Mind, Communication and Technology

Distributed Cognition

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- **Doctoral Researcher** – DSc. (Admin.) in Social and Health Sciences
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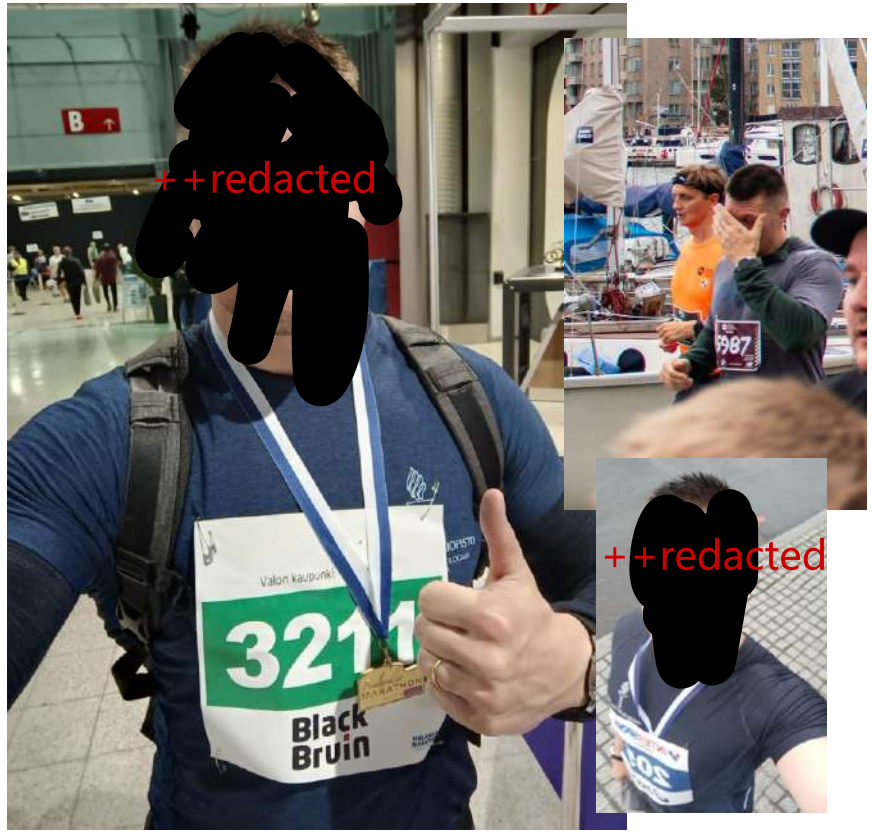

Research keywords: *Distributed Cognition; Hybrid Work; Cognitive Warfare; Organizational Studies; Strategy; Artificial Intelligence*

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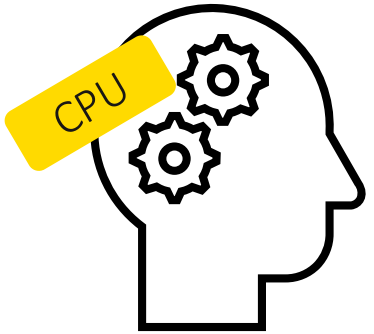
Distributed Cognition - So what?

- Useful analytical tool
- Tool for reflection
- Can be used for analysis and design of UX; Organizations; Work-processes etc.
- Very nice theoretical framework for essays; thesis; etc.

Distributed Cognition - Structure

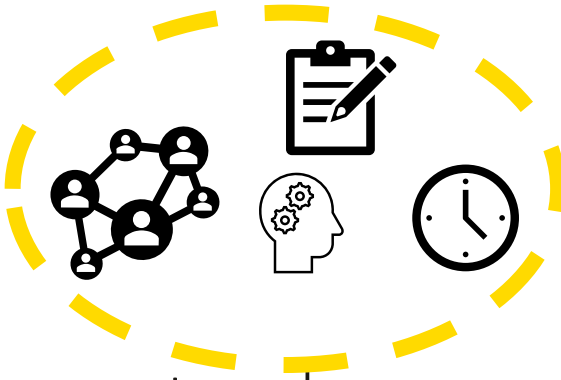
- Intro
- Traditional vs. Out-of-the-head cognition
- Distributed Cognition
- Edwin Hutchins
- DiCoT-CL framework
- My research
- What’s distributed here?
- Outro

“Traditional” view of Cognition



- Cognition primarily occurs inside the individual's brain (e.g., Fodor, J. A., 1983)
- Emphasizes mental processes, such as memory, problem-solving, and decision-making, as solely "in-the-head" activities (e.g., Anderson, J.R., 1983; Newell & Simon, 1972)
- Views the mind as a self-contained, information-processing system (e.g., Miller, G. A., 1956)
- Often neglects the role of the body, environment, and social context in shaping cognition (as criticized by e.g., Bruner, J. S., 1990)

