CRICOS PROVIDER 00123M

“Brain to behaviour” change: machine human interfaces and augmented reality technologies

Anna Ma-Wyatt
School of Psychology

Human Factors

- Fitting the machine to the human
- Fitting the human to the system
- Human system integration

Human machine interfaces

- Human in the loop
- Human on the loop

Human machine interfaces

- Human in the loop
- Human on the loop

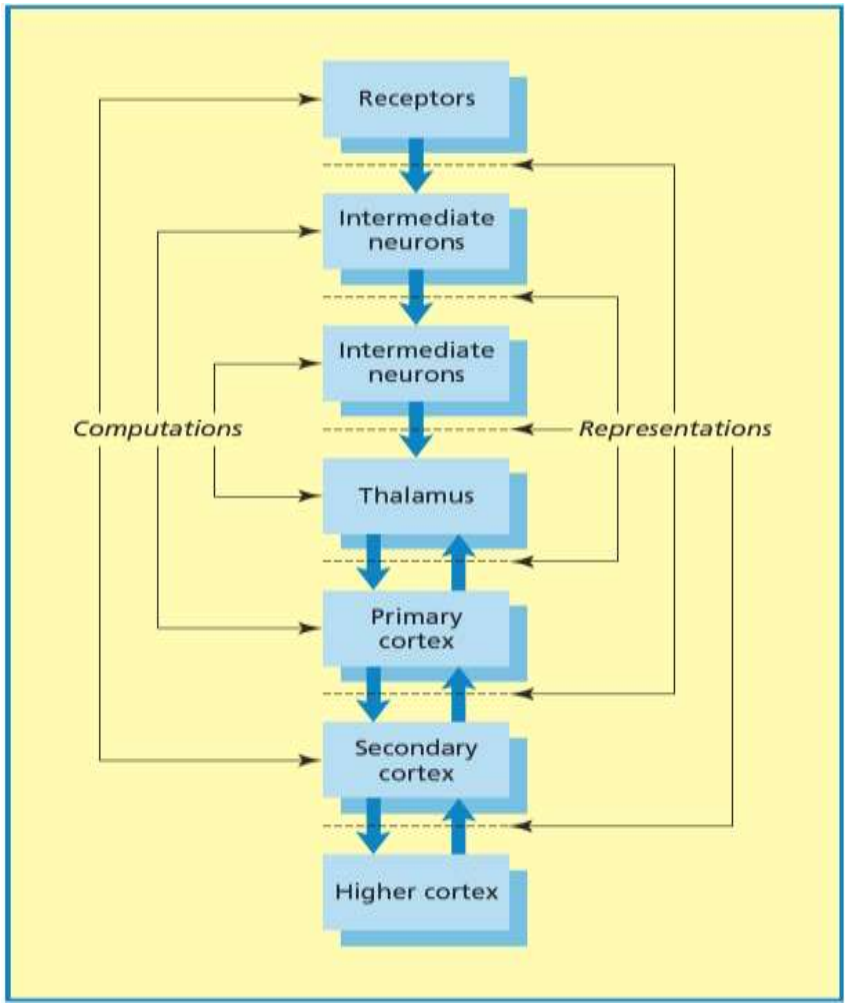
Current approaches

- Systems to provide advice
- Systems with different levels of transparency
- Prediction
- Efforts to use predictive work with EEG to have the system adapt to the person

