Presuppositions in the Scope of Quantifying Expressions: Eye Tracking Data

Introduction. Presuppositions are a component of meaning displaying distinct behavior from asserted content. A longstanding debate in the theoretical literature on presuppositions (PSPs) concerns the question of how sentences with a presupposition are interpreted when one of the presupposition triggers' arguments is bound by a quantifying expression. The theories proposed in Heim (1983) and Beaver (1992) are on the two extreme ends with regard to what a sentence like (1) might presuppose:

(1) Every nation cherishes its king.

Whilst Heim's theory predicts a universal presupposition (that every nation has a king), an existential presupposition is expected according to Beaver's account (that at least one nation has a king). Crucially, both theories do not discriminate between different quantifiers or presupposition triggers. This paper reports four Eye Tracking experiments with varying quantifiers (*each* and *one*) and PSP triggers (*again* and the definite article). The results reveal that different quantifiers lead to different processing patterns. We will show that this result isn't compatible with either Heim's or Beaver's theory. Finally, we suggest a quantifier-dependent analysis of the projection behavior of PSPs out of quantified statements which can be extended to other phenomena connected to presupposition projection.

Previous Work. In recent experimental work, Chemla (2009) investigated how the PSP triggered by *know* projects out of quantified expressions. The results of his offline study suggest that PSPs triggered in the nuclear scope of *each* and *none* generally lead to universal PSPs, while this is less clear for other quantifiers (*most, few, many, less than* x*, more than* x*, exactly* x). These results tell us that treating the projection of PSPs out of quantifying expressions as a unified phenomenon may not be the right way to go. However, they do not inform us about the time course in which interpretation proceeds. The projection out of quantified statements is a difficult matter which is even more complicated if we assume a mechanism like local accommodation to be standardly available. This means that there might be several ways to reach one and the same interpretation eventually. By asking for offline judgments, the final interpretation is all we get. However, in order to be able to discriminate between theories such as Heim's (1983) and Beaver's (1992), it is necessary to obtain more time sensitive measures to judge which difficulties the interpreter encounters during interpretation.

Experiment. Using eye tracking in reading, we investigated the processing of German sentences with the presupposition triggers *wieder* ('again') and the definite article in the scope of the quantifying expressions *jeder* ('each') and *eine/r* ('one').

We treated every quantifier-trigger combination (*jeder-wieder; jeder*-definite*; einer-wieder; einer*-definite) as one separate experiment with the two-level factor **Context** (*two of three* / *three of three*). The context varied in how many individuals possessed the presupposed property: *Two out of three* **C1** or *three out of three* **C2**.

C1: Sabine, Inge und Karin nehmen an einer Konferenz teil. Sabine und Inge haben neulich einen Laptop von ihrem Arbeitgeber bekommen, während Karin erst einen Laptop kaufen muss.
Sabine, Inge and Karin are at a conference. Sabine and Inge got a laptop from their employer recently, whereas Karin still has to buy a laptop herself.

C2: Sabine, Inge und Karin nehmen an einer Konferenz teil. Sabine und Inge haben neulich einen Laptop von ihrem Arbeitgeber bekommen, während Karin selbst einen Laptop kaufen musste.
Sabine, Inge and Karin are at a conference. Sabine and Inge got a laptop from their employer recently, whereas Karin had to buy a laptop herself.

Target:	Heute	hat	{jede/eine}	der	drei	Konferenzteilnehmerinnen	ihren	Laptop	in einer Sitzung
	Today	has	{each/one}	of.the	three	conference.attendees	her	laptop	in a session
	benutzt.								
	used								

Trigger	*again*				definite det.			
Quant.	*Each*		*One*		*Each*		*One*	
Context	*two/three*	*three/three*	*two/three*	*three/three*	*two/three*	*three/three*	*two/three*	*three/three*
First Pass (ms)	228.8	204.9	231	219.7	233	209.8	218.7	222.6

Table 1. Sig. differences: *each* – *again* ($|t| = 2.48$, $p < .05$) ; *each* – definite determiner ($|t| = 1.988$, $p < .05$)

In total, 28 items per experiment were designed. These were intermixed with 56 filler items (half of them being the items with the second quantifier and presupposition trigger). Sentences with a non-presupposing expression in place of the presupposition trigger were inserted as controls. Based on similar eye tracking experiments (e.g. Schwarz and Tiemann 2013), increases in reading times are expected for sentences in contexts that are inconsistent with the presupposition as soon as the content of the presupposition is evident (i.e. on the critical word). In our material, this was always the word after the trigger (*Laptop* in the example above).

Predictions. Since both Heim's and Beaver's theory treat PSP projection out of different quantifying environments on par, processing should not be dependent on the quantifier. More specifically, we expect an increase in reading times for the *two of three* contexts in all experiments under Heim's account because the universal PSP is not satisfied in these contexts. According to Beaver's analysis, there should be no difference between the two contexts, since the existential PSP is satisfied in both.

Results. For sentences with both triggers – *again* and the definite determiner – mean first pass durations on the word after the critical word (*in* in the example above) were significantly longer in the *two of three* context than in *the three of three* context when the quantifier was *each*. No significant differences for all eye tracking measures were present when the quantifier was *one*, and in the control conditions. Mean first pass duration times on the word after the critical word are presented in table 1.

Discussion. The results of this experiment do not fit with either of the two theories discussed above. Even if we assume *local accommodation* (Heim 1983) to be available, it is not clear why there should be a processing difference between the two quantifiers investigated.
We thus conclude that the projection behavior of PSPs is highly dependent on the respective quantifier and that it is not a uniform phenomenon. The fact that the perceived PSP hinges on the quantifier suggests that the source of the projection behavior lies in the quantifier rather than anywhere else. We thus suggest that quantifiers introduce PSPs themselves which lead to the observed PSP interpretation. The lexical entry for an existential quantifier could thus look like (2). Such a lexical entry also presupposes that there is at least one x in the restrictor of which g(x) is true which is desirable (cf. Cooper (1983)). The lexical entry for the universal determiner according to such an analysis is given in (3).

(2) $[[\text{some}]] = \lambda g_{<e,t>}.\lambda f_{<e,t>}$: {x: g(x)=1} ∩ {x: f(x) is defined) ≠ ∅. {x: g(x)=1} ∩ {x: f(x)=1} ≠ ∅

(3) $[[\text{every}]] = \lambda g_{<e,t>}.\lambda f_{<e,t>}$: {x: g(x)=1} ⊆ {x: f(x) is defined) ≠ ∅. {x: g(x)=1} ⊆ {x: f(x)=1} ≠ ∅

There are several intriguing advantages to an analysis which roots the projection behavior of PSPs in the embedding operator: First, it is able to account for the differences between the different quantifiers observed both in Chemla (2009) and the experiments reported here. Second, it offers the interesting opportunity to be extendable to other environments such as *if*-clauses, which are standardly assumed to be quantifiers over possible worlds.

References:

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