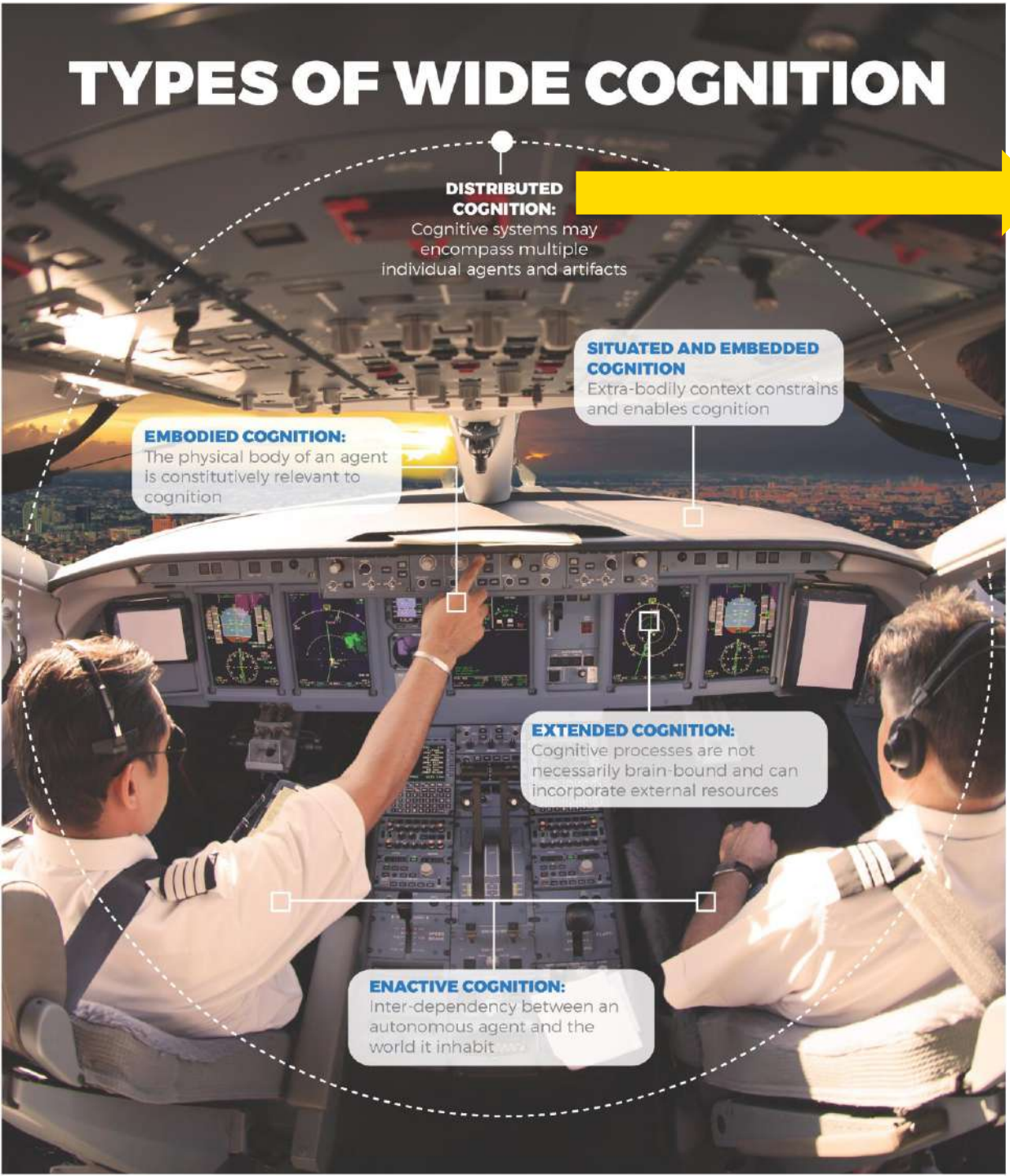
Out-of-the-head cognition



- Cognition is not confined to the brain but extends into the body, environment, and social interactions (e.g., Varela et al. 1991; Hutchins, 1995; Wilson, M. 2002)
- Suggests that cognition situates through active engagement with the world, rather than being solely internal (e.g., Suchman, L. A., 1987)
- Explores how cognition can be extended beyond the brain through tools, technology, and social networks (e.g., Clark & Chalmers, 1998)

- Extended Cognition
- Embodied Cognition
- Enacted Cognition
- Grounded Cognition
- 4E Cognition

The case of Patrick Jones



Distributed Cognition

- Methodology of studying all of cognition
- The study of socio-technical systems

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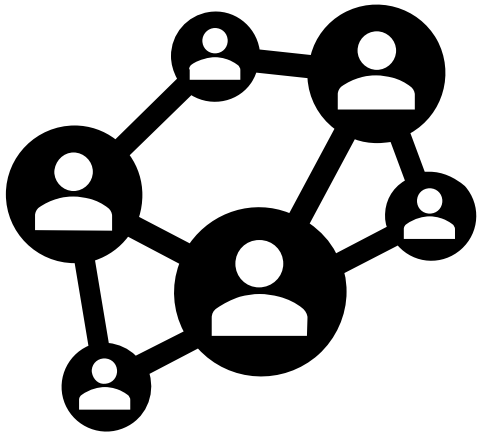
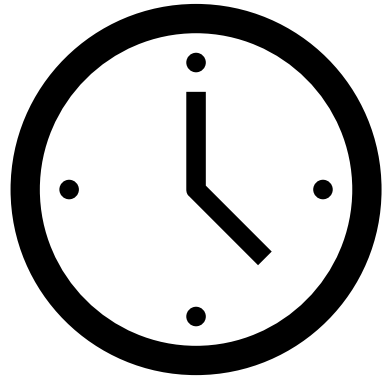
Distributed Cognition



Social interaction
e.g., solving problems through interaction in a brainstorming session

Artefacts and structures
e.g., using notepad as an external memory



Time
e.g., previous tasks have influence to future tasks

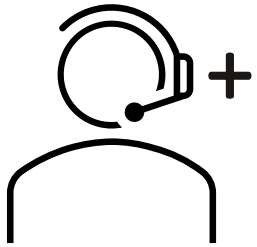
Conceptual ambiguity of Distributed Cognition

Systems-based view

- Distributed Cognitive System (Hutchins, 1995)
- Socio-technical system (Hollan et al. 2000)
- A methodology of studying all of cognition (Hollan et al. 2000)

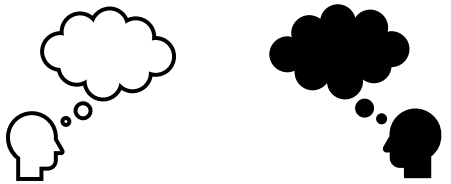
"Person plus"

- The world as *augmenting* human cognition (Perkins, 1991)
- Cognitive offloading (Clark, 1998)
- *Partnership* between mind, body and world (Clark, 1998)



Distinct type of cognition

- "Stretched over" minds, bodies, activity, culture, and artifacts (Lave, 1998)
- *Cognition* and *Distributed Cognition* as separate entities (Salomon, 1993)



