutes

6. Group Discussion on Quantifying Human Augmentation

state-of-the-art & future challenges



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