

Human-Computer Interaction

COMS30029

aka **#HCI_Theory**

Oussama Metatla and Dan Bennett

Week 7: What Next?

**Chunk 1: Computation and
Integration**

Week 7: What's Next?

Chunk 1: Computation and Integration

Managing and Thinking about Complexity

Wave Review

- **1st wave** – How do peoples' brains drive interaction, and how do we apply natural science to interaction?
- **2nd Wave** – how do bodies and situations get involved, and how can we create native HCI theory?
- **3rd Wave** –OK, but what about society, what about difference, what about happiness and ethics?

Complexity?

Entanglement HCI The Next Wave?

CHRISTOPHER FRAUENBERGER, Human-Computer Interaction Group TU Wien

This article argues that our intimate entanglement with digital technologies is challenging the foundations of current HCI research and practice. Our relationships to virtual realities, artificial intelligence, neuro-implants or pervasive, cyberphysical systems generate ontological uncertainties, epistemological diffusion and ethical conundrums that require us to consider evolving the current research paradigm. I look to post-humanism and relational ontologies to sketch what I call Entanglement HCI in response. I review selected theories—Actor-Network Theory, Post-Phenomenology, Object-Oriented Ontology, Agential Realism—and their existing influences on HCI literature. Against this background, I develop Entanglement HCI from the following four perspectives: (a) the performative relationship between humans and technology; (b) the re-framing of knowledge generation processes around phenomena; (c) the tracing of accountabilities, responsibilities and ethical encounters; and (d) the practices of design and mattering that move beyond user-centred design.

CCS Concepts: • Human-centered computing → HCI theory, concepts and models;

Emergent Interaction: Complexity, Dynamics, and Enaction in HCI

Dan Bennett
Bristol Interaction Group, Bristol University

Feng Feng
School of Computing, University of Eastern Finland

Alan Dix
Computational Foundry, Swansea University

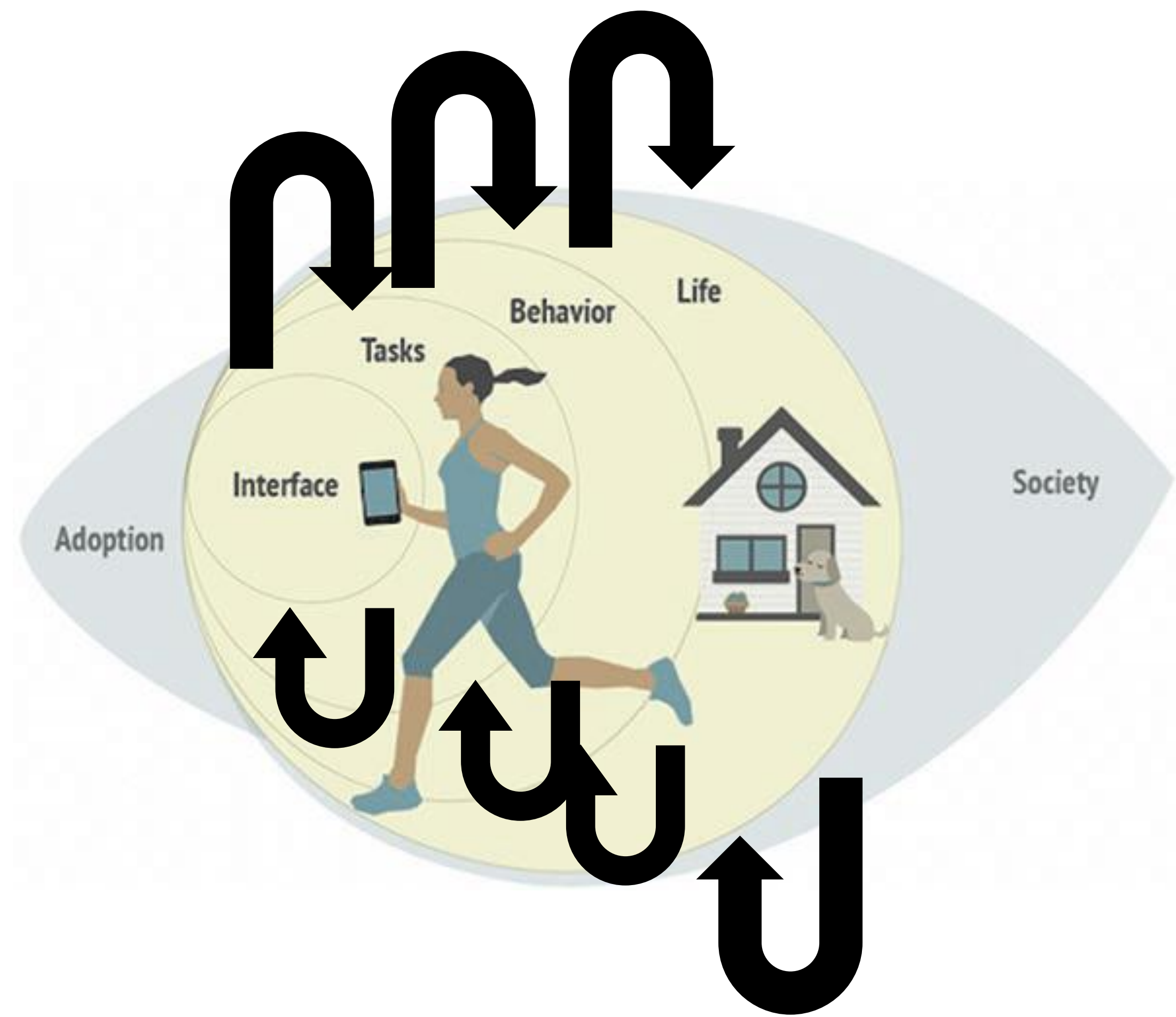
Tom Froese
Embodied Cognitive Science Unit, Okinawa Institute of Science and Technology Graduate University

Sebastien Lerique
Embodied Cognitive Science Unit, Okinawa Institute of Science and Technology Graduate University

Niels van Berkel
Department of Computer Science, Aalborg University

Parisa Eslambolchilar
School of Computer Science and Informatics, Cardiff University

Vassilis Kostakos
School of Computing and Information Systems, University of Melbourne



Feedback across scales?