Distributed Cognition: Edwin Hutchins

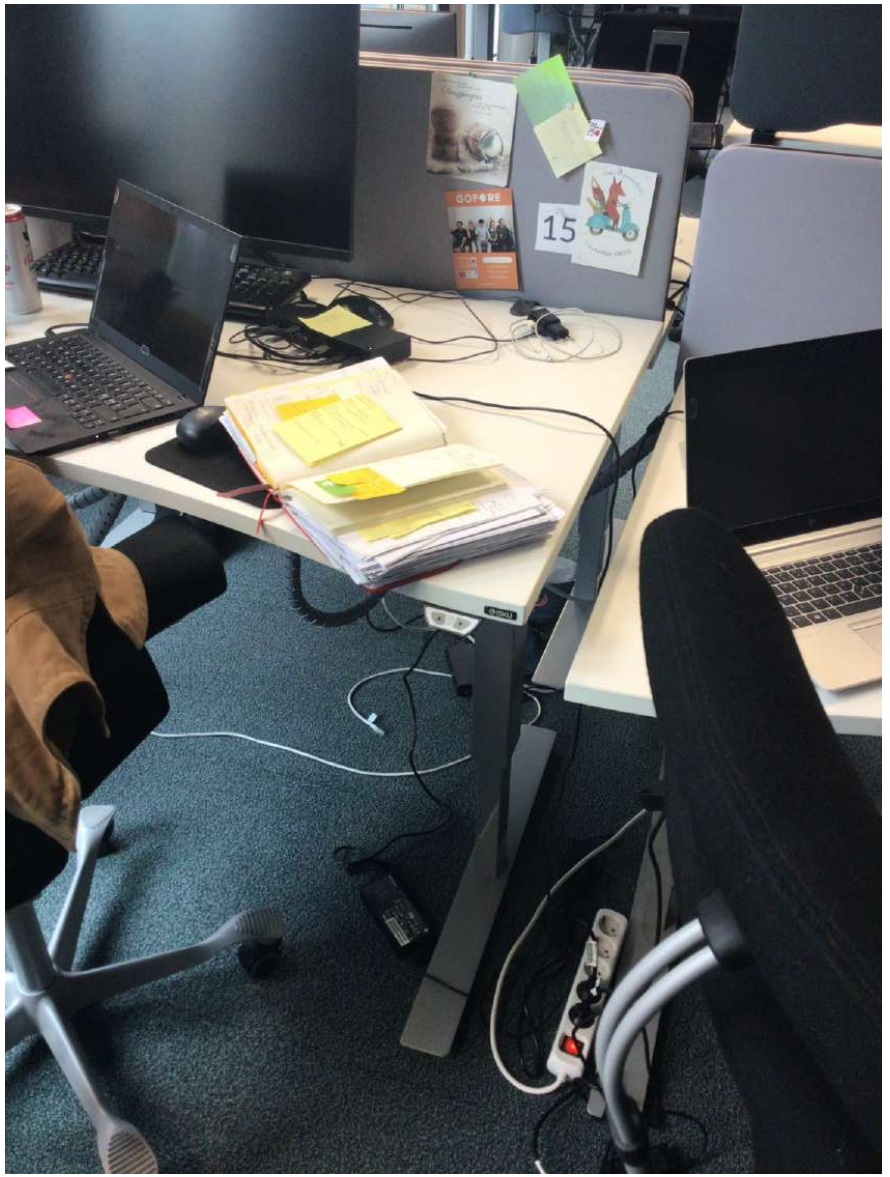
- Main figures in the development of Distributed Cognition
- Seminal works include “Cognition in the Wild”, 1995
- Cognitive Ethnography on a navy vessel

Edwin Hutchins:
“Humans create their cognitive powers by creating the environments in which they exercise those powers.”

- Cognition in the Wild, p.169

Cognitive Ethnography (Hutchins, 1995)

- Walking inside a cognitive system
- Contextual understanding – being part of the cognitive ecosystem (Hutchins, 2014)
- Living the culture and everyday actions of the studied systems
- Observing artifacts, social interaction, culture, physical spaces etc.

