Referee’s report on

“Logics of Communication and Change”
by J. van Benthem, J. van Eijck, and B. Kooi
submitted to Information and Computation

Review: The paper deals with dynamic epistemic logics with common knowledge. Section 2 presents the logic of public announcements PAL and its extension with common knowledge operator PAL-C. Then the authors introduce a new operator of relativized common knowledge $C_B(\varphi, \psi)$ with intended meaning ‘after the public announcement of $\varphi$ it will become common knowledge amongst the agents in $B$ that $\psi$ was the case before the announcement’. This operator is expressible in PDL with test. A proof system for the epistemic logic extended with this operator EL-RC is provided and a completeness proof is sketched. Its extension PAL-RC is shown to be syntactically reducible to EL-RC, and therefore equally expressible. Then, model comparison games for EL-RC and for PAL-C are introduced and proved to capture the respective logical equivalences. These games are used to show that EL-RC is strictly more expressive than PAL-C, and complexity of model and satisfiability checking for these logics is briefly discussed. Section 3 consists of some examples and a narrative discussion of epistemic update models. Section 4 contains the main contributions of the paper. It introduces a new logic of communication and change LCC, which is an extension of PDL+test with a new operator for update execution $[U,e]\varphi$. LCC is shown to be non-trivially reducible to Epistemic PDL, both having the same expressive power. Then, a complete axiomatic system for LCC is obtained by adding reduction axioms to PDL. In Section 5 some types of communication are analyzed with LCC. The paper ends with concluding remarks and discussion of further work.

Comments:
The paper is well-written and well-motivated. I find the topic interesting and important, and, albeit somewhat off the publication profile of the journal, certainly relevant to its aims and scope.

Some suggestions:

- As far as I could check (not in every detail), the results are correct, but some proofs are rather terse (e.g. Lemma 1) with missing essential details, while others, in Section 4, are too technical. The technical proofs should stay, as these are the really new results in the paper, but I would suggest that, to improve readability, the authors give outlines of these proofs in the main text, and defer the technicalities to an appendix.

- Given that EL-RC can be embedded in PDL with test, and the known complexity results for the former match those of the latter, the authors should discuss why the fragment EL-RC should be preferred.

- Section 3 is rather loosely related to section 2. Should it not be moved to/after the introduction?
• References [4,6,7,12] are manuscripts; please update or give access details. Likewise for the tech. report [19].

• The following reference seems to me appropriate to be mentioned: Heikki Tuominen, Translations from Epistemic into Dynamic Logic. ECAI 1988: 586-588.

Some corrections:

• p.1, middle: Explain briefly the meaning of the operator $\phi$ here.

• The languages are assumed to have a finite number of propositional variables. This number may affect the expressiveness of the logic, especially depending on the number of agents.

• p.5, Remark: ‘...dynamic...’

• p.6, line 8: you should add some details. line 10: 'We can show that...' This is not obvious, actually it is a major syntactic step in the proof, so you should at least sketch it.

First paragraph of section 2.5: edit the sentence ‘Note that this holds ...’

• p.7, line 7: it seems the reference to a Lemma 2 here is inaccurate, and actually redundant.

• p.8, the $[\varphi]$-move clause: define $\overline{S}, \overline{S'}$.

• p.9, Def 13, R: redundant pair of parentheses.

• p.9, line -9: what does it mean ‘the Duplicator does not move at all’?

• p.10, line -8: remove a ( and reverse the arrow in this definition.

• p.11-12, Def. 14, 15: the pairs $(u, s_m)$ and $(u, t_m)$ indicated on the pictures are missing in the definition of $R$.

• p.11, Lemma 4: the statement of the lemma should be corrected, as $m - \min(x, y) \leq 0$. Check also the last paragraph of the proof. Likewise in Lemma 5 on p.12.

• p.12, Def 15: correct to $0 \leq n \leq m$. Also, use different notation for these models, to avoid confusion with those defined in Def 14.

• p.13, Lemma 6, Proof: give reference.

• p.18: Def.18 introduces update models and events, while Def. 20 refers to action models and action states. Reconcile.

• p.21, proof of Thm 9: $R$ is a bad notation for a bisimulation, easily confused with an accessibility relation.
• p.26, Def. 27: define/recall the notation $p^{\text{sub}(c)}$.

• p.27, line -8: ‘...live inside...’

• p. 31, second last bullet: can you support ‘...we have a proof that...’ with a reference?

• p. 31, line -2: something is wrong with this reduction formula.

• p. 32, line 3: any reference here? p.32, middle: I do not understand the sentence ‘In the setting of . . . ’. Edit, please.

**Recommendation:** I recommend publication in Information and Computation after due revision.