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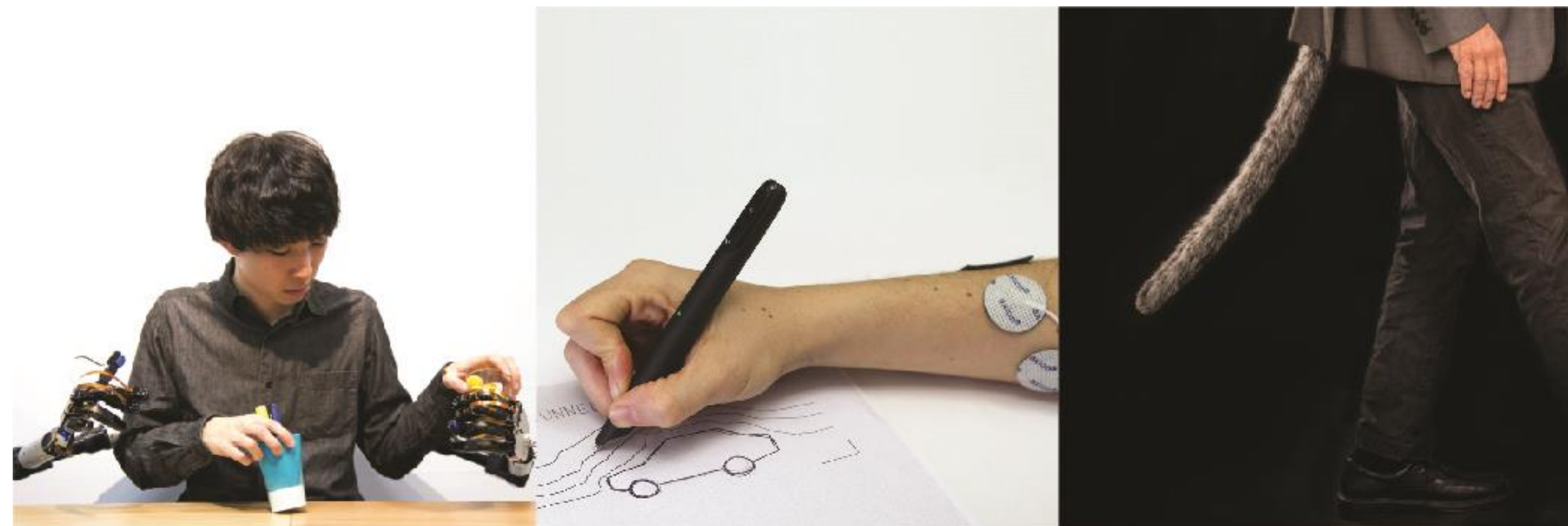
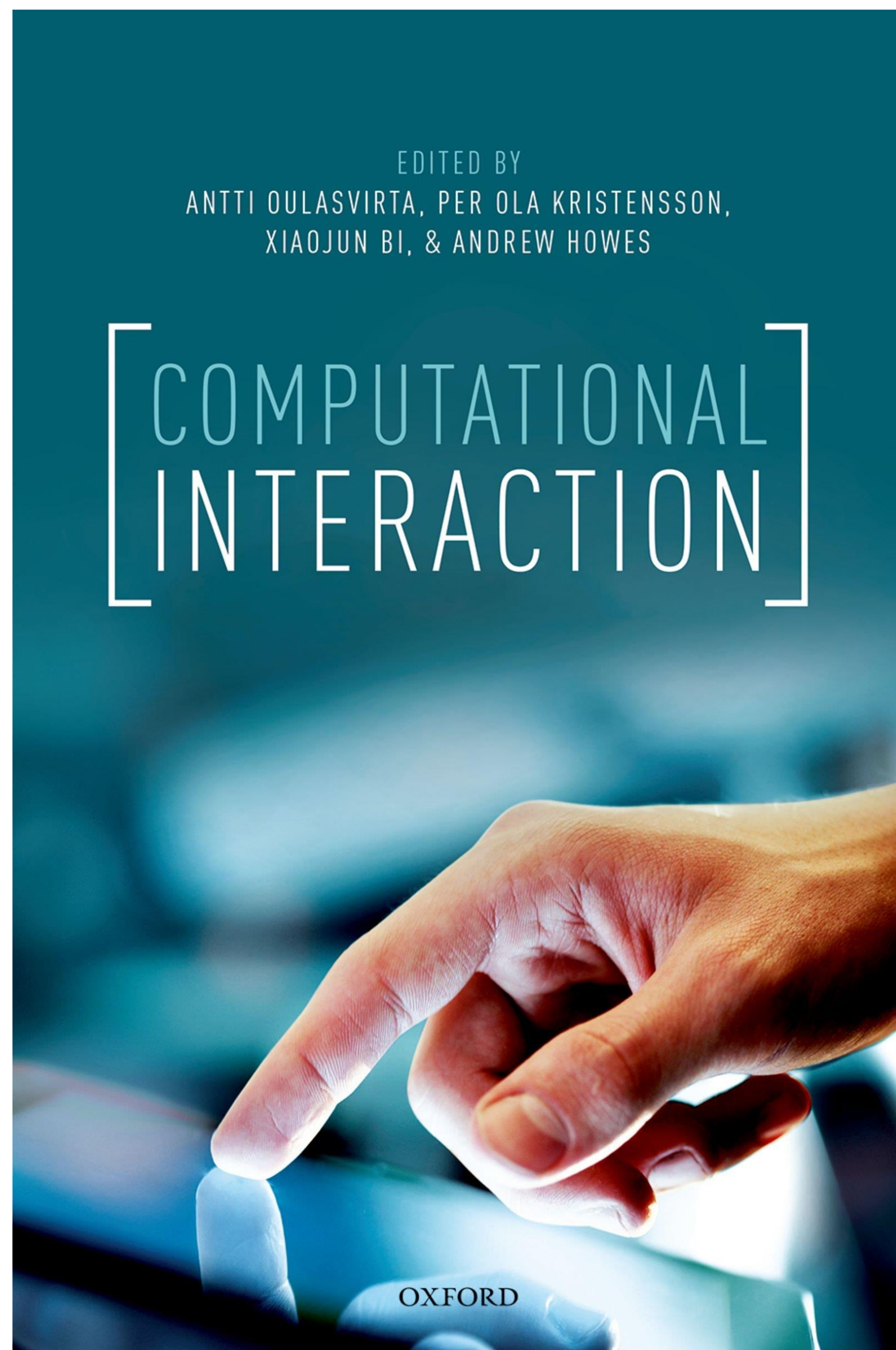
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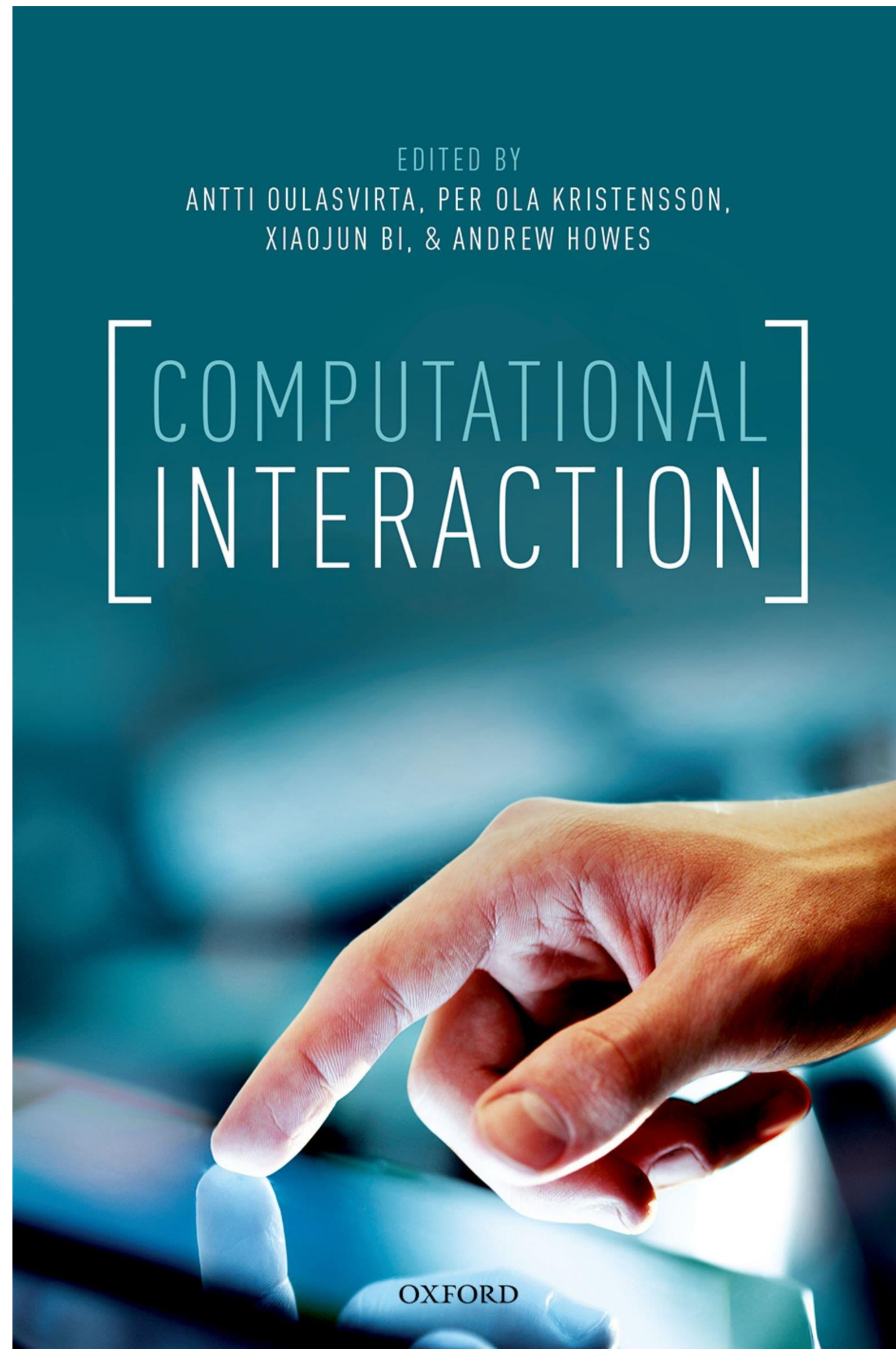
Sebastien Lericque
Embodied Cognitive Science Unit,
Okinawa Institute of Science and
Technology Graduate University

Niels van Berkel
Department of Computer Science,
Aalborg University



Micro-waves?