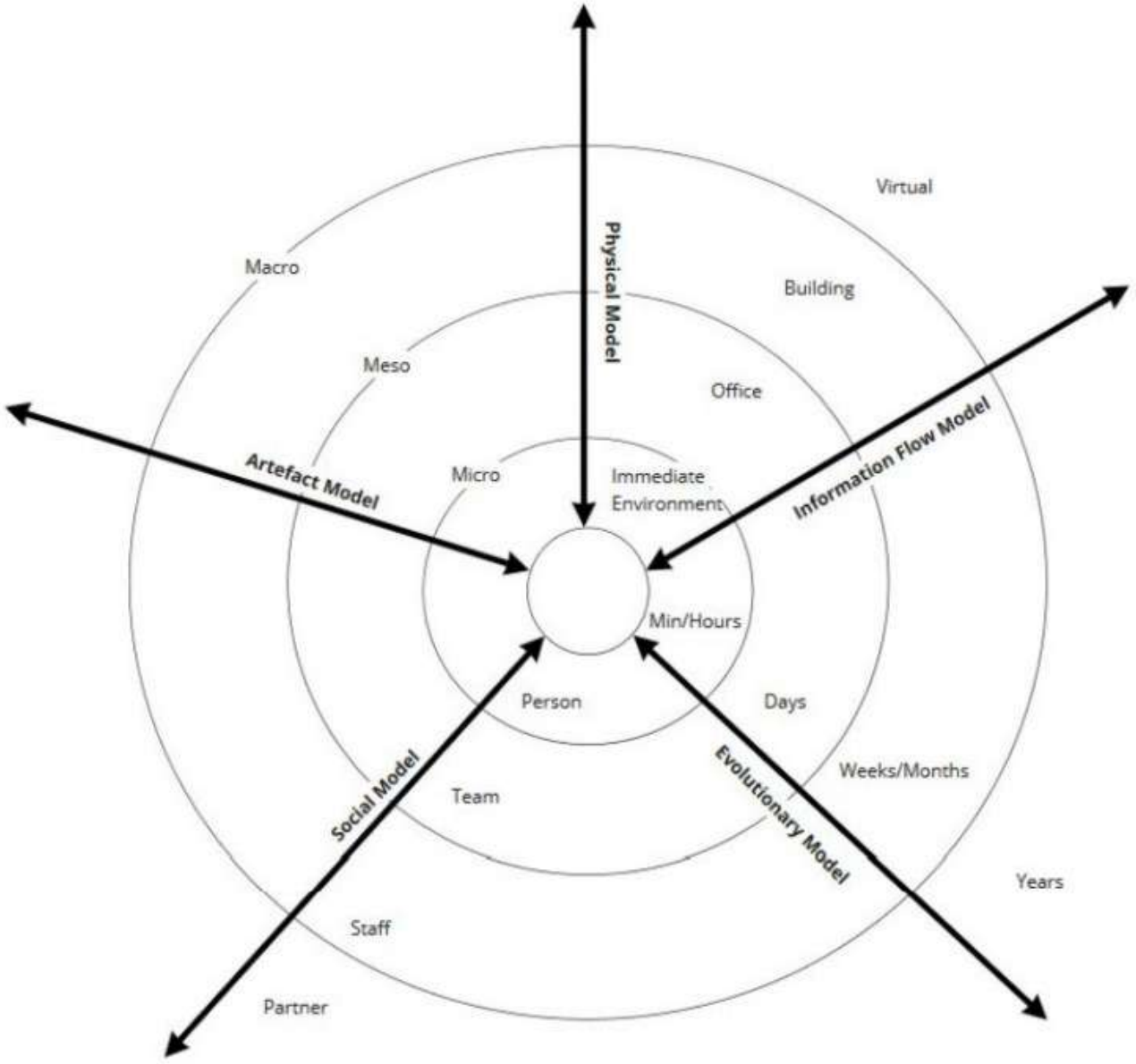


DiCoT-CL

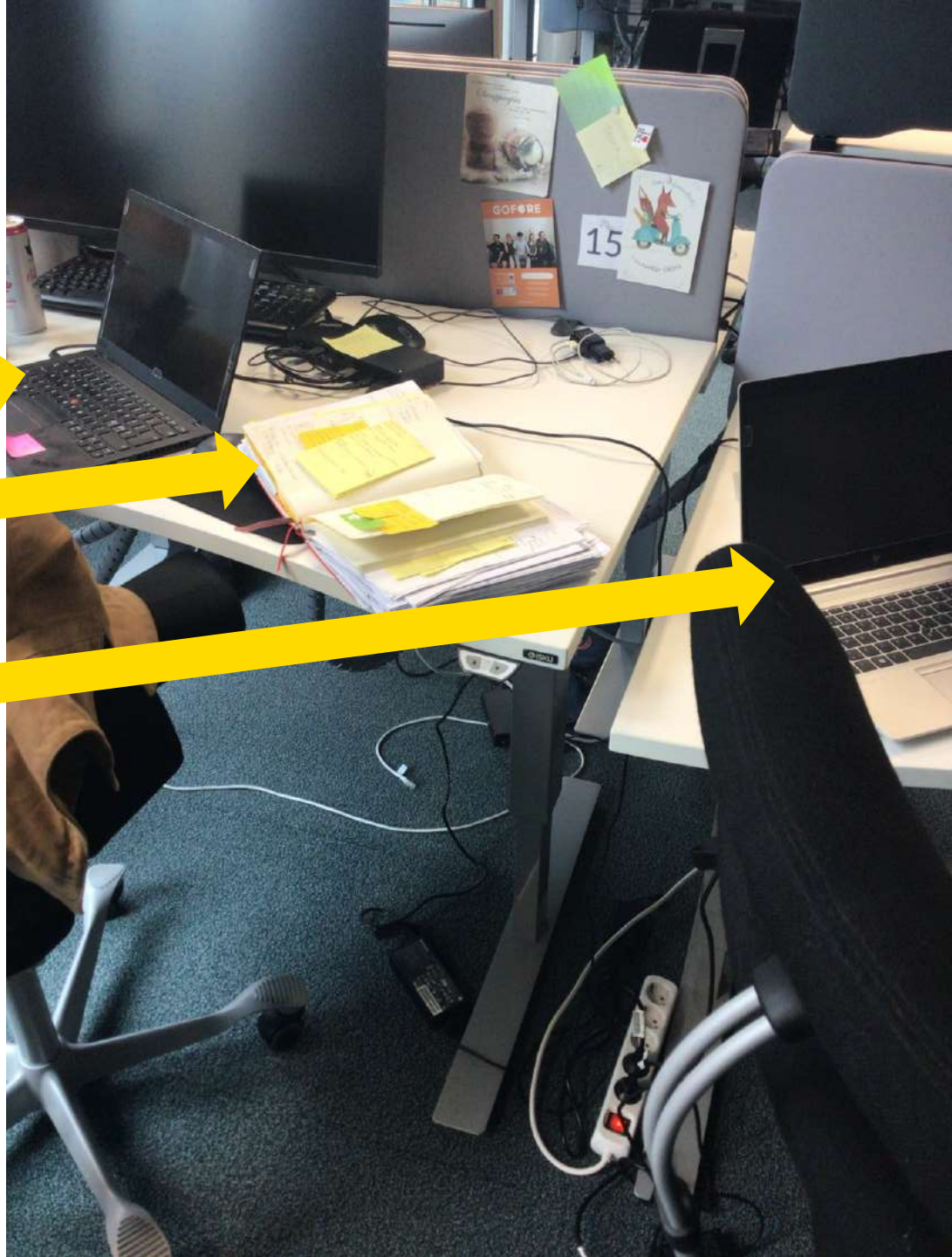
Distributed Cognition for Teamwork – Concentric Layers

Distributed Cognition for Teamwork – Concentric Layers (DiCoT-CL)

- Developed by **Ann Blandford** and **Dominic Furniss** (2006; 2015; 2019)
- **Five themes:**
  - *Physical model*
  - *Artefact model*
  - *Social model*
  - *Information flow model*
  - *Evolutionary model*
- Micro-Meso-Macro layers for added depth
- Brings rigor and "off-the shelf" analytical lens for applying Distributed Cognition



Themes and principles	
Information Flow Model	
Information Movement	Information movement in physical realizations or representations in a cognitive system.
Information Transformation	How, why, where, and how transformation of information happens when moving in the system.
Information Hubs	Central nodes where information from different sources merge and decisions happens.
Buffering	Holding of information until processing can happen.
Behavioral Trigger Factors	What triggers action without planning.
Communication Bandwidth	Amount and richness of information in different channels of communication, e.g., text versus speech.
Informal Communication	The role of informal communication in information propagation.
Artefact Model	
Mediating Artefacts	Any artefact that is used for the completion of a task.
Creating Scaffolding	Using external environment to simplify cognitive tasks.
Representational – Goal Parity	Using physical artefacts to represent current state and goal state.
Coordination of Resources	Artefacts that coordinate plans, goals, current state etc. to support aid cognition to accomplish tasks.
Social Model	
Social Structure and Goal Structure	How social structure forms and imposes goals and hierarchy.
Socially Distributed Properties of Cognition	Cognitive tasks that are shaped by sharing them in a group.
+Social Circles of Privacy	How the role of privacy behavior relates to information that is shared.
+Social Emersion	How social roles emerge in an organization or environment.
Physical Layout Model	
Space and Cognition	How physical layout support cognition in activities.
Perceptual Principle	Using spatial representation that relate to the task to support cognition.
Naturalness Principle	The proximity of representation and what is being represented.
Subtle Bodily Supports	Bodily actions that are used for supporting cognition e.g., pointing a finger to a point to remember.
Situation Awareness	How the actors in a system are kept aware of what is the current situation.
Horizon of Observation	What can be seen or heard and observed.
Arrangement of Equipment	How the physical layout of artefacts support cognition e.g., access to information.
Evolutionary Model	
Expert Coupling	How interaction and experience accumulate to support cognitive performance in tasks.
Cultural Heritage	How cultural aspects provide a landscape to support cognitive action.
+Semantics of Body	How positions of artefacts influence and evolve to support cognition.
+Continuity	Links between tasks, events, and artefacts support sense-making and cognition.
+Mutual Adaptation	How individuals and the environment co-adapt and how individuals and teams utilize artefacts to adapt for task completion.