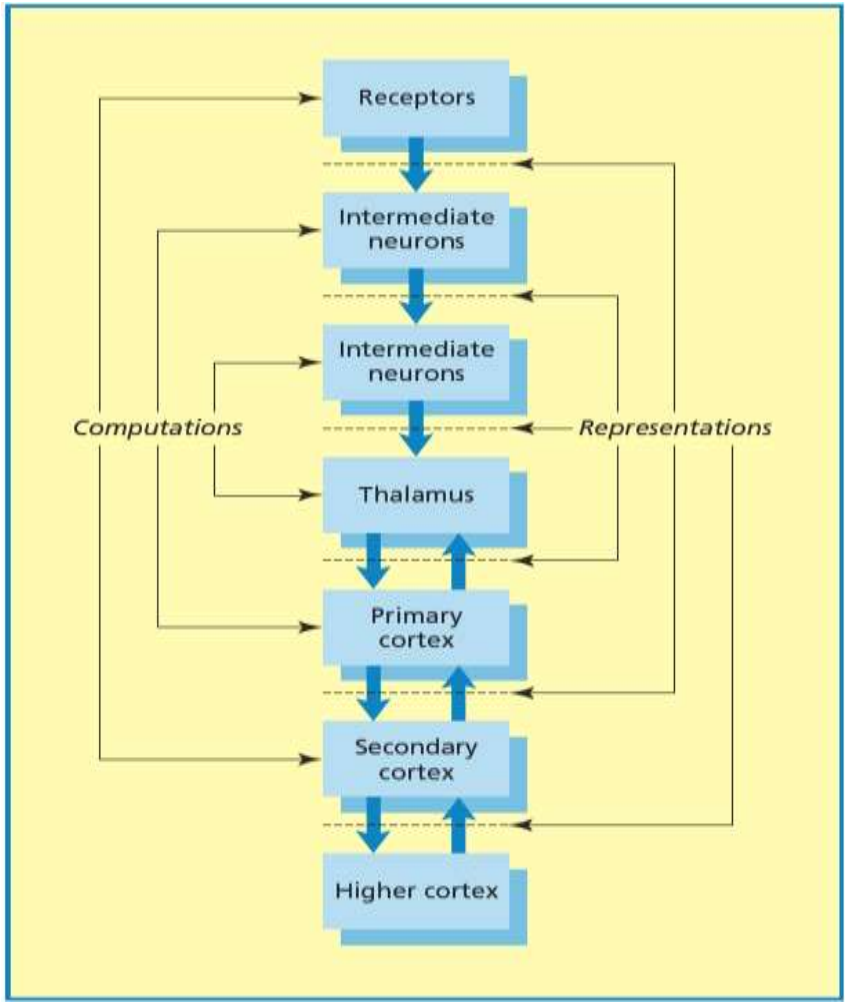
This is what humans do..

- Prediction
- Monitor the environment
- Monitor the internal state
- Make decisions
- Act on the environment

It’s complicated..



It’s complicated..and it’s a *system*



Ethical considerations

- The human is required to understand what is going on

- The human is required to make informed decisions about what is going on

Computers in Human Behavior 85 (2018) 43–53

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

Full length article

Do you want to be a cyborg? The moderating effect of ethics on neural implant acceptance

Eva Reinares-Lara [a], Cristina Olarte-Pascual [b, *], Jorge Pelegrín-Borondo [b]

[a] Department of Business Administration, Universidad Rey Juan Carlos, Facultad de Ciencias Jurídicas y Sociales, Paseo Artilleros s/n, 28032, Vicálvaro, Madrid (Spain)
[b] Department of Business Administration, Universidad de La Rioja, Facultad de Ciencias Empresariales, La Cigüeña 60, 26006, Logroño, La Rioja (Spain)

How to achieve this?

- Working *with* humans
- Machine learning with humans
- Transparency and trust
  - Shared representations

Technical and societal trends, barriers and drivers

- Barriers:
  - Humans have limited processing capacity, and performance changes over time
  - Context is key but how to define it and quantify it?
  - Ethical considerations

- Drivers:
  - Development of AR, VR and AI
  - New techniques for neuroimaging, eye tracking and data analysis

Advances in technology

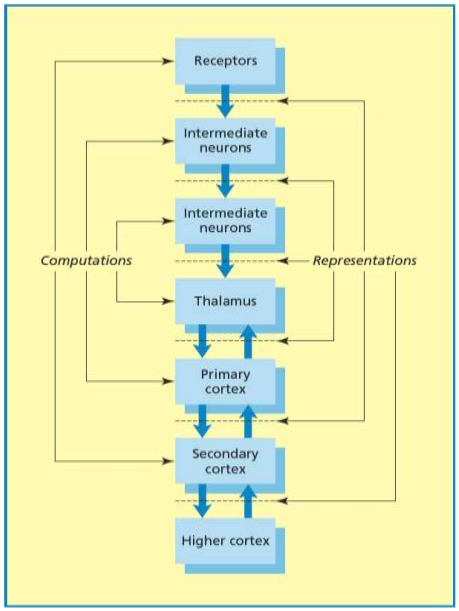
Cheaper, lighter, more portable

New tools

- AR and VR systems, eye tracking systems that are easily accessible: cheap, portable, wearable
- Wide scale collection of (naturalistic) data
- Machine learning
- Neuroimaging- mobile and wearable

What's stopping us?