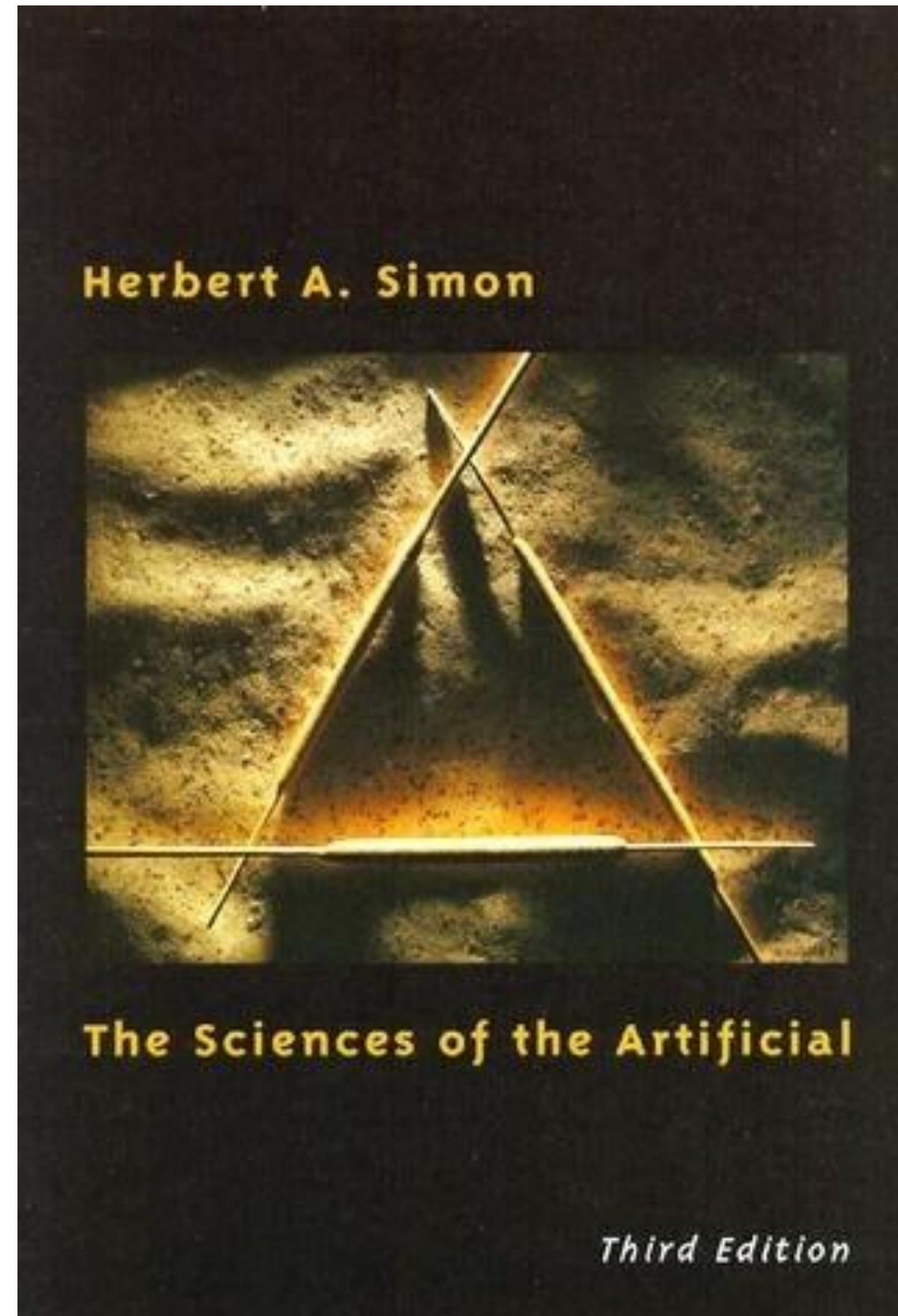
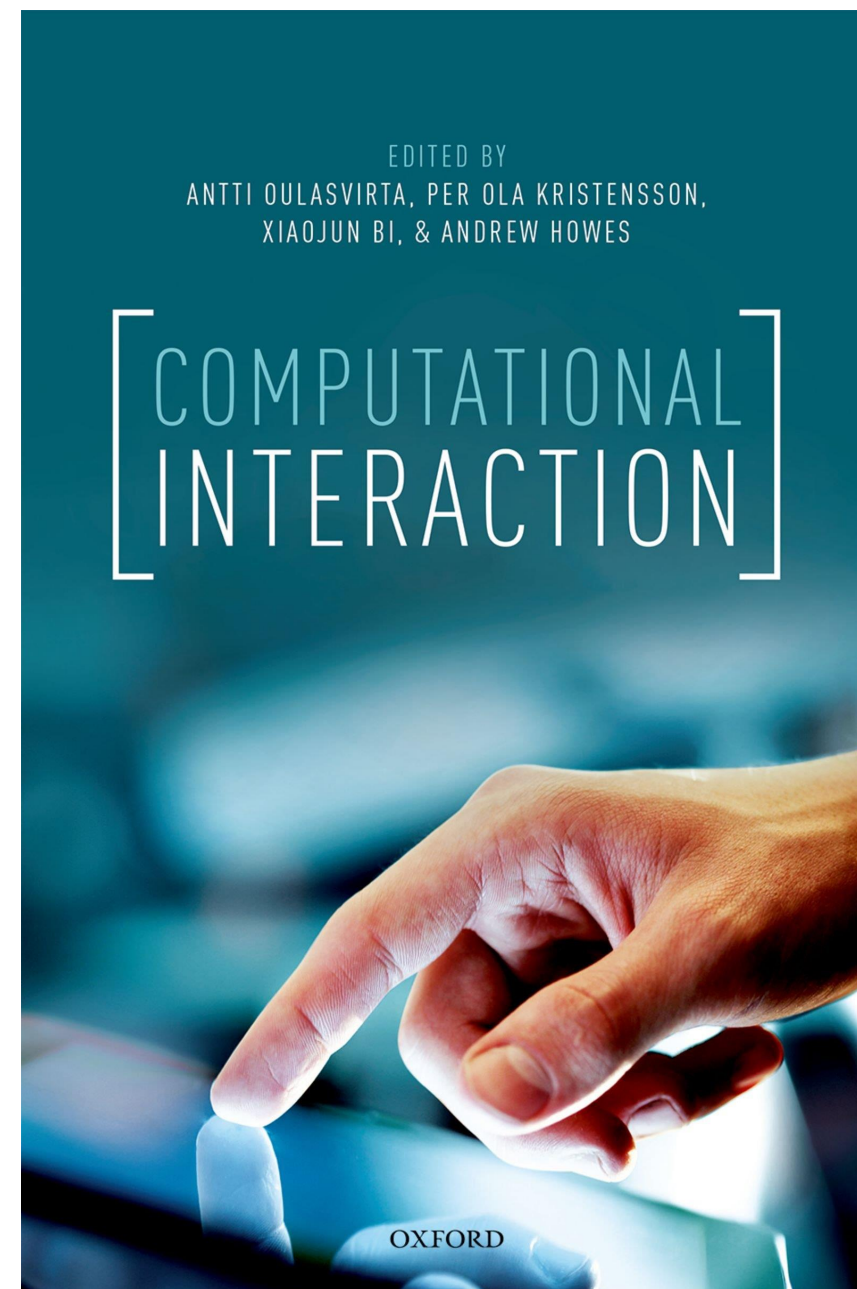


Computational Interaction

First Wave Throwback?

