


Shared Understanding within Military Coalitions: A Definition and Review of Research Challenges

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Focus Topics

- ▶ What do we mean by terms such as ‘understanding’ and ‘shared understanding’ (SU)?
 - ▶ What is the relationship between shared situation awareness (SSA), shared mental models (SSA) and shared understanding?
 - ▶ Do notions of understanding apply to synthetic agents?
 - ▶ Are there multiple kinds of shared understanding?
 - ▶ What are the research challenges associated with shared understanding research?
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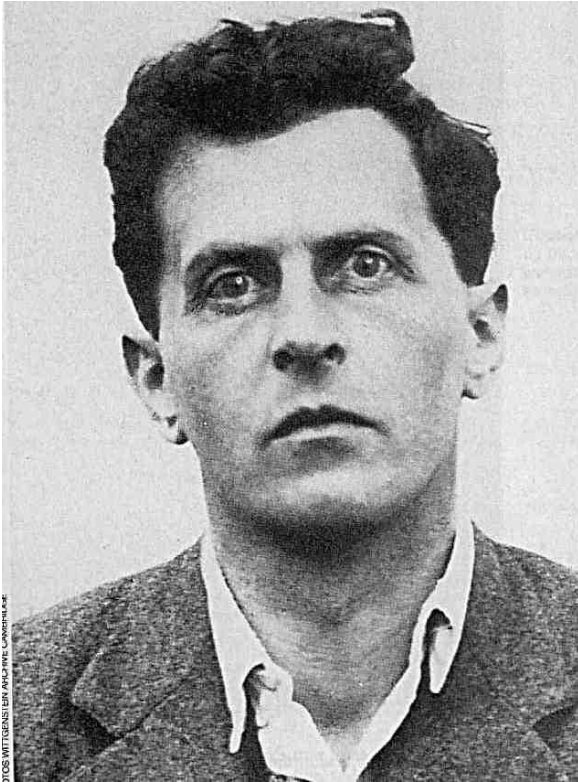
Understanding

- ▶ In order to derive a definition of SU we need to look at the notion of ‘understanding’
- ▶ What do we mean by ‘understanding’?
 - how is the term used in the scientific and philosophical literature?
 - understanding of sensory stimuli (perception)
 - understanding of intentional actions
 - situation understanding
 - language understanding

Sensory Sensemaking

- ▶ Perception is a form of understanding:
 - “To see one must have visual impressions that one understands”
(Noe, 2004; pg. 6)
- ▶ Conscious experiences result from knowledge of ‘sensorimotor dependencies’
- ▶ Perception is a form of understanding that is grounded in our knowledge about the way sensory stimuli change as a result of (self-generated) movement
- ▶ Some forms of understanding may therefore be constituted by predictive abilities

Language Understanding



- ▶ Wittgenstein
 - understanding is a kind of ability
 - understanding is described as “meaning in use”
 - distinction between ‘occurrent’ and ‘dispositional’ forms of understanding
 - ability-based view of understanding rejects the notion of dispositional forms of understanding

Understanding – A Definition

- ▶ Definition:

Understanding is an ability to exploit bodies of causal knowledge (i.e. knowledge about the antecedents and consequents of particular phenomena) for the purpose of accomplishing cognitive and behavioural goals.

- ▶ Understanding comprises an ability to establish (veridical?) expectations and explanations about events, situations, actions and system states
- ▶ Does this definition cover all forms of understanding, e.g. language understanding?

Understanding vs. MMs

- ▶ **Mental Models (MMs):**

“...mechanisms whereby humans are able to generate descriptions of system purpose and form, explanations of system functioning and observed system states, and predictions of future system states” (Rouse & Morris, 1986)
- ▶ Notion of mental models is clearly related to our notion of understanding
- ▶ MMs can be cast as an **enabling mechanism** for understanding
- ▶ MMs support the generation of behaviour warranting the ascription of understanding to a system

Understanding vs. SA

- ▶ Situation Awareness (SA)

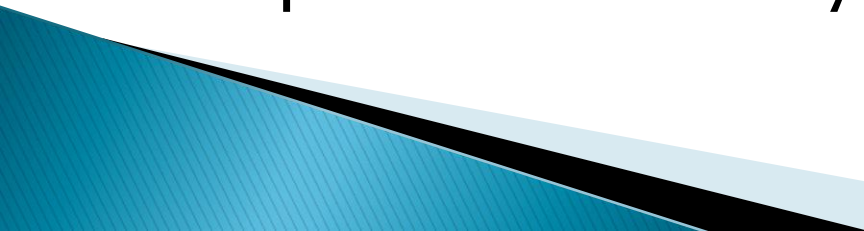
“...the perception of the elements in the environment within a volume of space and time, the comprehension of their meaning and the projection of their status in the near future.” (Endsley, 1995)

- ▶ Comprehension and projection seem relevant to our notion of understanding
- ▶ One possibility is that ‘understanding’ is subsumed by the notion of SA...
- ▶ ...but couldn't one could be ‘aware’ of situation-relevant information without necessarily understanding it?

