

Incremental and predictive discourse processing based on causal and concessive discourse markers: A visual world study

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While there is some evidence that (marked or unmarked) causal discourse relations are processed incrementally (Traxler et al. 1997; Kuperberg et al. 2011), the time-course of comprehending concessive discourse markers (e.g. nevertheless) has not yet been investigated. Given that concessives are often defined as negative causals (e.g. König & Siemund, 2000), the time-course of processing of concessives and negations may be similar. Interestingly, Ferguson et al. (2008) found that counterfactual negated discourse information is not used incrementally but has a delayed effect on comprehension.

We examined whether this is also true for concessive discourse markers by investigating the time-course of processing causal versus concessive discourse markers in German within a visual-world experiment. In particular, we examined the stepwise integration of information from discourse context (causal/concessive marker) and grammar (gender marking) for predicting a target referent. Participants were exposed to 60 trials (20 items, 40 fillers), each consisting of three spoken sentences and a static scene (Ex.1). The second sentence always identified a **category** (e.g. 'keyboard instruments'), matching two of the depicted objects (piano and organ). Two other objects in the scene belonged to another category (the counter category, wind instruments: saxophone and trumpet). The third sentence began either with a causal or a concessive **connector** (within-participant factor) and included the gender-marked **pre-target** noun region (ein reduziertes, 'a reduced'), preceding the target noun (causal: piano, concessive: saxophone). Target nouns were always congruent with the preceding discourse. All items and half of the fillers were followed by a comprehension question ('Does Tom think consider buying a keyboard instrument?'), which participants answered by button press (YES/NO).

Eye-movement data (N=32) reveals that when the **category** was uttered, participants inspected the two objects matching this category (piano and organ) more frequently than the other objects, independent of conditions. In the causal condition, these objects were still looked at most often when the **connector** was uttered; in the concessive condition, however, participants inspected the two objects of the counter category most often in this region (saxophone and trumpet). This reveals that the concessive marker was immediately interpreted. Note that the connector could not be interpreted before subject and verb were presented (kauft sie, 'she buys'), meaning that the region provided limited time for interpretation. Interestingly, in the **pre-target** region, there were significantly more looks to the target object (causal: piano, concessive: saxophone) than to any other object, in both conditions, revealing that information from both the connector and the gender marking was rapidly processed and used for predicting the target, also in the concessive condition. However, while response times in the comprehension questions did not differ across conditions, accuracy was significantly lower in the concessive condition (78%) than in the causal condition (84%; $\chi(5) = 11.17$; $p < .05$).

These results clearly reveal that both causal and concessive discourse markers were integrated rapidly into on-line comprehension and, together with gender marking, gave rise to the prediction of the target noun. The finding that accuracy of question answering was worse in the concessive than the causal condition additionally suggests that processing was rather shallow, causing a late cognitive burden for global interpretation. We suggest that the differences between our and Ferguson et al.'s (2008) results are due to the type of negations investigated.

(Ex.1) Frau Weber sucht ein Geschenk für ihren Mann. Er könnte neue [Winterkleidung gebrauchen.]_{category}
[Deswegen/Dennoch kauft sie voll überzeugt]_{connector} [einen hochwertigen]_{pre-target} Schal/Sonnenhut.
 'Mrs. Weber is looking for a present for her husband. He needs new [winter clothes.]_{category} **[Therefore/However,**
 she buys entirely convinced]_{connector} [a high-quality]_{pre-target} scarf/sun hat. '
 [depicted: scarf (Schal: masc.), warm hat (Mütze: fem.), sun hat (Sonnenhut: masc.), trunks (Badehose: fem.)]

Ferguson et al. (2008). Eye-movements and ERPs reveal the time course of processing negation and remitting counterfactual words. *Brain Research* 1236: 113-125.

Kuperberg et al. (2011). Establishing causal coherence across sentences. *J.Cog.Neurosci* 23: 1230-1246.

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