





# ISSUES OF HUMAN INTERFACE DESIGN

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# Disclosures

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# Question???



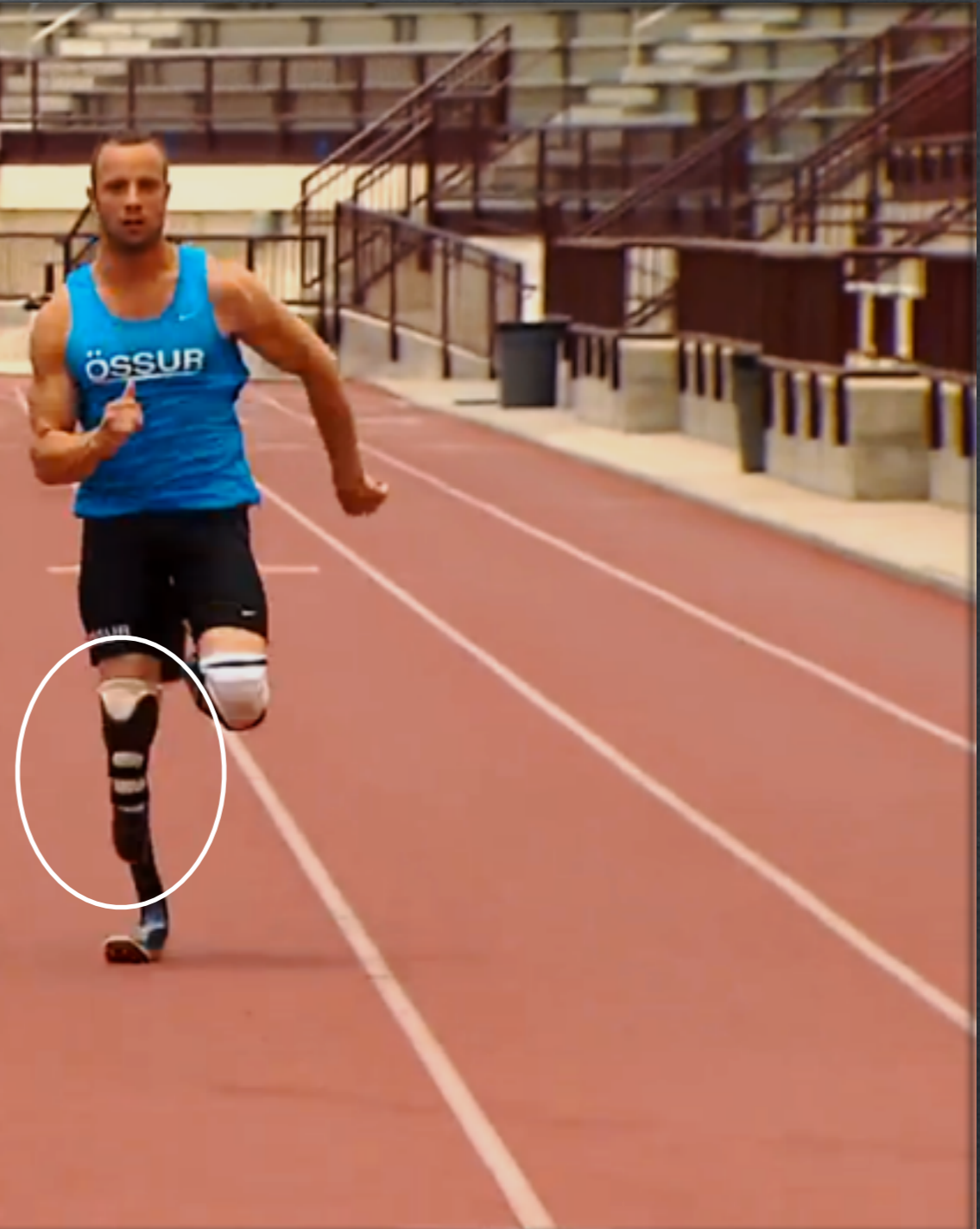
**THE BIGGEST PROBLEM WITH HUMAN INTERFACE  
DESIGN IS: HUMANS**







**A prosthesis must fit intimately enough to comfortably support the limb during high loading, not bother the soft tissues or bone and transfer motion from the human to the device with extreme efficiency... and stay in place!**











WHERE DOES THE  
PRESSURE GO????



**We start with the person,  
their goals and their  
limitations.**















Given that everyone is different, are there some generalizations that can be made???





AND.... HOW DO WE INSURE THE  
LONG TERM SUCCESS FOR THE  
PEOPLE WE ARE SUPPOSED TO HELP?