Use-cases for DiCoT

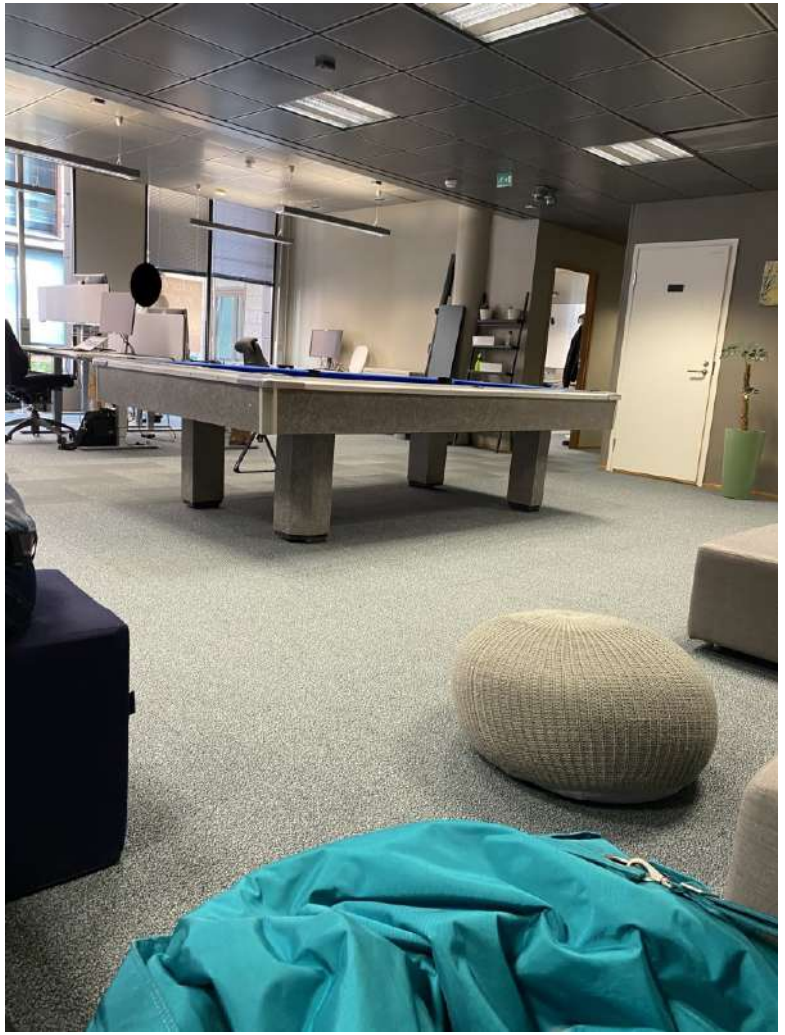
- Studying the use of infusion devices in operating theatres (Berndt et al., 2014)
- Patient Safety (Furniss et al., 2019; Garfield et al., 2020)
- Ambulance Control Room (Furniss & Blandford, 2010)
- Collaborative Learning (Vasiliou, 2017)
- Simulation-based team training (Rybing et al., 2015)
- Infection Control (Hussain & Weibel, 2016)
- Designing teamworking systems (Furniss & Blandford, 2006)
- Blood Glucose meter usage (Furniss et al., 2015)
- Health informatics (Furniss et al., 2019)

Hybrid Work through the lens of Distributed Cognition – case Gofore Oyj (Merilehto & Riihikoski, 2022)

- **Digital transformation company**, at the time had around 800 employees
- **Multiple offices in Finland** and abroad

- Essentially a ***Cognitive Ethnography*** **at Gofore Oyj**

- 14 days of **field observations** at 4 locations
- 6 months of **virtual ethnography** (see: Hine, 2000)



Example: Hohto - Cognitive Artefact

“If there is no coordination that enables dynamic configuration, there is no distributed cognitive system at all.”

Hollan et al. 2000, p. 175

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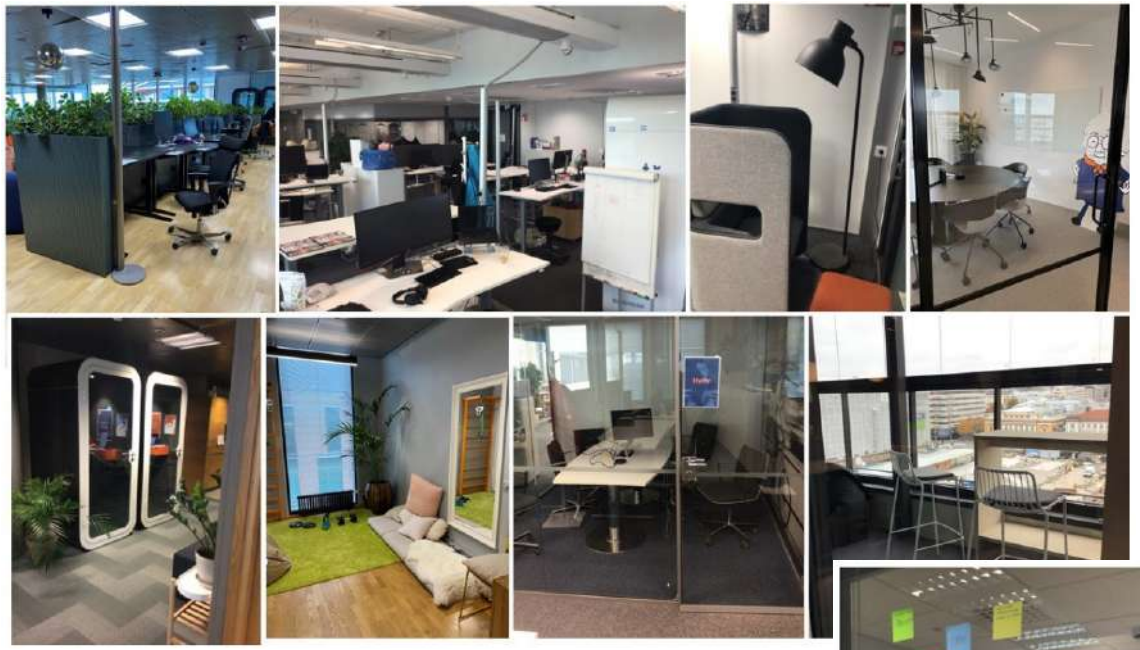
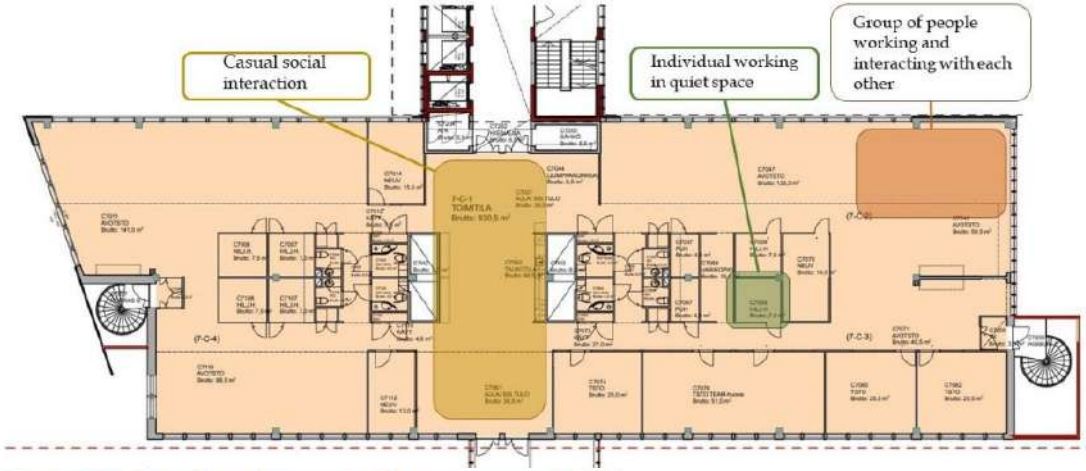
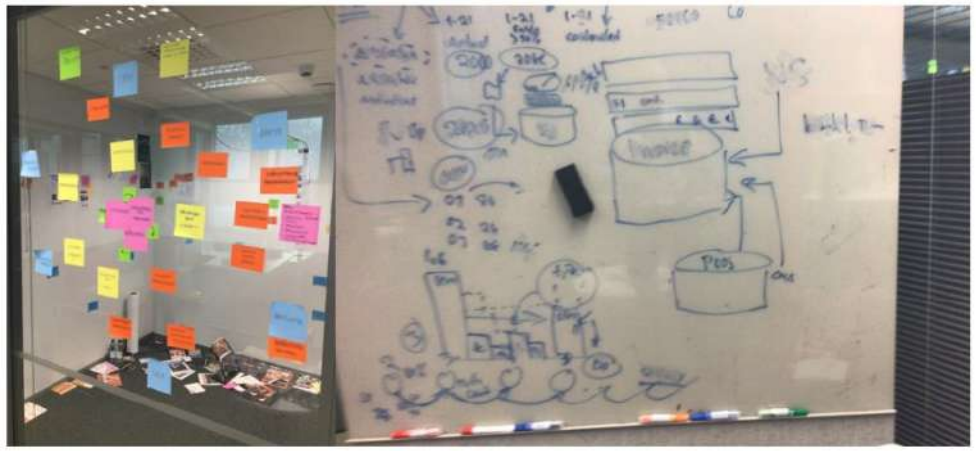
Example: Physical Layout – Cognitive Niches