- **Modern computational methods**
- **Open to a broader conception of behavioural science (in principle!)**

HCI as a “Science of the Artificial”



HCI as a “Science of the Artificial”

1. “Inner and Outer Environment”

Inner: the nature of the device / object

Outer: the nature of the context

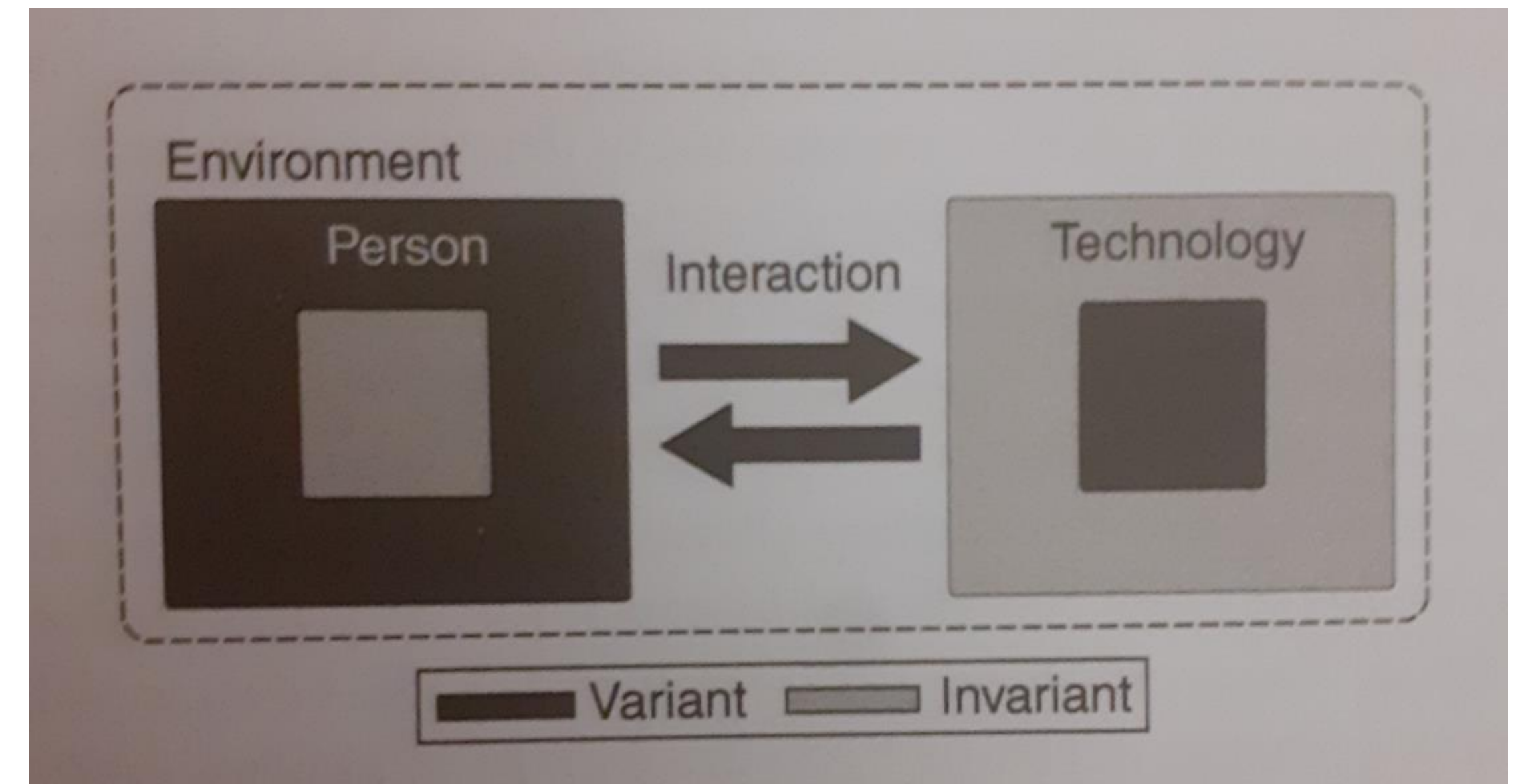
Variant and Invariant properties

Variant: changeable

- **Tech:** algorithm, interface surfaces
- **People:** behaviours and skills

Invariant: (effectively) fixed

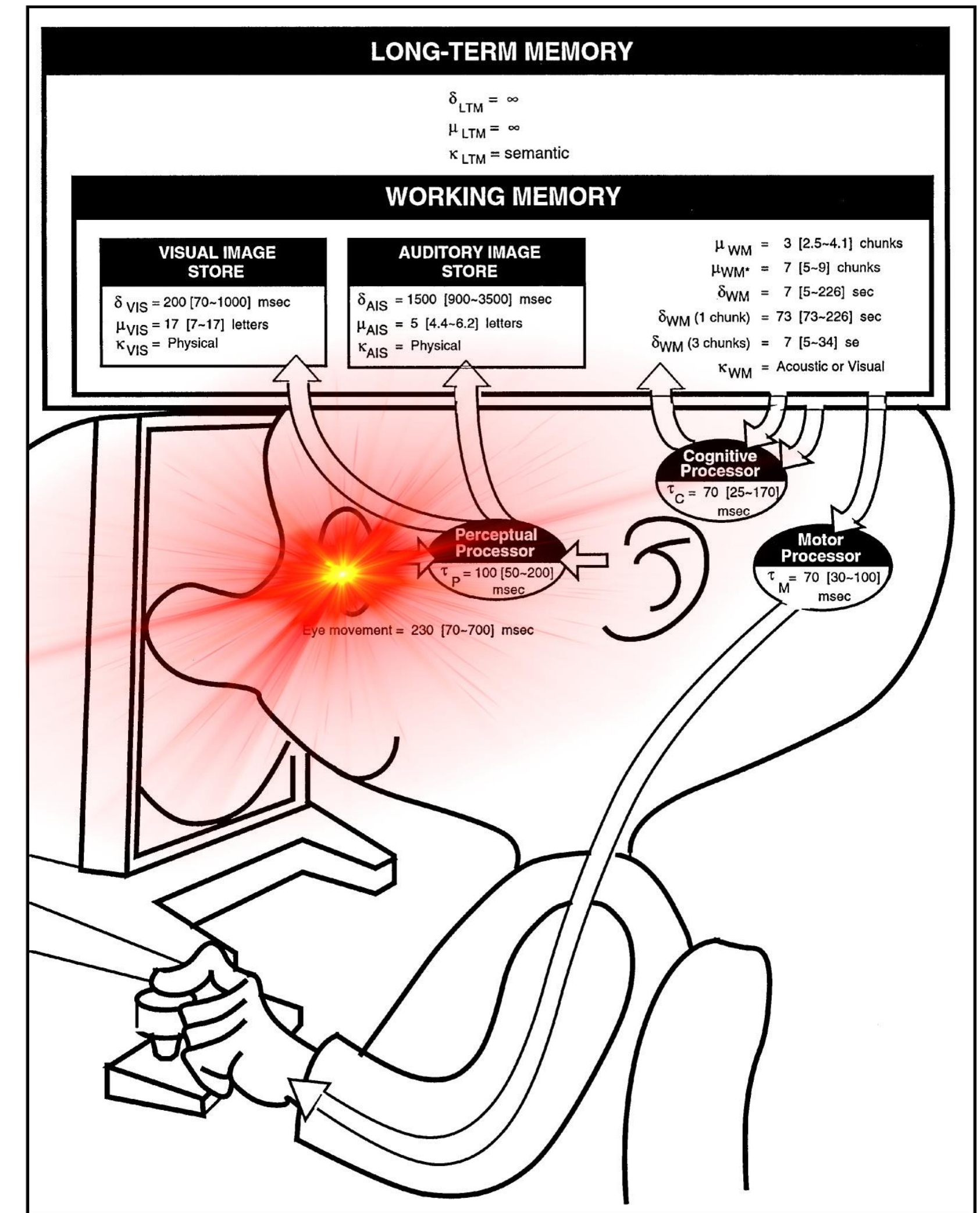
- **Tech:** Operating System, hardware
- **People:** biological limits on perception and behaviour,
(culture, norms??)



