READING BETWEEN THE LINES: THE INFLUENCE OF SCRIPT KNOWLEDGE ON ON-LINE COMPREHENSION

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While the influence of linguistic context on language processing has been extensively studied [1,2], less is known about the mental representation, structure and use of so-called *script* knowledge. Scripts [3,4] are defined as a person's knowledge about temporally and causally ordered sequences of events. They are often activated by linguistic context, but otherwise left implicit. In two ERP studies we examine how such non-linguistic event knowledge influences predictive language processing (as addressed by e. g. [5,6]) beyond what linguistic prediction or lexical priming alone can explain. Specifically, we find evidence for a decrease in N400 amplitude - known to reflect a word's unexpectedness [7] - for target nouns consistent with events that are expected according to script knowledge.

Experiment 1 focuses on differentiating the relative contribution of lexical priming and script knowledge. Assuming the temporal structure of scripts is accessible and used for prediction, but does not alter any influence of priming, we inserted temporal shifts affecting the plausibility of the critical object.

Intro:
Am Abend ging Peter zum Fondue essen.
(In the evening Peter went to eat a fondue.)

Target sentence:

(1) Minor temporal shift / Script-fitting target	Einen Moment später schmolz er den *Käse*. (A moment later he melted the *cheese*.)
(2) Minor temporal shift / Neutral target	Einen Moment später schmolz er den *Schnee*. (A moment later he melted the *snow*.)
(3) Major temporal shift / Script-fitting target	Einen Tag später schmolz er den *Käse*. (One day later he melted the *cheese*.)
(4) Major temporal shift / Neutral target	Einen Tag später schmolz er den *Schnee*. (One day later he melted the *snow*.)

Participants were presented with a context sentence introducing a script. The context sentence was followed by a transitive target sentence, presented word-by-word, in which the direct object resulted in either a script-fitting event (1/3) or a neutral event (2/4). Additionally, target sentences started with a temporal adverbial indicating that either the script mentioned before was still active, expressed by a minor temporal shift (1/2), or likely inactive, expressed by a major temporal shift (3/4).

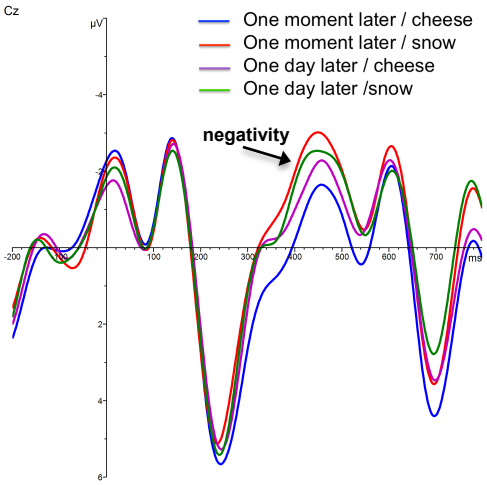

Figure 1: conditions 1-4 on electrode Cz; data was filtered for presentation purposes only with 8hz low-pass filter

Materials were normed in off-line experiments. Context-fitting and neutral objects were obtained in a cloze task study with high cloze values (>0.5) for script-fitting and low cloze values (<0.1) for neutral ones. A plausibility judgment task further ensured the acceptability of all target sentences.

Fitted linear mixed-effect models (300-500ms after onset of the direct object) show a significant, broadly distributed fronto-central negativity for conditions (2) and (4) compared to condition (1), as well as a frontal negativity (300-400ms) for major shift (3/4) vs. minor shift conditions (1/2). This is consistent with the view that script knowledge rapidly facilitates comprehension of script-congruent object nouns, which is not explainable by priming alone. Comprehenders appear to be sensitive to temporal components of scripts, making objects with an implausible temporal shift more difficult to process.

Results from Exp. 1 suggest that, even after a large temporal shift, a script-fitting object noun is still easier to process than a neutral one. One reason for this may be that the temporal shift used in Exp. 1 was not salient enough to completely deactivate a script. **Experiment 2**, for

which data is currently being collected, explores how script knowledge is used when context provides two scripts. One script is active, and thus expected to influence processing of target nouns to a greater extent.

Participants are presented with a context sentence introducing two scripts (Intro 1/2). By using a past tense structure combined with telic verbs, one script is perceived as ongoing, while the other is completed. A second context sentence provides more information regarding which point within either of the two scripts the target sentence is referring to.

The direct object of the word-by-word presented target sentence refers to an event either within the ongoing (1) or the inactive script (2). As suggested by reviewers, the 2x2 design is completed by the scripts in the context sentence presented in reversed order (Intro 2) to control for effects caused by the distance between script and direct object.

Intro 1: Script 2 active	**Intro 2: Script 1 active**
Nachdem Petra ins Kino gegangen war, erreichte sie die *Kneipe*.	Petra erreichte die *Kneipe*, nachdem sie ins Kino gegangen war.
(After going to the cinema, Petra reached the bar.)	(Petra reached the bar after going to the cinema.)
Rasch schaute sie auf den Aushang.	Rasch schaute sie auf den Aushang.
(Quickly she looked at the bulletin.)	(Quickly she looked at the bulletin.)

Target sentence:

(1)	Active-script target	Sie trat ein und kaufte das *Bier* ohne zu zögern. (She entered and bought the *beer* without hesitation.)
(2)	Inactive-script target	Sie trat ein und kaufte das *Ticket* ohne zu zögern. (She entered and bought the *ticket* without hesitation.)

Having shown that comprehenders are sensitive to temporal aspects of scripts (Exp 1), we expect to see a reduced negativity for the object fitting the active script (1) compared to the one fitting the inactive script (2). Any such effect would be unexplainable by simple priming, as both scripts are introduced.

We do not expect a main effect of script order, but merely an interaction with script congruency. This should manifest in a large N400 for inactive script-fitting objects when the active script was mentioned first (Intro 2 / Target 2) and a reduced N400 for script-fitting objects where the active script was mentioned last (Intro 1 / Target 1). The other conditions (Intro 1 / Target 2 and Intro 2 / Target 1) are expected to plot between these two extremes.

Since unexpected elements have been linked to positive-going ERP effects [8], we may additionally expect a positivity for the object fitting the inactive script.

By demonstrating that minimal linguistic material is sufficient to rapidly activate detailed script knowledge and make it accessible for language processing, we conclude that scripts provide an interesting method to investigate the interaction of non-linguistic knowledge in on-line comprehension. Specifically, drawing on aspects of their temporal and hierarchical structure we hope to further explore the role of implicit causal, temporal, and spatial relations in language comprehension.

References

[1] Kutas, 1993; [2] Kutas & Federmeier, 2011; [3] Schank & Abelson, 1975; [4] Rumelhart, 1980; [5] Bicknell et al., 2010; [6] Metusalem et al., 2012; [7] Kutas & Hillyard, 1984; [8] Thornhill & Van Petten, 2012;