

Logical Dynamics of Speech Acts

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1. Development of DMEDL⁺

Definition 1 Take a countably infinite set Aprop of proposition letters and a finite set I of agents, with p ranging over Aprop and i, j, k over I . The language of Multi-agent Epistemic Deontic Logic MEDL is given by:

$$\varphi ::= \top \mid p \mid \neg\varphi \mid (\varphi \wedge \psi) \mid K_i\varphi \mid O_{(i,j,k)}\varphi$$

Intended reading

$O_{(i,j,k)}\varphi$ It is obligatory for the agent (obligor) i with respect to the agent (obligee) j by the name of the agent k to see to it that φ .

Definition 2 Take a countably infinite set Aprop of proposition letters and a finite set I of agents, with p ranging over Aprop and i, j, k over I . The languages of Dynamified Multi-agent Epistemic Deontic Logic DMEDL⁺ is given by:

$$\begin{aligned} \varphi & ::= \top \mid p \mid \neg\varphi \mid (\varphi \wedge \psi) \mid K_i\varphi \mid O_{(i,j,k)}\varphi \mid [\pi]\varphi \\ \pi & ::= \text{Command}_{(i,j)}\varphi \mid \text{Promise}_{(i,j)}\varphi \mid \text{Request}_{(i,j)}\varphi \mid \text{Assert}_{(i,j)}\varphi \end{aligned}$$

Intended reading

$[\pi]\varphi$ Whenever an act of type π is performed, φ holds in the resulting situation.

$\text{Command}_{(i,j)}\varphi$ The type of i 's acts of commanding j to see to it that φ .

$\text{Promise}_{(i,j)}\varphi$ The type of i 's acts of promising j that i will see to it that φ .

$\text{Request}_{(i,j)}\varphi$ The type of i 's acts of requesting j to see to it that φ .

$\text{Assert}_{(i,j)}\varphi$ The type of i 's acts of asserting to j that φ .

Semantics

An epistemic deontic model $\mathcal{M} = \langle W^M, \{E_i^M : i \in I\}, \{O_{(i,j,k)}^M : i, j, k \in I\}, V^M \rangle$ includes an epistemic accessibility relation E_i^M for each agent $i \in I$ and a deontic accessibility relation $O_{(i,j,k)}^M$ for each triple (i, j, k) of agents $i, j, k \in I$. Truth definition for the languages of MEDL and DMEDL⁺ is given with reference to the class of epistemic deontic models.

Theorem 1 There are complete axiomatizations of MEDL and DMEDL⁺ with respect to the class of epistemic deontic models.



2. Some Illocutionary Acts in DMEDL⁺

Though not without exceptions, acts of [C]ommanding, [P]romising, [R]equesting, and [A]sserting [U]sually [G]enerate [O]bligations. Note that different obligations are generated by different kinds of acts.

Proposition 1 (CUGO Principle, Yamada 2007) If φ is a formula of MEDL and is free of occurrences of the modal operators of the form $O_{(j,i,i)}$, the following formula is valid:

$$[\text{Com}_{(i,j)}\varphi]O_{(j,i,i)}\varphi .$$

Proposition 2 (PUGO Principle, Yamada 2008) If φ is a formula of MEDL and is free of occurrences of the modal operators of the form $O_{(i,j,i)}$, the following formula is valid:

$$[\text{Prom}_{(i,j)}\varphi]O_{(i,j,i)}\varphi .$$

Proposition 3 (RUGO Principle, Yamada 2011) If φ is a formula of MEDL and is free of occurrences of the modal operator of the form $O_{(j,i,i)}$, the following formula is valid:

$$[\text{Req}_{(i,j)}\varphi]O_{(j,i,i)}(K_i O_{(j,i,i)}\varphi \vee K_i \neg O_{(j,i,i)}\varphi) .$$

Proposition 4 (AUGO Principle Yamada 2016) If φ is a formula of MEDL and is free of occurrences of the modal operators of the form $O_{(i,j,i)}$, the following formula is valid:

$$[\text{assert}_{(i,j)}\varphi]O_{(i,j,i)}O_{(j,i,i)}K_j\varphi .$$

The Plan

I will explore the logical dynamics of utterance-context interaction by extending and/or revising DMEDL⁺ with inputs from other researchers.