HCI as a “Science of the Artificial”

2. Simulation and Modelling

- Simulation supports “counterfactual” reasoning (“what might be”)
- Goes beyond intuition in exploring implications of a theory
- Can be built directly into systems



HCI as a “Science of the Artificial”

3. Empirical Research

- **Testing of the technology in “outer environments” (the real world)**
- **Also testing of the MODEL (and thereby the theory)**



Computational Interaction in Practice

1. “Inner and Outer Environment”
2. Simulation and Modelling
3. Empirical Research

Optional reading:

It's Time
to Rediscover
HCI Models

 **Antti Oulasvirta**, Aalto University

Insights

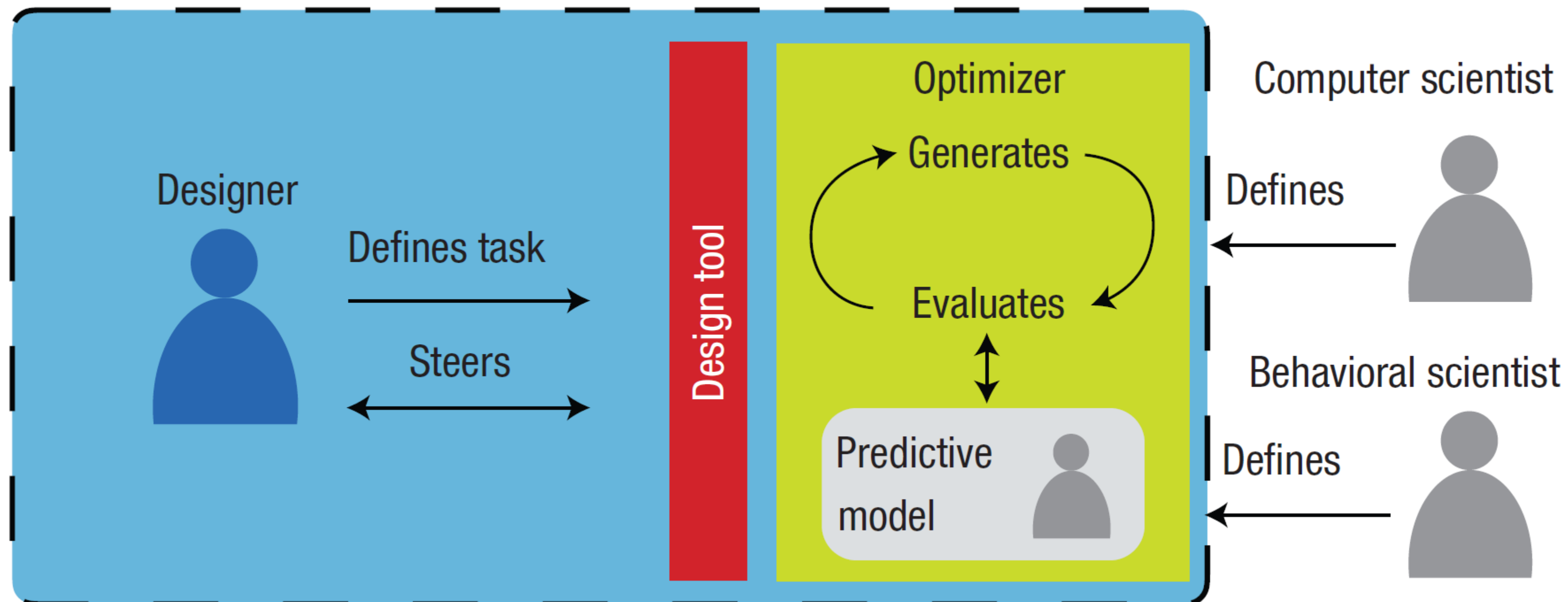
- Modeling has improved significantly since GOMS and Fitts's law.
- We have a new bedrock in powerful computational models that can explain and predict behavior with higher fidelity and address a broader scope beyond point-and-click interfaces.
- The most far-reaching development is that we have learned how to use models to drive the algorithmic generation and adaptation of UIs.