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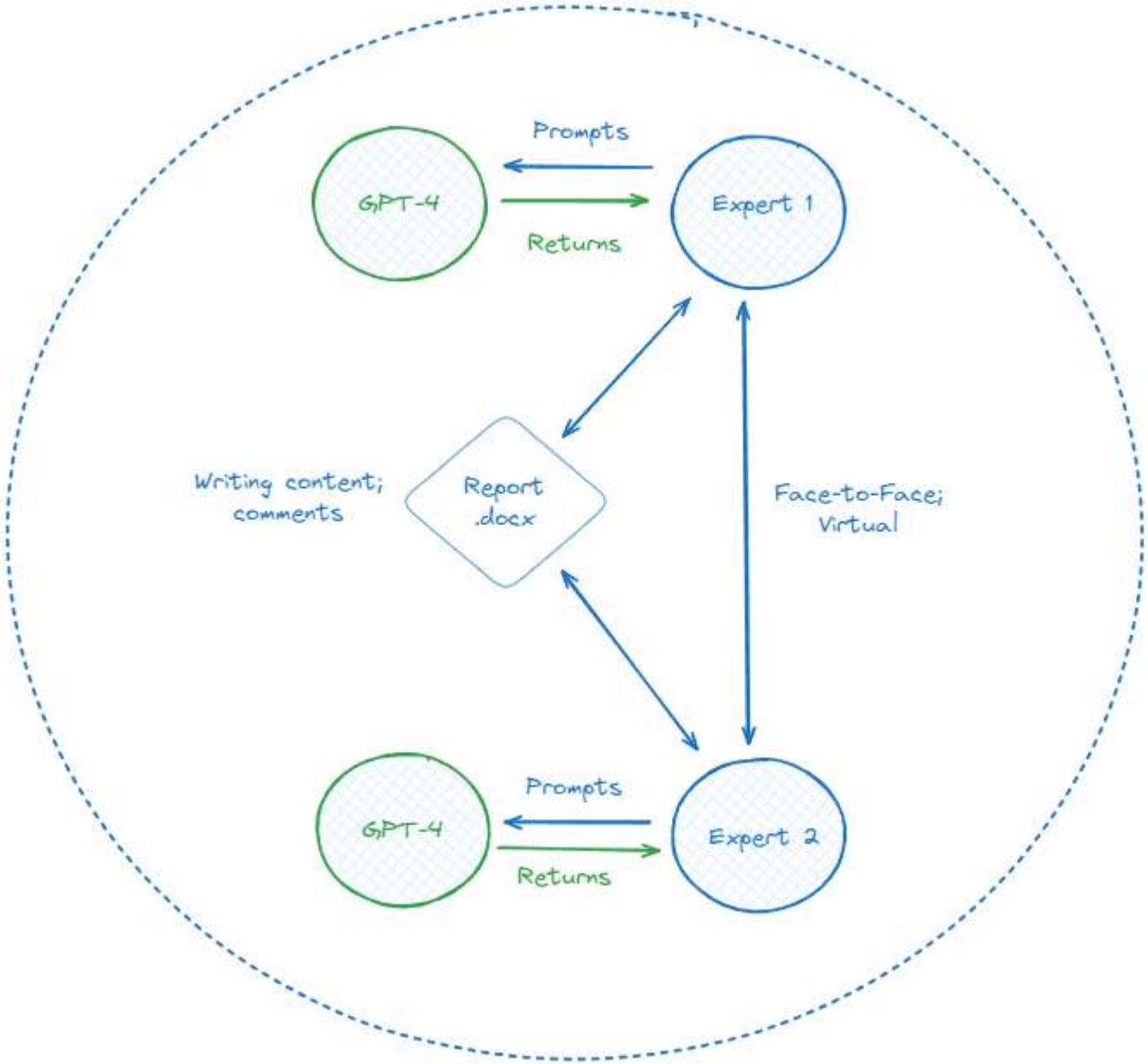
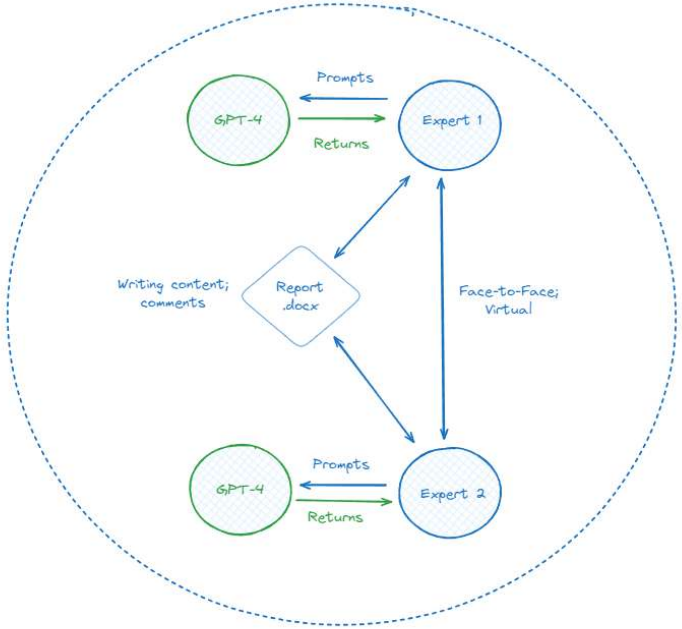


Welfare region:
Experts + LLMs as a Distributed Cognitive System



Outsourcing “critical” cognitive functions to LLM’s

- Negative effects on individual cognition?
- Positive effects on system-level cognition?

