The use of alternatives in incremental processing

Theories of implicature and focus both make use of alternatives. For instance, quantity Implicature (QI) is derived by negating an alternative utterance [1], and focus particles like *only/also* are interpreted as an exhaustivity operator/presupposition trigger, with respect to sets of alternatives [2]. While alternatives play a crucial role in these theories, to date little is known about how comprehenders use alternatives in real time. Here we investigate whether comprehenders draw their visual attention to the depicted alternative when interpreting QI and *only*. Participants were presented with a visual display (fig.1). We tracked their eye movements while they listened to a two-sentence discourse in German. The target sentence was preceded by either an implicature sentence (1a) or an explicit sentence with *only* (1b). The interpretations of (1a) and (1b) are equivalent and spelled out in the target sentence. Because of German word order, the noun *die Torte* precedes the target action *nicht geschnitten*. Then during critical windows 'Sie hat' and 'die Torte', we predict that if participants rapidly compute QI and the meaning of *only*, their attention should be directed to the competitor, which is the representation of the alternative state, before being switched to the target, which is the representation of the implied/asserted state. In order to have a baseline against which to determine whether the representation of the alternative state influences participants' attention during critical windows, we included a condition containing *also* as in (2), where the target is the representation of both presupposed and alternative state, and the competitor is the opposite state. We predict more looks to the competitor in *QI* and *only* conditions than in *also* condition (baseline) during critical windows. In addition, there is no reason to predict any difference between *QI* and *only* conditions. Filler items were constructed to counterbalance the polarity of the target sentence and to minimize the effect of discourse relations like contrast and parallel (Table1).

QI condition	*Only condition*
(1) a. Mia hat die Banane geschaelt.	b. Mia hat nur die Banane geschaelt.
Mia has the banana peeled.	Mia has only the banana peeled.

Target sentence: Sie hat die Torte nicht geschnitten.
                   She has the cake not cut.

Also condition (2) Mia hat auch die Banane geschaelt. Sie hat die Torte geschnitten.
                        Mia has also the banana peeled.   She has the cake cut.

Results (n=22) showed that in *only* and *also* conditions participants anticipated the target by the offset of 'die Torte' ($p=.01$; $p=.02$), and in the *QI* condition, they anticipated the target 150ms after the onset of 'geschnitten' ($p<.01$). Comparing with the baseline, there were more looks to the competitor in *QI* than in *also* for both windows ($p=.02$; $p=.04$, *QI* Competitor vs. *Also* Competitor, fig.2), and looks to the competitor increased marginally faster in *only* than in *also* ($p=.053$, *Only* Competitor vs. *Also* Competitor, fig.2) in 'Sie hat' window. In addition, we found that there were more looks to the competitor in *QI* than in *only* for both windows ($ps<.01$, *QI* Competitor vs. *Only* Competitor, fig.2). In the *QI* condition, growth curve analysis suggested a marginally significant shift of attention to the target ($p=.06$) from 'Sie hat' onset to 'die Torte' offset. These results suggest that listeners make use of alternatives in real-time. The difference between *QI* and *only* is not predicted by formal theories, however, our results are in line with previous results on comparison between scalar implicature and *only* [3-4]. For example, [3] suggests a greater cost for QI might be due to more attention to context. Likewise, in our QI condition, the alternative could be represented as being under discussion.

[1] Geurts, B. (2010). Quantity implicatures. [2] M. Rooth. (1992). *Natural Lang Sem*, 1(1), 75-116. [3] Bott, L., Bailey, T., & Grodner, D. (2011). *J Mem Lang* 66, 123–142. [4] Marty, P., & Chemla, E. (2013). Frontiers in Psychology, 4, 1–12.

