

Unawareness In Multi-Agent Systems with Partial Valuations

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Summary

- Introduction: why awareness?

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- Related work

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- Agent awareness using partial valuations

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- Raising awareness

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⇒ Awareness

Partial
valuations
for DEL

[Jaspars and Thijsse, 1996]

Related Work

Partial
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Awareness
logic

[Fagin and Halpern, 1987]

Related Work


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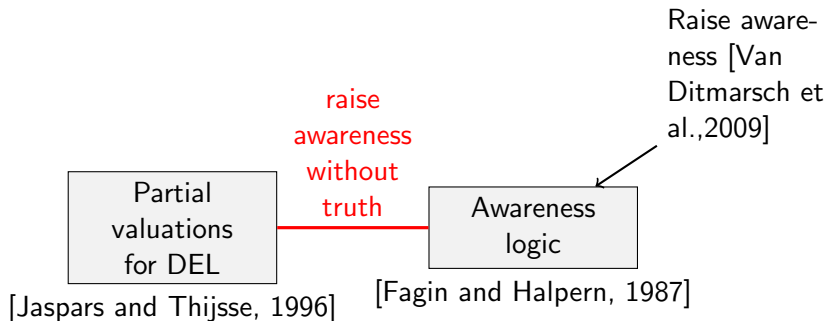
Awareness
logic

[Fagin and Halpern, 1987]

Raise aware-
ness [Van
Ditmarsch et
al.,2009]



Related Work



⇒ Becoming **aware of a proposition** and learning **its truth** value are two different acts

Unawareness with Partial Valuations

- Partial valuations allow propositions to be true, false or **undefined**

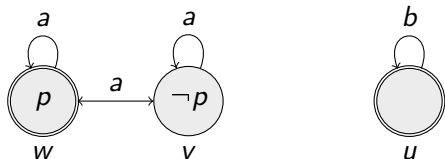
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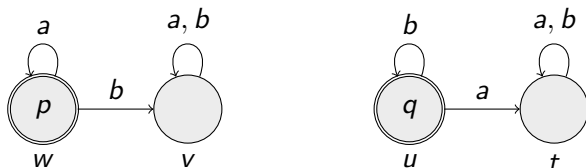
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Unawareness with Partial Valuations

- Partial valuations allow propositions to be true, false or **undefined**
- Agents can be uncertain and **unaware** about p
- Allowing agents to have different knowledge representations about the world

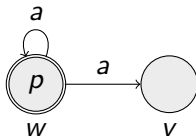


Properties of awareness

Agent awareness is preserved over accessibility:

Properties of awareness

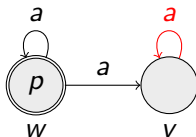
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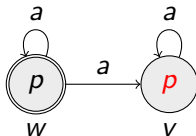
- Weak reflexivity



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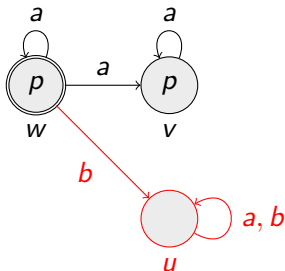
- Weak reflexivity
- Consideration consistency



Properties of awareness

Agent awareness is preserved over accessibility:

- Weak reflexivity
- Consideration consistency
- Specification



- Verification and falsification

$$\begin{array}{ll} \mathcal{M}, w \models \neg\phi & \text{iff } \mathcal{M}, w \not\models \phi \\ \mathcal{M}, w \not\models \neg\phi & \text{iff } \mathcal{M}, w \models \phi \end{array}$$

Semantics

- Verification and falsification
- Conjunction false iff both conjuncts defined

$$\mathcal{M}, w \models \phi \wedge \psi \quad \text{iff} \quad \mathcal{M}, w \models \phi \text{ and } \mathcal{M}, w \models \psi,$$
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Semantics

- Verification and falsification
- Conjunction false iff both conjuncts defined
- Knowledge and belief

$$\mathcal{M}, w \models K_a \phi \quad \text{iff} \quad \forall v \text{ s.t. } w \sim_a v : \mathcal{M}, v \models \phi$$

$$\mathcal{M}, w \models B_a \phi \quad \text{iff} \quad \forall v \text{ s.t. } w \rightarrow_a v : \mathcal{M}, v \models \phi$$

$$\mathcal{M}, w \models \neg K_a \phi \quad \text{iff} \quad \exists v \text{ s.t. } w \sim_a v : \mathcal{M}, v \models \neg \phi$$

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Where \sim_a and \rightarrow_a are defined as “all accessible worlds with reflexivity” and “most plausible worlds with reflexivity”.

- Verification and falsification
- Conjunction false iff both conjuncts defined
- Knowledge and belief
- Raise awareness

$$\mathcal{M}, w \models [+p]\psi \quad \text{iff} \quad \mathcal{M}^{+p}, w \models \psi$$

$$\mathcal{M}, w \not\models [+p]\psi \quad \text{iff} \quad \mathcal{M}^{+p}, w \not\models \psi$$

Raising awareness

Raise awareness of p :

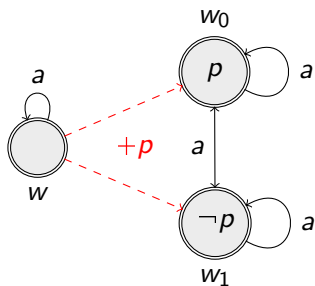
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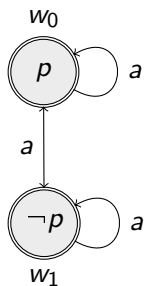
Raising awareness

Raise awareness of p : $+p$



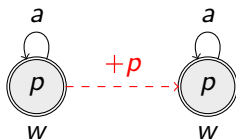
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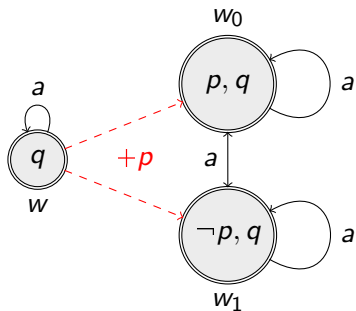
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- Agents raise their awareness when needed
- Alignment Repair Game [Van den Berg, Atencia and Euzenat, 2020]
- Full awareness is not a necessary condition for successful communication
- Forgetting awareness

Thank you!