Shared Understanding (1)

- ▶ Definition:

Shared understanding is the ability of multiple agents to exploit common bodies of causal knowledge for the purpose of accomplishing common (or shared) goals.

- ▶ Entails commitment to ability-based view of understanding
 - ▶ Does shared understanding imply commonality of response output?
 - ▶ In some situations we may expect individuals with shared understanding to behave in similar ways, e.g. to provide common explanations for system behaviour...
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Shared Understanding (2)

- ▶ ...but **coordination** of cognitive/behavioural responses seems equally important:
 - Shared understanding is the ability of multiple agents to coordinate their behaviours with respect to each other in order to support the realization of common goals or objectives.
- ▶ Each agent may have to take different actions
- ▶ Response output needs to be adaptive
- ▶ Therefore we need definitions of SU that are sensitive to the possibility of **both** common and adaptive ('synchronized') behaviours

SU, SSA and SMMs

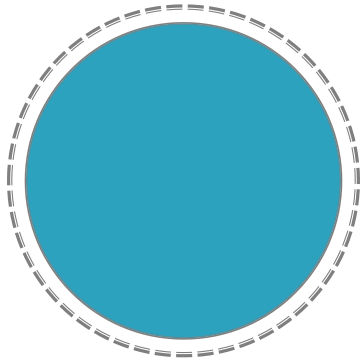
- ▶ Shared Mental Models (SMMs)
 - mental models possessed by multiple individuals
 - enable individuals to anticipate one another's information requirements
 - SMMs may provide a **realizing mechanism** for shared understanding
 - ...however, similarity of SMMs is **not required** for shared understanding!
- ▶ Shared Situation Awareness (SSA)
 - may be important to discriminate a shared awareness of information from the abilities that *constitute* shared understanding

Machine Understanding

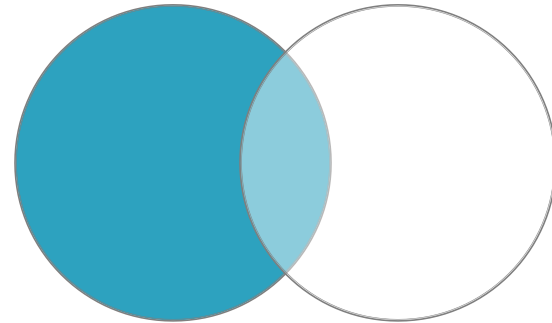
- ▶ Can synthetic agents ever be said to understand?
- ▶ Searle's Chinese Room:
A symbol processing machine can never properly be said to understand anything, irrespective of its overt behaviour (abilities).
- ▶ Argument seems to be based on a strong constitutive role for 'feeling' in understanding
- ▶ Stevan Harnad – “thinking is feeling”
- ▶ But can this argument really be made to work?



Forms of Shared Understanding



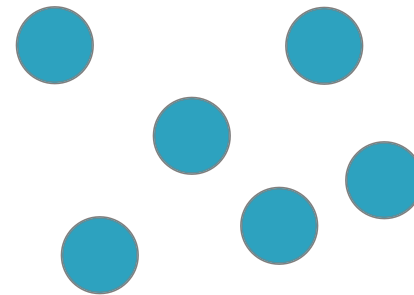
Identical Understanding



Similar Understanding




Complementary Understanding



Distributed Understanding

Issues for Future Research

- ▶ How should SU be measured?
 - ▶ Are understanding and SU unitary constructs?
Can a single definition cover all forms of understanding (or at least multiple uses of the term)?
 - ▶ What factors contribute to (or undermine) SU?
 - ▶ Is SU *always* desirable?
 - ▶ How does SU relate to group performance outcomes?
 - ▶ Who (or what) shares understanding?
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Conclusion

- ▶ SU is defined as:
 - ...the ability of multiple agents to exploit common bodies of causal knowledge for the purpose of accomplishing common (or shared) goals.
- ▶ Commonality of response output is not necessary for SU
- ▶ SU entails the adaptive coordination of behaviours to accomplish common objectives
- ▶ No principled reason to restrict the notion of understanding to human agents
- ▶ SU can be distinguished from SSA and SMM
- ▶ Lots of issues to resolve in future research!