| Exp./ Filler	Condition	Number of items	Example
Exp.	Only	6	Mia hat nur die Banane geschaelt. Sie hat die Torte nicht geschnitten.
	QI	6	Mia hat die Banane geschaelt. Sie hat die Torte nicht geschnitten.
	Also	6	Mia hat auch die Banane geschaelt. Sie hat die Torte geschnitten.
Filler	Only	6	Mia hat nur die Torte nicht geschnitten. Sie hat die Banane geschaelt.
	QI	6	Mia hat die Banane nicht geschaelt. Sie hat die Torte geschnitten.
	Also	6	Mia hat auch die Banane nicht geschaelt. Sie hat die Torte nicht geschnitten.
	Ignorance	6	Mia hat die Banane nicht geschaelt. Ich weiß nicht, ob sie das andere erledigt hat.
	Ignorance	6	Mia hat die Torte geschnitten. Ich weiß nicht, ob er das andere erledigt hat.
	Total	48	
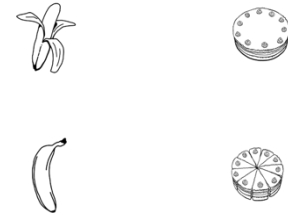
Table 1. Design and examples of experimental and filler sentences.
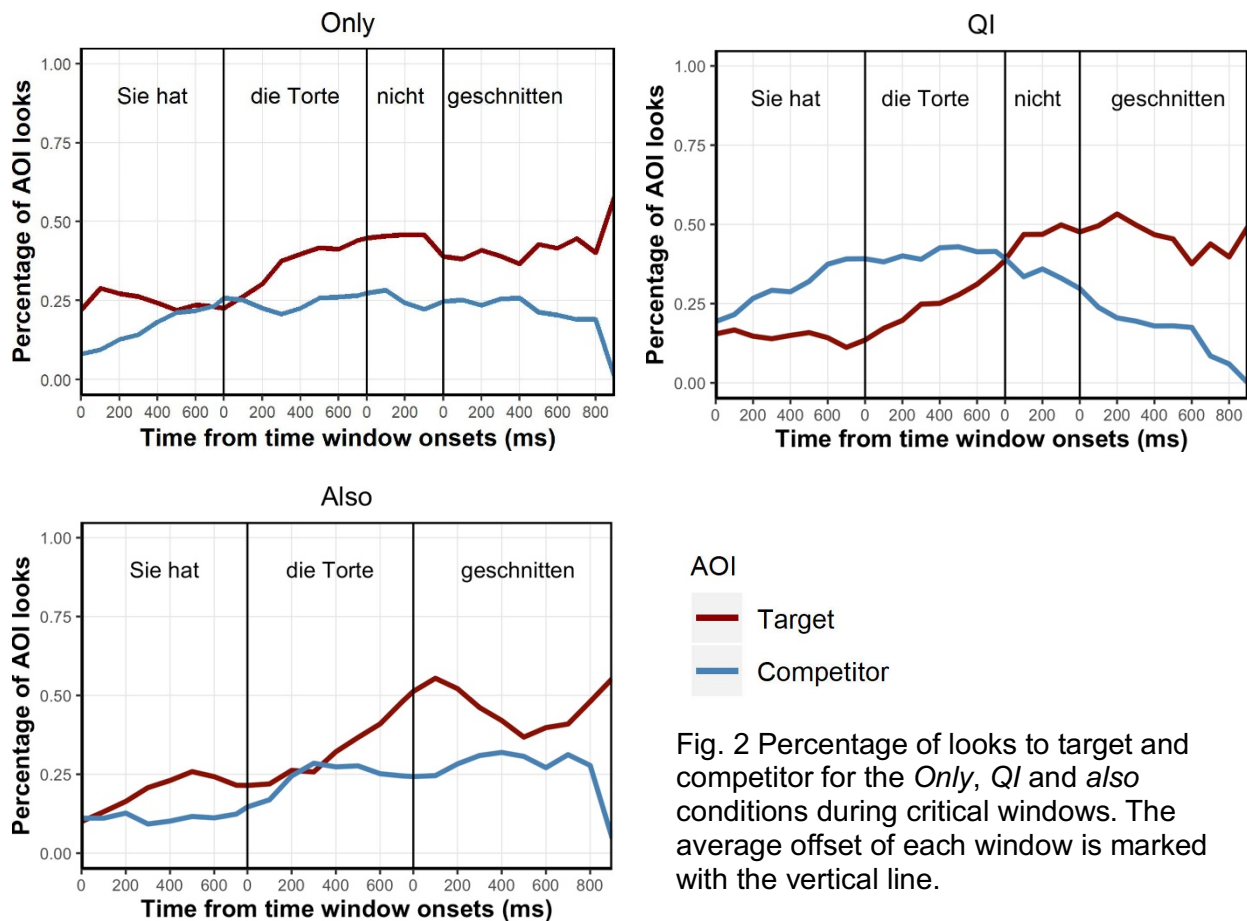
Fig. 1 Visual display

Fig. 2 Percentage of looks to target and competitor for the *Only*, *QI* and *also* conditions during critical windows. The average offset of each window is marked with the vertical line.