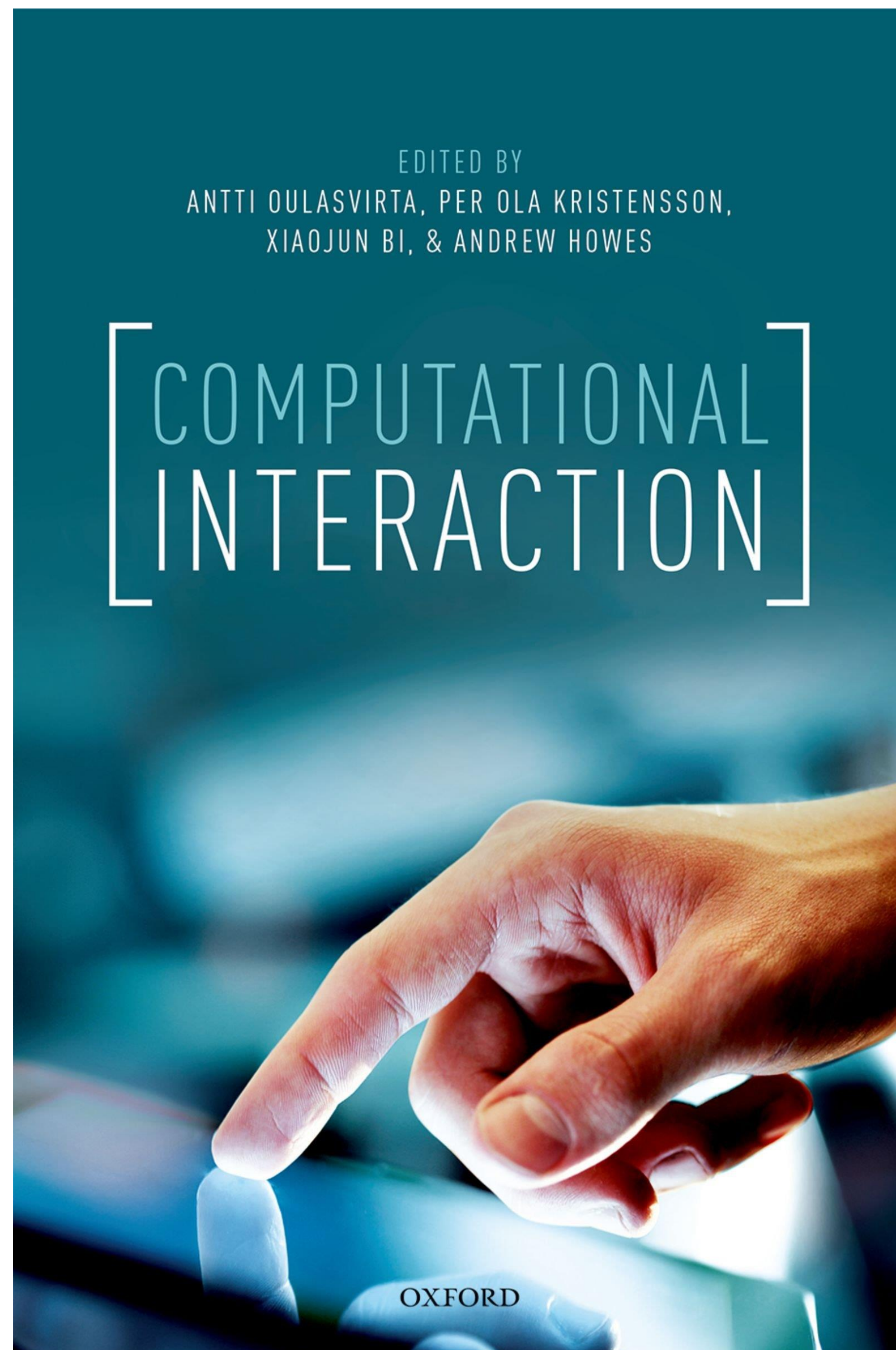
Computational Interaction in Practice

- Predictive model
- Optimization
- Interaction with Designer

It's Time
to Rediscover
HCI Models

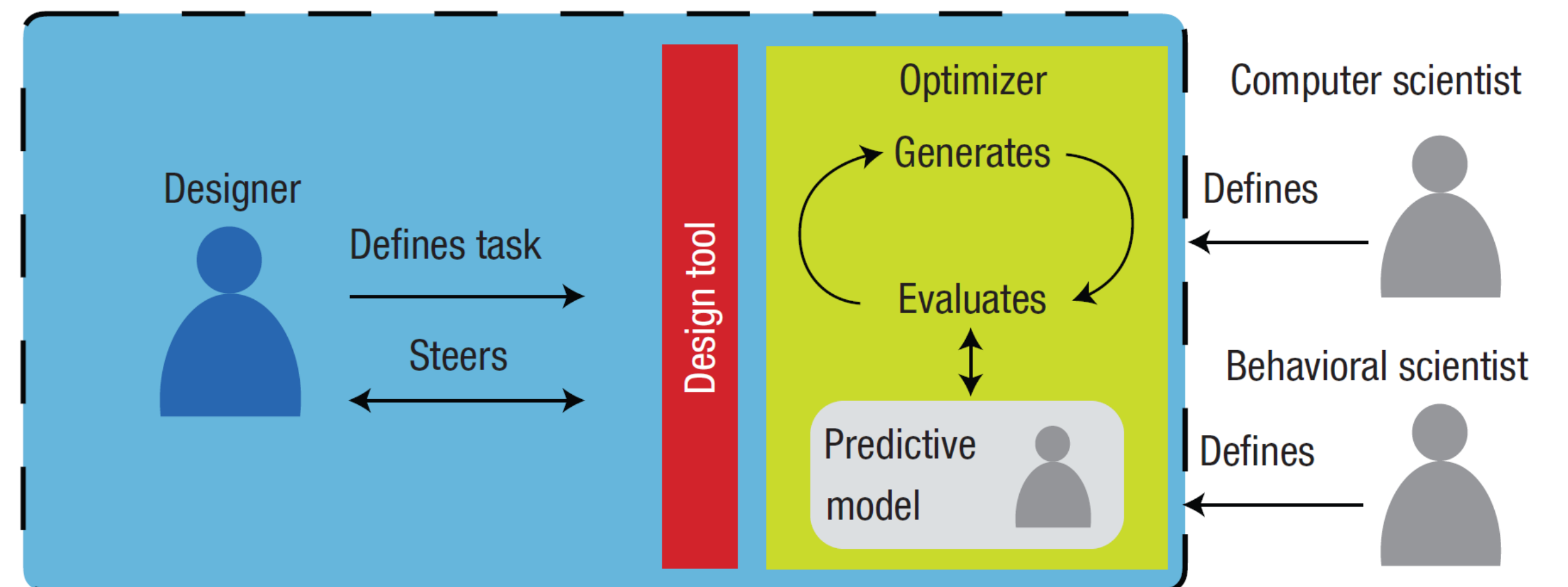
🔥 Antti Oulasvirta, Aalto University



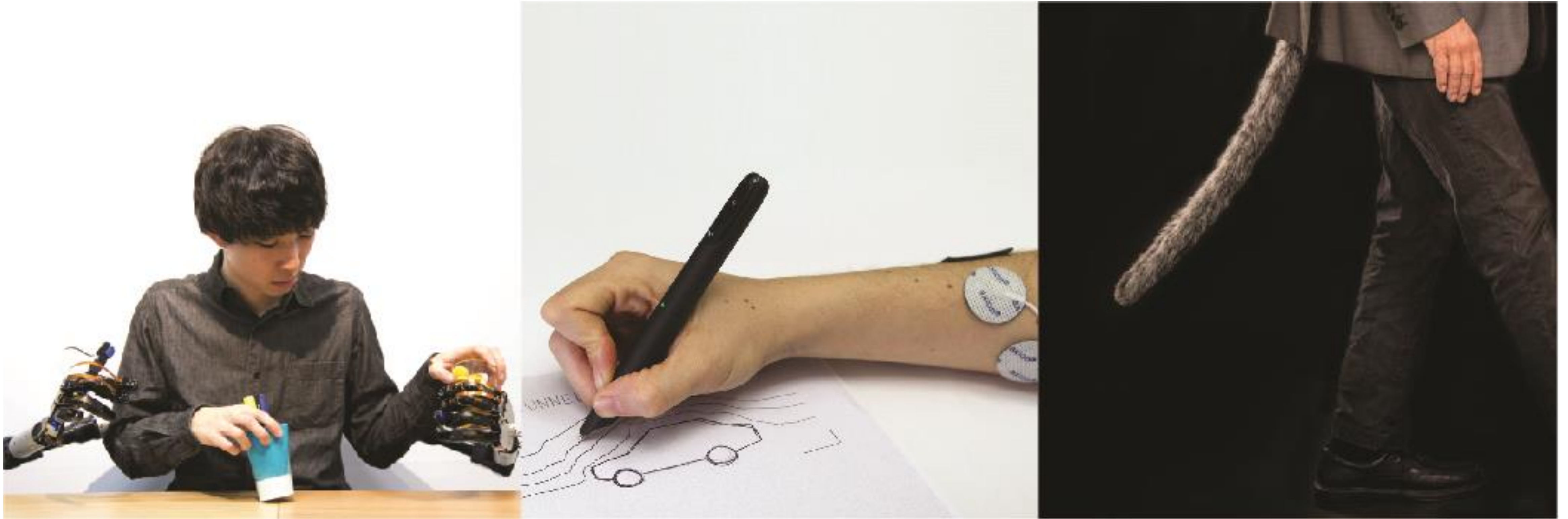


It's Time to Rediscover HCI Models