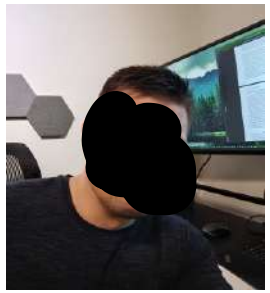
How is cognition distributed in context X?

Task: Reflect a situation/context through the lens of Distributed Cognition.

Supporting questions:

- What system(s) can you perceive?
- Are you part of a Distributed Cognitive System?
- How does cognition distribute in that system?
- Is there an emphasis on some aspect? i.e., social, artefacts, etc.

Distributed Cognition – This course



Time (hours, days)

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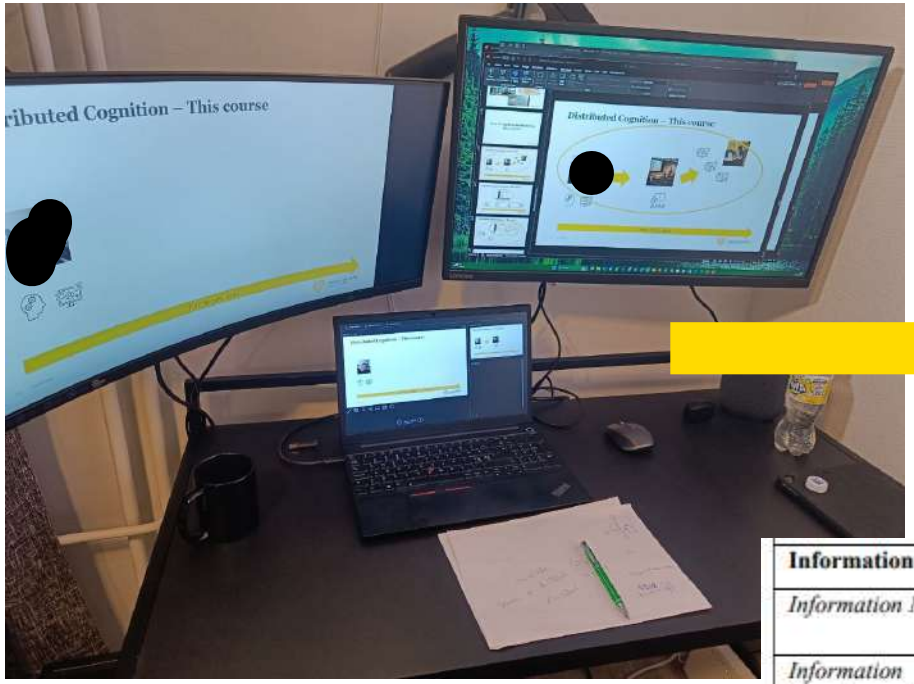

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Distributed Cognitive System – This course

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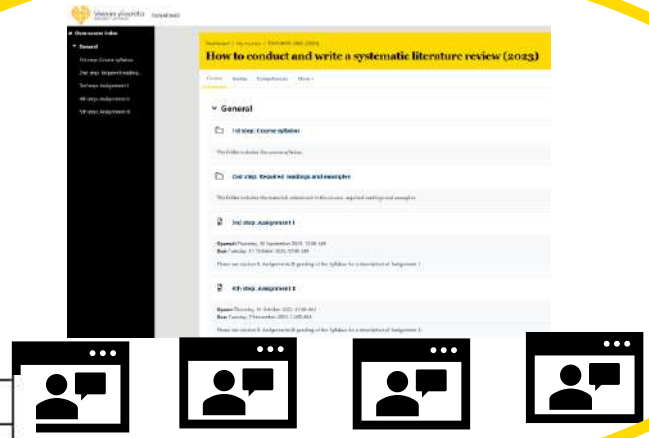

Time (weeks, months)

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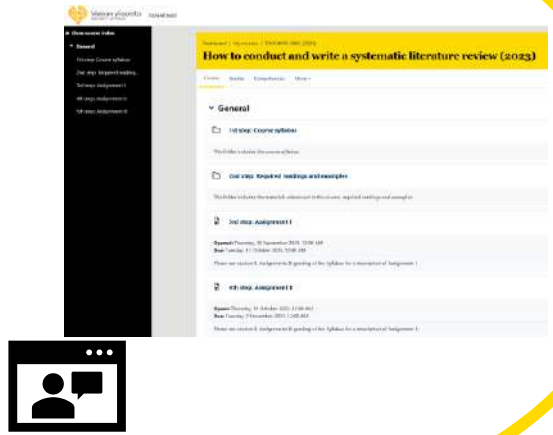
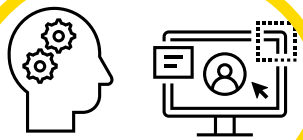
Distributed Cognitive System – This course

Macro

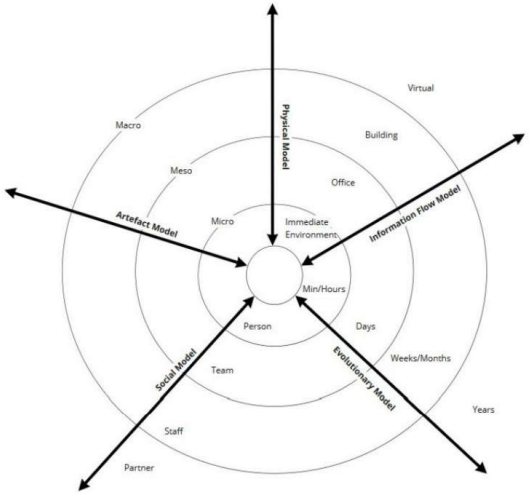
Meso





Micro

Where do you draw the boundaries?



