The modal analysis of *fog*

The idea that future morphemes are not only used to make predictions, but also as an equivalent of the epistemic *must* cross-linguistically is not new in the literature (see Giannakidou and Mari 2016).

> (1) *Context: I see a wet umbrella.*
>
> | *Deve* | *star/* | *starà* | piovendo. | (*Italian*) |
> |---|---|---|---|---|
> | Must.PRES.3SG | be | be.FUT.3SG | rain.GERUND. | |
>
> 'It must be raining.'
>
> Giannakidou and Mari (2018:6)

In (1), future and epistemic necessity modals pattern up in being nonveridical, and neither is compatible with knowledge of *p* (Giannakidou and Mari(2018:7)). The literature on the Hungarian future morpheme *fog* 'will, going to' treats it as future tense (see Lotz (1962)), a future morpheme that is "*not always void of modal shades*" (Csató 1994:240), or as a modal operator that can only take a metaphysical modal base (Palffy-Muhoray (2016)). The idea that it can express epistemic modality has only been considered but rejected by Palffy-Muhoray (2016). I argue that *fog* can express epistemic modality and it is no exception to the hypothesis that future morphemes can have epistemic interpretation cross-linguistically (Giannakidou and Mari (2016)). This is one of the reasons why the formal semantic analysis Palffy-Muhoray (2016) provides cannot account for the various uses of *fog*.

> (2) The lexical entry of fog provided by Palffy-Muhoray (2016) (*to be reconsidered*)
>
> $[\![FOG]\!] = \lambda P \lambda i \lambda w. \forall w'[w' \in Best(MB_M)(OS)(w)(now) \rightarrow AT(P,i,w')]$[1]

The other reason is that *fog* can be used in embedded contexts and it can have the *future in the past reading*. In my talk, I argue that the above mentioned features of *fog* must be considered when trying to give its formal representation.

In order to show that *fog* can express epistemic modality, and thus it can be equally acceptable in certain contexts as the future oriented, epistemic use of *kell* 'must', I conducted an online survey among native speakers of Hungarian. The participants were adult speakers of Hungarian (n=70). The questionnaire included 3 types of situations and the respondents had to evaluate the acceptability of three sentences (one containing *fog*, one containing *kell* 'must', and one containing the non-past) in each situation on a scale of 1 to 6 (1= totally unacceptable, 6=totally acceptable). In the case of the type 1 situations, the situation provided direct evidence that the proposition *p* is going to be true shortly after the utterance-time. In these situations, the non-past proved to be more acceptable than the use of *fog*[2], and the use of the epistemic *kell* 'must' was unacceptable (average: 2,97). Type 2 sentences were the ones in which the assertions were based on what the speaker knows about the world, thus they expressed epistemic modality. In these cases, I expected *fog* to be equally acceptable as the future oriented epistemic *kell* 'must'. I assumed the non-past cannot convey this meaning. The results proved these hypotheses. There was no statistically significant difference in the acceptability of *fog* and *kell* in this group[3], however, the non-past was significantly less acceptable than *fog*[4] and *kell*[5]. This result supports my claim that *fog* can have an epistemic meaning in certain contexts. In contexts where the speaker expresses the following, '*based on what I know about our world*

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[1] Best(MB_M)(OS) selects the most ideal worlds from the metaphysical modal base MB_M, given the ordering given by OS. *w* stands for our world and *now* is the time of speaking. The AT relation is defined by Condoravdi (2002).

[2] paired t-test t(551)=3.0241, p<0.05

[3] paired t-test: t(557)=1.4567, p>0.05

[4] paired t-test: t((557)=5.3134, p<0.05

[5] paired t-test: t(557)=6.7344, p<0.05

and my previous experiences p must be true some time after the utterance–time'. These propositions are subjective to a great extent because different speakers who know different facts and have different past experiences would make different predictions.

In the third-type situations, the predictions were based on past experiences and they entirely lacked factual support at the time of speaking. In this group, *fog* proved to be the most acceptable and the acceptability of *kell* and the non-past depended on the time adverbials they were used with.

	type 1	**type 2**	type 3
fog	4,52 (0,6)	**4,32 (0,34)**	4,72 (0,6)
kell	2,97 (0,79)	**4,55 (0,4)**	4,14 (0,84)
non-past	4,95 (0,18)	**3,59 (0,09)**	4,11 (1,34)

Table 1: The average and standard deviation of the averages of sentences containing *fog*, *kell* and the non-past in different contexts (type 1, type 2, type 3)

Moreover, *fog* can have *the future in the past* interpretation.

(3) Az-t   gondol-t-am,   hogy   a   csomag-om-(nak)
     That-ACC   think-PST-1SG   that   the   parcel-POSS.1SG-(DAT)
     meg   kell   érkez-ni-e/   meg   fog   érkez-ni   a   hét-en.
     PRT   must   arrive-INF-3SG   PRT   will   arrive-INF   the   week-ON
     'I thought that, my parcel had to/would arrive during the week.'

The sentence in (3) can mean that the event (*arriving of my parcel*) happens in the future of the past reference-time, but in the past of the utterance-time or it can mean that the event happens in the future of the utterance-time. However, in both cases, the sentence can be paraphrased as the following, '*given what I knew at the past salient reference time, it was necessary that my parcel arrives during the week*'. So that, in both cases, the worlds were generated in the modal base at the past reference-time and not at the utterance-time. The sentence cannot mean that '*given what I know, my parcel must arrive during the week*'. If we want to indicate that our epistemic state still has not changed, we need to add something like '*Még mindig ezt gondolom*' 'I still think that'. Palffy-Muhoray (2016)'s formal analysis cannot account for the meaning shown in (3), because in (2), the modal base must be formed at the utterance-time.

Therefore, (2) should be reconsidered[6] in a way it can account for both the epistemic reading of *fog* and the fact that it allows the *future in the past reading* (3).

(4) $[\![FOG]\!] = \lambda P \lambda i \lambda w . \forall w'[w' \in Best(MB)(OS)(w)(i) \rightarrow AT(P,(i,\infty),w')]$

Best(MB)(OS)(w)(i) represents the set of worlds in the modal base in our world *w* at *i* that are ranked as the most ideal ones given the ordering source *OS*. *Fog(P)* is true in *w* at *i* iff *P* holds some time after *i* ((i,∞)) in all the best worlds *w'* in the modal base (*MB*) according to the ordering source (*OS*).

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[6] Condoravdi (2002) defined the operator WOLL similarly, she includes [i,∞) which designates an interval with the initial subinterval and extends into infinity (Condorvadi (2002:71).