 **Antti Oulasvirta**, Aalto University



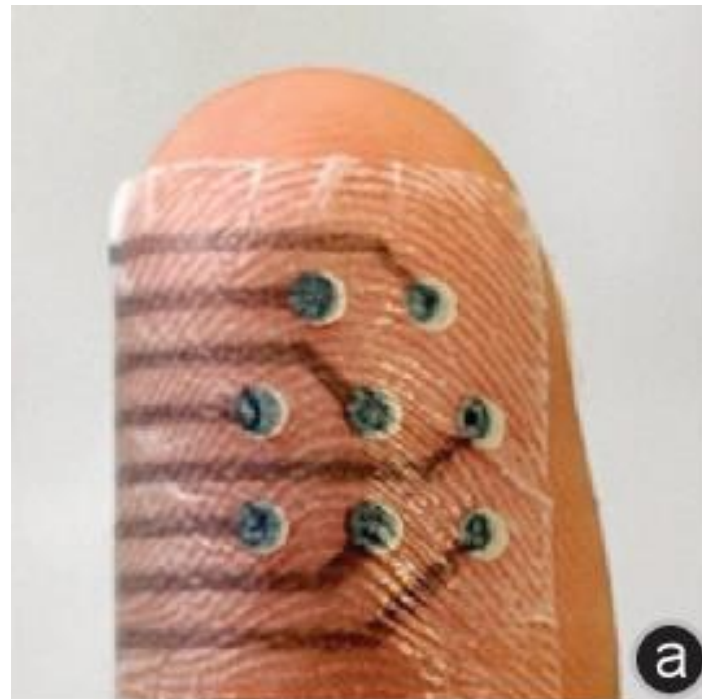
Human Computer Integration



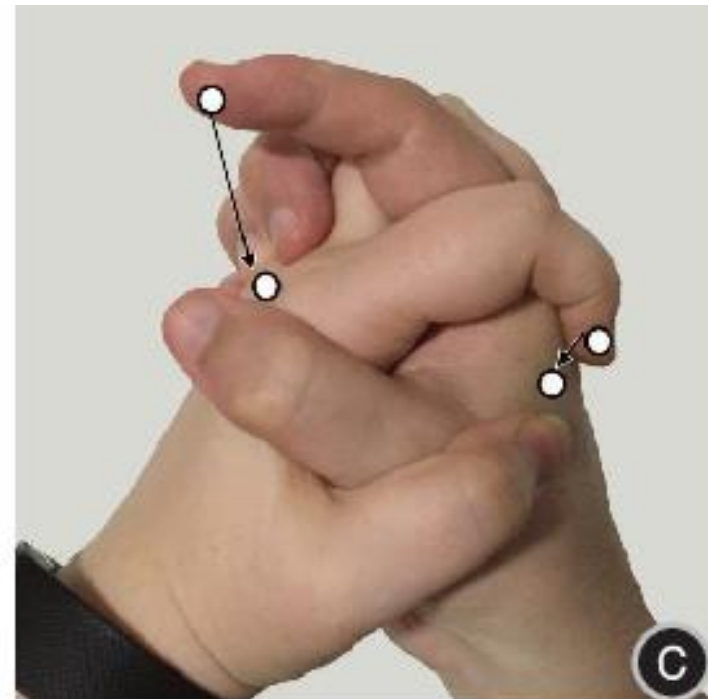
Human Computer Integration

Challenges:

1. Compatibility



Epidermal Technologies



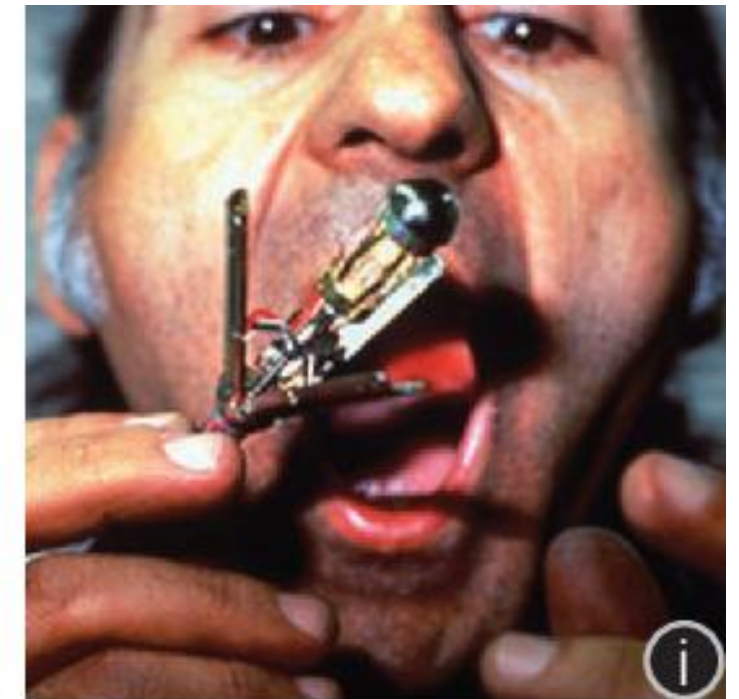
Subdermal Technologies



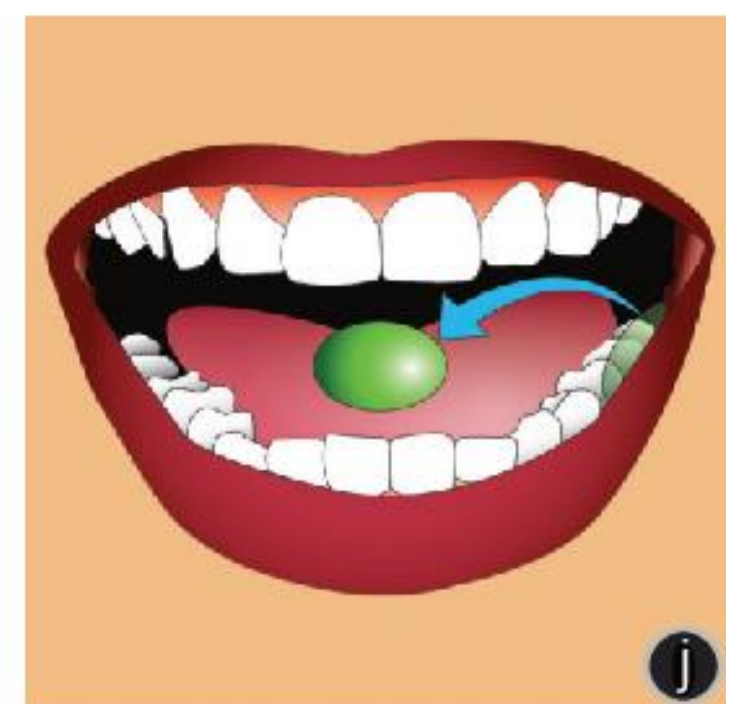
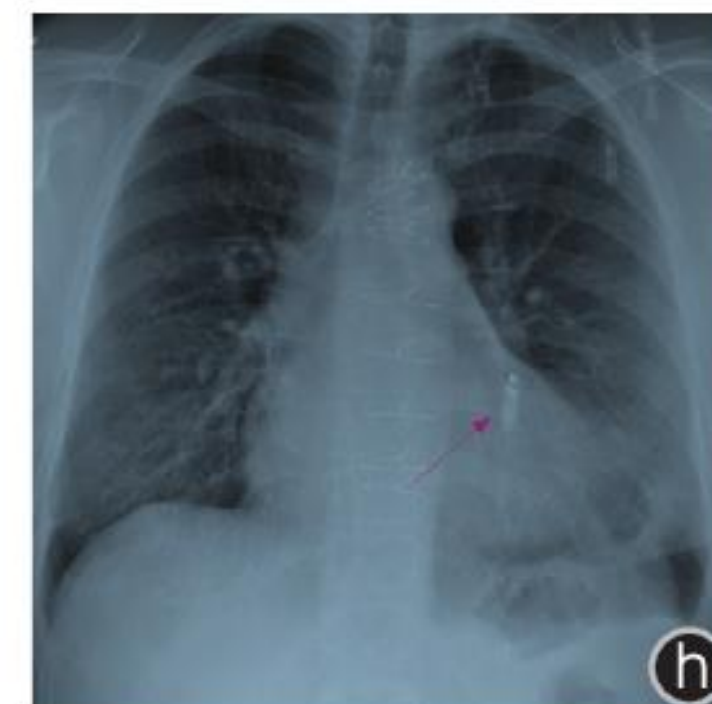
Transdermal Technologies