# “MOMENTS OF TRUTH” IN INTERFACE HUMAN DESIGN

- ✿ What is a “Moment of Truth”?
- ✿ Independent but significant and often overlapping considerations for any device (or experience) that will interface with a person.
- ✿ Failure at any one could destroy the long term success



# FIVE C'S

- Comfort
- Cosmesis
- funCtion
- Cost
- Cool



# COMFORT

UN-  
\* What makes something comfortable?



# COMFORT

- ✻ Transference of pressure
- ✻ No “noxious” stimuli (noise, vibration etc)
- ✻ Heat
- ✻ Nuisance factor
- ✻ Weight
- ✻ Sensitivity of skin or nerve















# COMFORT IS ILLUSIVE

- ✻ What may be “comfortable” one minute may not be the next.....



# COSMESIS

☼ What is cosmetic?







# COSMESIS

- ✻ How do we perceive ourselves?
- ✻ How do changes to our body affect our perception of cosmesis?















# FUNCTION

- ✻ Is it a device that reliably does what it is intended to do?







# FUNCTION

✻ Is there a device that can do everything?









SAN JOSE  
**FIRE**  
DEPARTMENT





BIONIC













COOL



# WE HAVE A PROBLEM WITH TECHNOLOGY

- We always want something new, often without formal training and **WITHOUT QUANTIFIABLE BENEFIT** and on some occasions, causing harm.



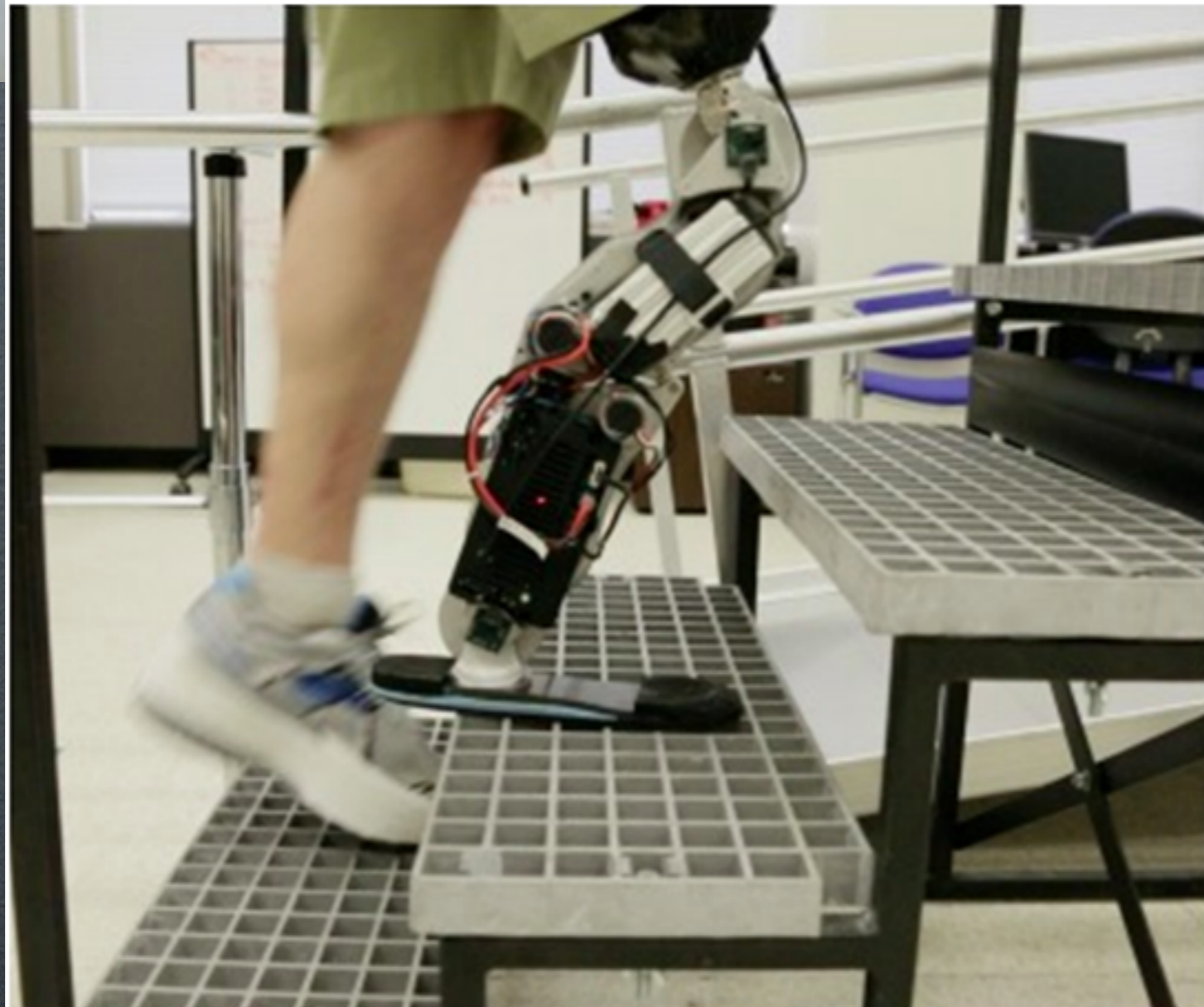
According to Stryker, the wide variety of component lengths and sizes were intended to provide surgeons more options to achieve a better fit in their patients. The neck is made of cobalt chromium and the stem is made of Stryker's proprietary titanium alloy blend designed to resist corrosion and fretting.