- Current gaps in knowledge (or science base)
  - Understanding of *system wide* sensory integration and how it relates to cognition and action



Where is it most effective to augment for different capabilities?

What's stopping us?

- Current gaps in knowledge (or science base)
  - Understanding of *system wide* sensory integration and how it relates to cognition and action
  - Understanding of how context affects and interact with this process
  - Theory *and* data

Opportunities for virtual reality and simulation

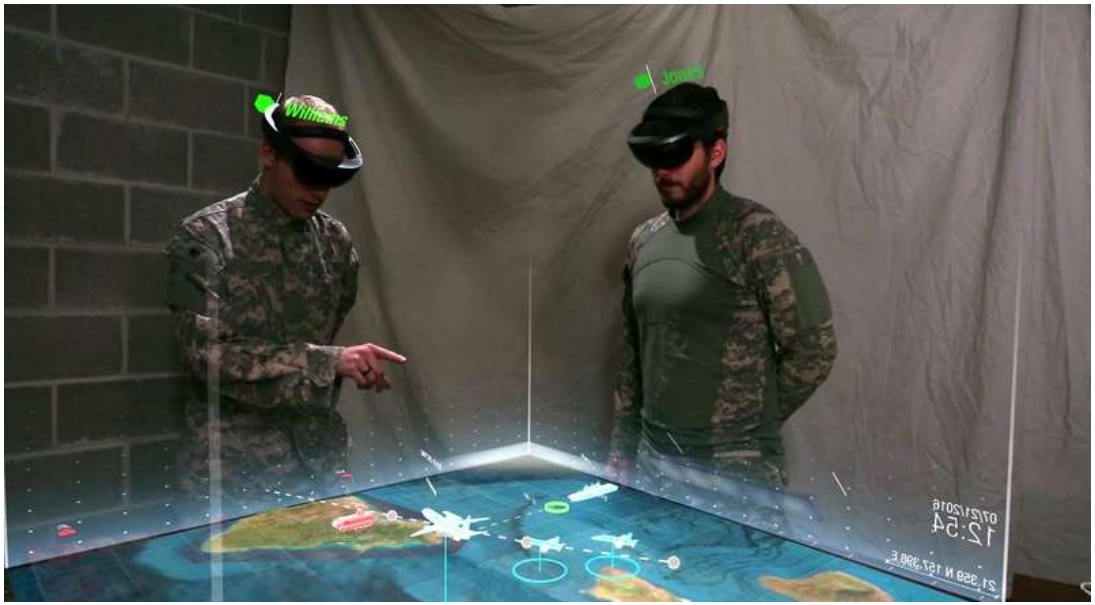
- Movie 1 : https://youtu.be/bbenHLjo1bo
- Movie 2: https://youtu.be/f3tPtfrgC4c