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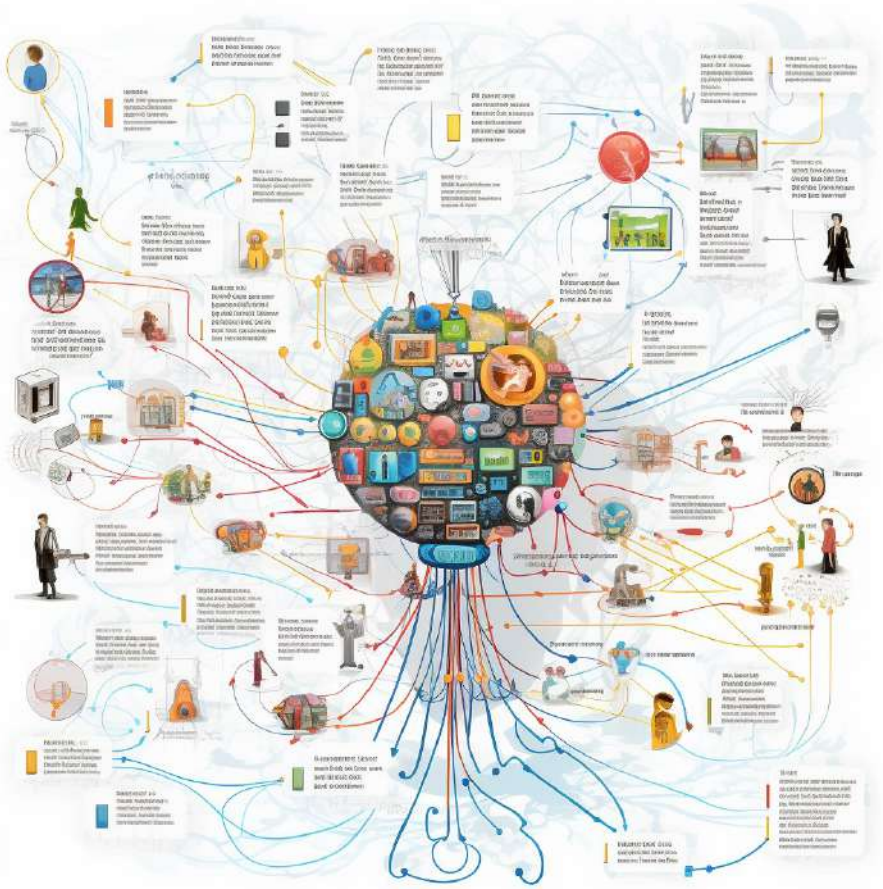
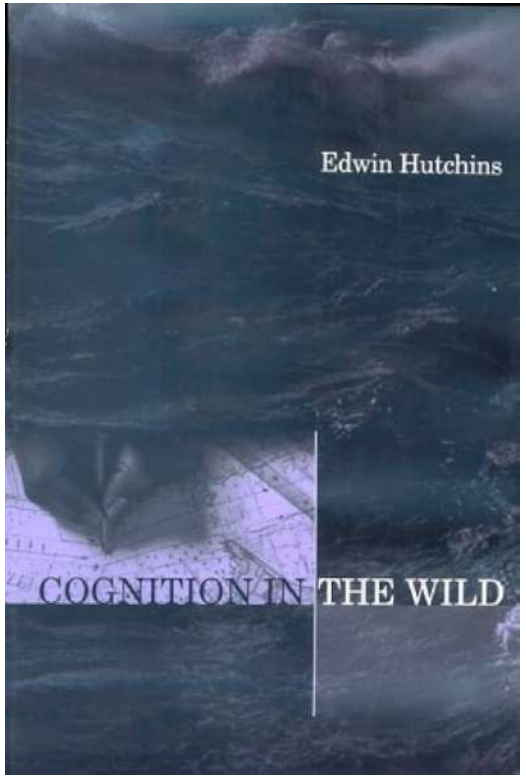
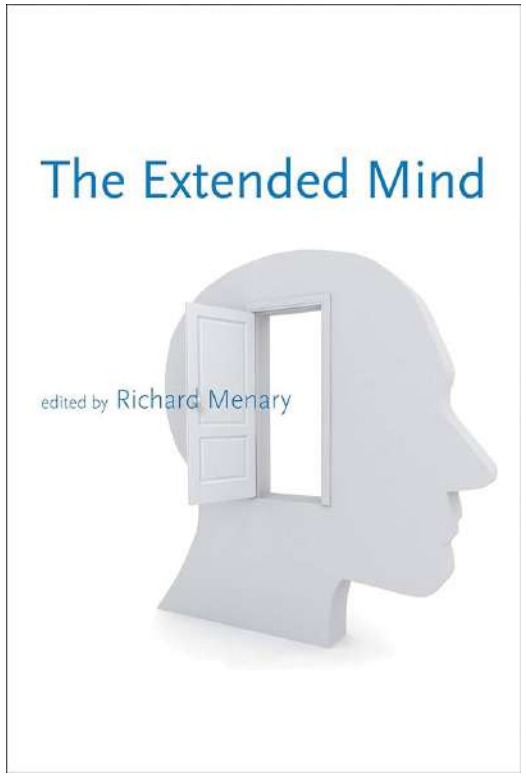
Questions & Comments

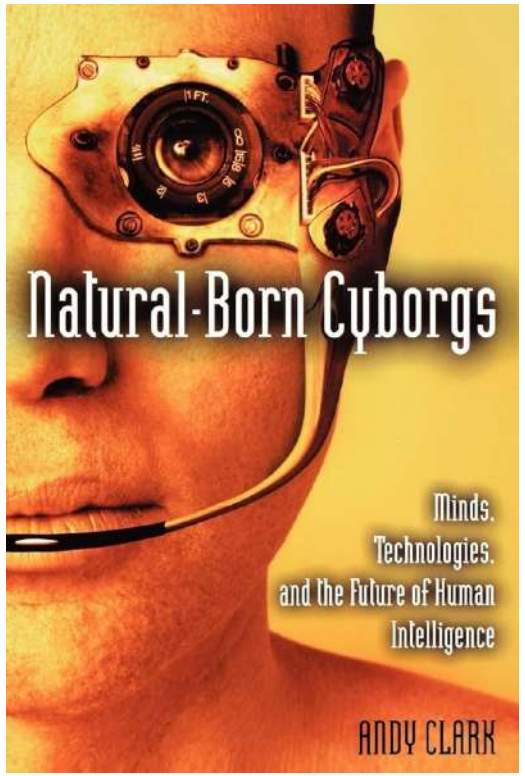


Recommended reading – you can also email me for these

Clark & Chalmers, 1998







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See the interview of Andy Clark – Extended Mind

- https://www.youtube.com/watch?v=kc-TdMjuJRU

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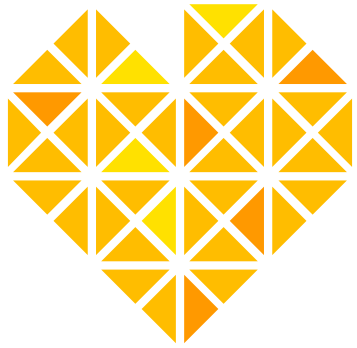

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