Just two months before the recall, Stryker issued an Urgent Field Safety Notice that warned doctors and hospitals that these two implants had an increased rate of Adverse Local Tissue Reactions (ALTRs). ALTRs are complications arising from inflammation in the tissues surrounding the implant because of metal debris released when they components rub together. These ALTRs usually end in painful and complex revision surgeries. Because stems are imbedded in the femur, they are more difficult to remove and can increase the rate of femur fracture.

The metal liner, which created a metal-on-metal junction when it was used, was marketed as durable and wear-resistant. However, in the recall, Smith & Nephew said the metal liner had not performed as well as the company had expected.

DePuy's ASR acetabular implant was replaced or removed 29 percent of the time after just six years. This was compared with an overall 9.5 percent failure rate for all-metal hip implants. In January 2013, the jury in the first ASR trial heard evidence that, at the time of the recall, DePuy knew that within five years, 40 percent of its ASR implants would fail.





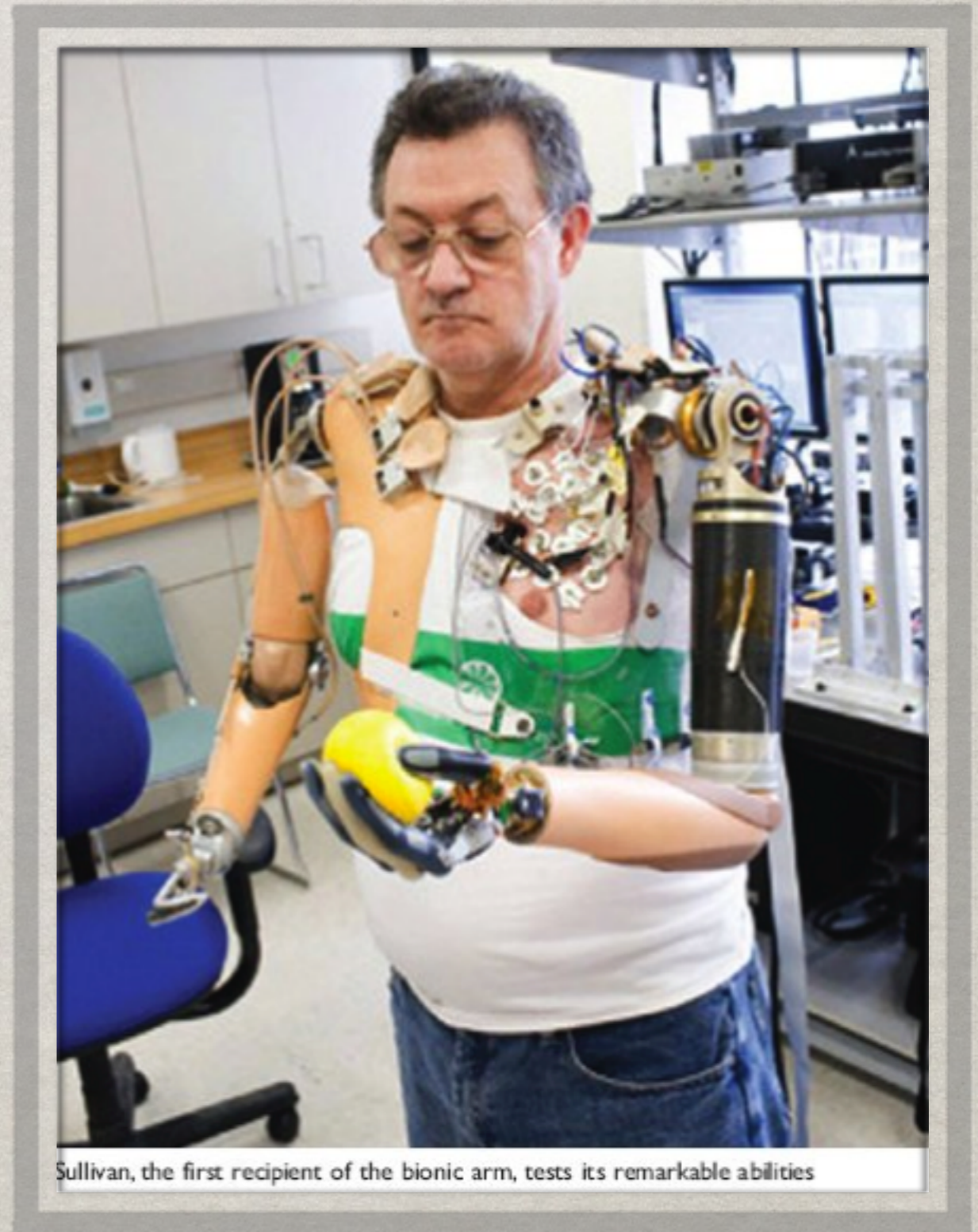




COST



27 degrees of  
freedom arm  
controlled by re-  
innervated muscle  
groups