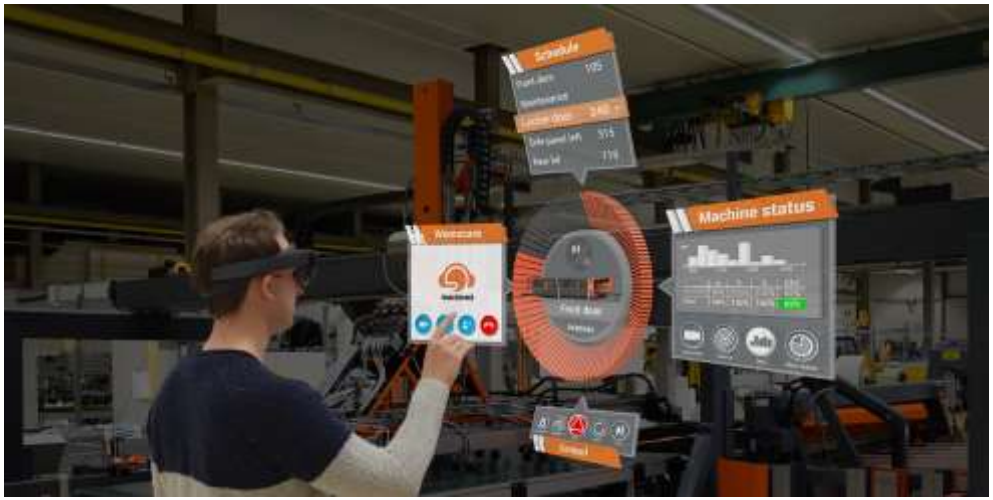
Courtesy of Dr Hamish MacDougall
Sydney Human Factors Research
University of Sydney

HAL

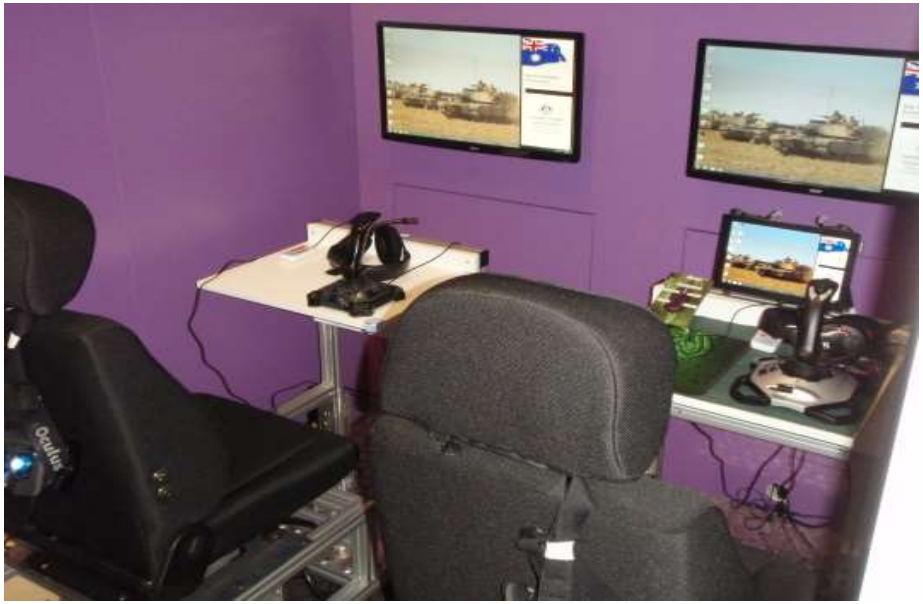
Courtesy of Dr Hamish MacDougall
Sydney Human Factors Research
University of Sydney

Augmented and mixed reality with HoloLens





Opportunities to use augmentation and simulation to understand *teaming*



Tactical Team Simulator, DST Group

Bohemia

How will humans operate in this new environment?

- Technology is advancing rapidly

- BUT

How close are we?

- It takes 1kW to power an iPhone

www.apple.com

How close are we?

- It takes 1kW to power an iPhone
- It takes about 20W for a brain

www.adelaide.edu.au

www.apple.com

How do we *integrate*?

- Human in the loop
- Human on the loop

- Augmentation
- Decision making

Roles for augmentation for HMIs

Augmentation of human capabilities through:

- Prediction
- Monitoring of the operator/human
- Monitoring of the environment
- Decision making

10 years

- *System wide* work to understand how augmentation of one sense or level of information processing influences performance at the level of cognition and action

- Modelling and development of theory

20 years

- Integrated systems that enhance and genuinely augment human performance

- The dream: a system that is an extension of one’s self, not something that simply "fits”

How will things really change?

- Feeling optimistic
  - Implications for people with disabilities, healthy ageing

- The future is *interdisciplinary* and it's about integration

Thanks for your attention!