

## el.1 Public Announcement Logic

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Dynamic epistemic logics allow us to represent the ways in which agents' knowledge changes over time, or as they gain new information. Many of these represent changes in knowledge using informational *events* or *updates*. The most basic kind of update is a public announcement in which some formula is truthfully announced and all of the agents witness this taking place together. To do this, we expand the language as follows

**Definition el.1.** Let  $G$  be a set of agent-symbols. The basic language of multi-agent epistemic logic with public announcements contains

1. The propositional constant for **falsity**  $\perp$ .
2. The propositional constant for **truth**  $\top$ .
3. A **denumerable** set of **propositional variables**:  $p_0, p_1, p_2, \dots$
4. The propositional connectives:  $\neg$  (negation),  $\wedge$  (conjunction),  $\vee$  (disjunction),  $\rightarrow$  (**conditional**)
5. The knowledge operator  $K_a$  where  $a \in G$ .
6. The public announcement operator  $[\psi]$  where  $\psi$  is a **formula**.

The public announcement operator functions as a box operator, and our inductive definition of the language is given accordingly:

**Definition el.2.** **Formulas** of the epistemic language are inductively defined as follows:

1.  $\perp$  is an atomic **formula**.
2.  $\top$  is an atomic **formula**.
3. Every propositional variable  $p_i$  is an (atomic) **formula**.
4. If  $\varphi$  is a **formula**, then  $\neg\varphi$  is a **formula**.
5. If  $\varphi$  and  $\psi$  are **formulas**, then  $(\varphi \wedge \psi)$  is a **formula**.
6. If  $\varphi$  and  $\psi$  are **formulas**, then  $(\varphi \vee \psi)$  is a **formula**.
7. If  $\varphi$  and  $\psi$  are **formulas**, then  $(\varphi \rightarrow \psi)$  is a **formula**.
8. If  $\varphi$  and  $\psi$  are **formulas**, then  $(\varphi \leftrightarrow \psi)$  is a **formula**.
9. If  $\varphi$  is a **formula** and  $a \in G$ , then  $K_a\varphi$  is a **formula**.
10. If  $\varphi$  and  $\psi$  are **formulas**, then  $[\varphi]\psi$  is a **formula**.
11. Nothing else is a **formula**.

The intended reading of the formula  $[\varphi]\psi$  is “After  $\varphi$  is truthfully announced,  $\psi$  holds. It will sometimes also be useful to talk about common knowledge in the context of public announcements, so the language may also include the common knowledge operator  $\mathsf{C}_G\varphi$ .

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## Bibliography