Implanted Technologies



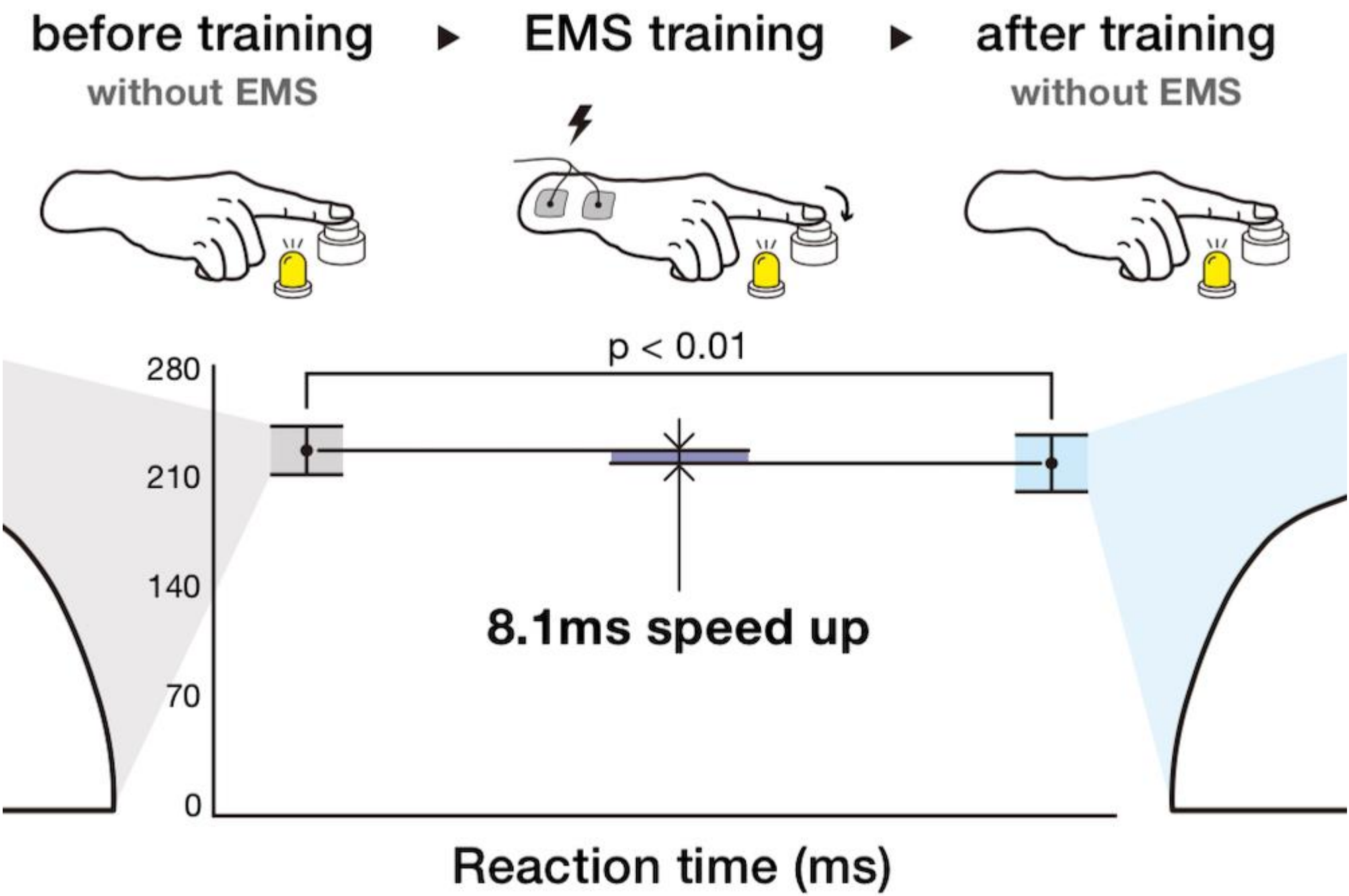
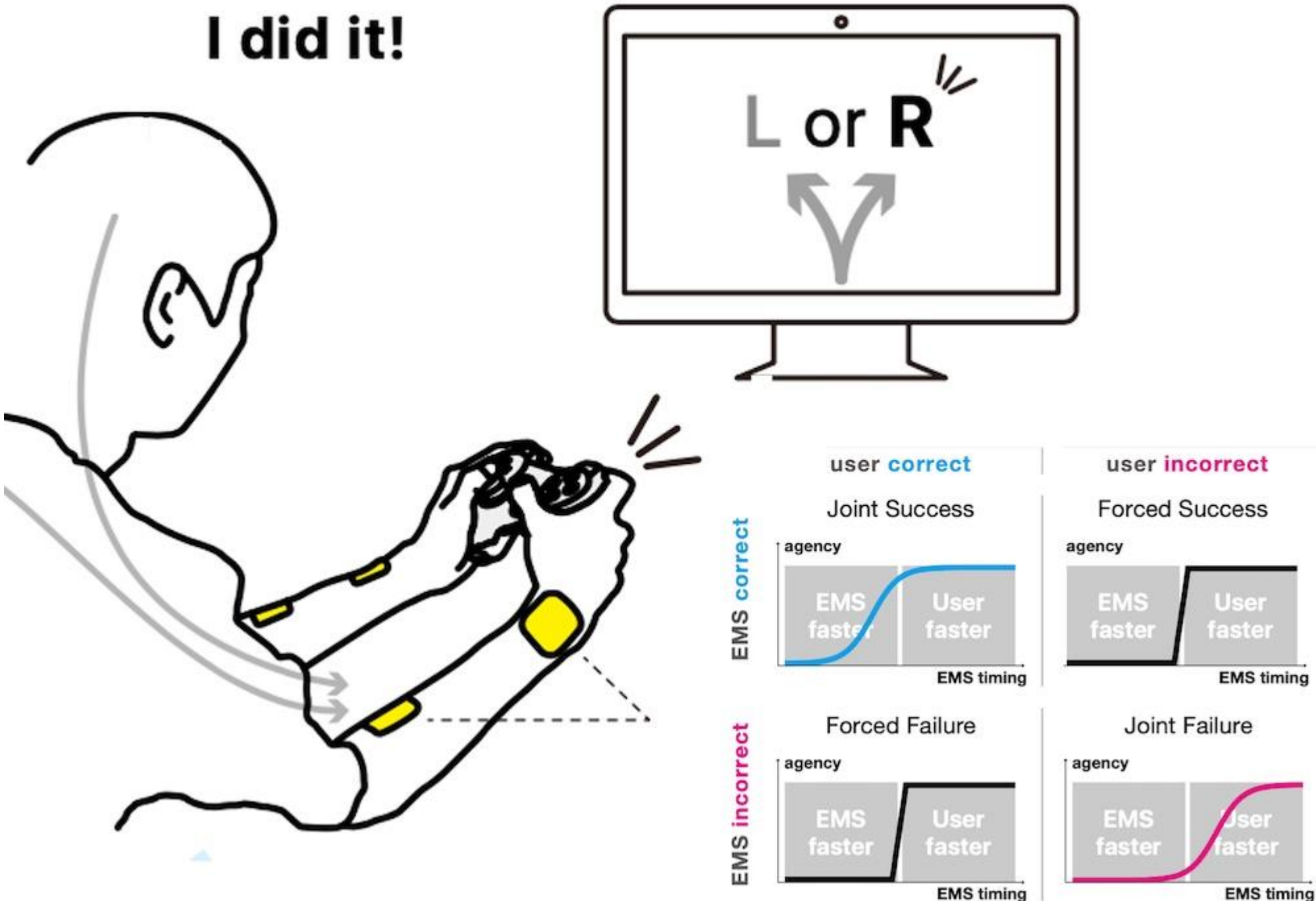
Pass-through Technologies



Human Computer Integration

Challenges:

2. Sense of Self and Agency



Human Computer Integration

Challenges:

3. Societal Impact



ERROR
34.4%
DIFFERENCE
IBM



Human Computer Integration

Challenges:

3. How to design integrated interactions



Next Steps in Human-Computer Integration

Florian ‘Floyd’ Mueller ¹, Pedro Lopes ², Paul Strohmeier ³, Wendy Ju ⁴, Caitlyn Seim ⁵,
Martin Weigel ⁶, Suranga Nanayakkara ⁷, Marianna Obrist ⁸, Zhuying Li ¹, Joseph Delfa ¹,
Jun Nishida ², Elizabeth M. Gerber ⁹, Dag Svanaes ¹⁰, Jonathan Grudin ¹¹, Stefan Greuter ¹²,
Kai Kunze ¹³, Thomas Erickson ¹⁴, Steven Greenspan ¹⁵, Masahiko Inami ¹⁶, Joe Marshall ¹⁷,
Harald Reiterer ¹⁸, Katrin Wolf ¹⁹, Jochen Meyer ²⁰, Thecla Schiphorst ²¹, Dakuo Wang ²²,
Pattie Maes ²³



Figure 1. Exemplars of Human-Computer Integration: extending the body with additional robotic arms; [71] embedding computation into the body using electric muscle stimulation to manipulate handwriting [49]; and, a tail extension controlled by body movements [87].

**#HCI
_Theory**