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THE PERFECT  
DEVICE IS ONE  
THAT  
BALANCES ALL  
OF THE ABOVE  
FOR THAT  
INDIVIDUAL







USING THE “C’S”



# THERE IS A 6TH 'C'

- CHANGE
  - Psychological change
  - Physical change
    - Yearly
    - Monthly
    - Daily
    - Hourly



# WHAT GOES IN TO PROVISION OF A PROSTHESIS??

AKA: What does Gary  
do when not hanging  
out with us!



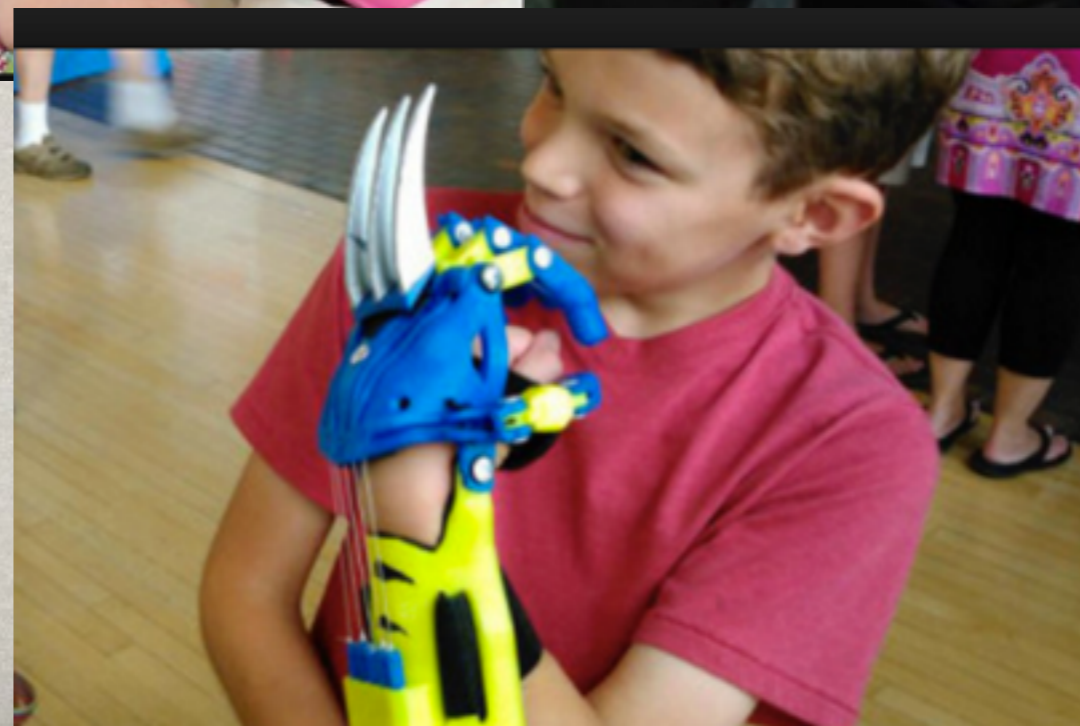


# 3D PRINTING AND THE 5-C's



☀ Cost

☀ Cool





# 3D PRINTING AND PROSTHETICS

CIRP 25th Design Conference Innovative Product Creation

Additive Manufacturing of Custom Orthoses and Prostheses – A Review

Yu-an Jin<sup>a,b,\*</sup>, Jeff Plott<sup>a</sup>, Roland Chen<sup>a</sup>, Jeffrey Wensman<sup>c</sup>, Albert Shih<sup>a,d</sup>

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- ✻ The study concludes that there are clinical, financial and technological barriers to full scale implementation of AM in a service system for custom Orthotics and Prosthetics.



# TAKE HOME

- Critically evaluate what we do and why.
- We must focus on solving problems, not just creating new devices or techniques that are equal to existing.
- Narrow your goals
- A prosthesis is not just a series of parts
- Just because you have a hammer, doesn't mean everything is a nail









THANK YOU