ATTENTION AND SYNTAX IN SENTENCE PRODUCTION: A MINI-REVIEW

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The relationship between language and cognition is fundamental to evolutionary, developmental, and functional theories of human language function. Understanding the interface between attention and language is a specific area of interest within this broad research program. Attention refers to the process of selectively focusing on certain aspects of the environment while ignoring others. Understanding of the attention-language interface relies on a well-developed theoretical and empirical analysis of the mapping mechanisms between the specific component systems of the overall attentional network (e.g., alerting, orienting, and executive control) and the corresponding aspects of language organization and/or linguistic performance influenced and constrained by them.

Existing literature provides ample evidence for the crucial role of attention in the organization of language faculty (Jackendoff 2002; Langacker 2000; Talmy 2008), referential (Chafe 1994; Givon 1992; Kibrik 2011), grammatical (Myachykov et al. 2018, for a review) organization of spoken sentences, and speaker-hearer coordination (Crocker et al. 2010). Both theoretical and empirical studies converge on a very important conclusion – a comprehensive «linguistic theory of attention» needs to account for the fundamental organization of the attentional system, including its cognitive, behavioral, and architectural factors. Investigations of the language-attention interface typically follow one of the two theoretical routes: (1) "from attention to language" (e.g., Myachykov et al. 2012) and "from language to attention" (e.g., Langacker 2000; Talmy 2008). Here, I will offer a very brief overview of the research in the former tradition.

The attention-to-language tradition is firmly grounded in a detailed analysis of the attentional system and its distinct processes including visual orienting as well as endogenous and exogenous attentional shifts (Posner 1980). It also underscores co-development of the attentional and the linguistic systems of the human brain (e.g., Mandler 1992) with the specific foci on the role of attentional amplification at the early stages of language development (Carpenter et al. 1998; Tomasello and Farrar 1986) as well as the role of joint attention in determining the success of

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early language acquisition (Baldwin 1995; Dominey and Dodane 2004). Understanding the role of the attentional system as a scaffold for language development (de Diego-Balaguer et al. 2016) allows to hypothesize the existence of regular linguistic counterparts of attentional processes in adult language use and design psycholinguistic experiments that register coactivation of attentional and linguistic processes in visually situated speech production and comprehension contexts.

One aspect of the attention-language interface is the process of selecting and prioritizing certain elements of the described event in the configuration of spoken sentences. As above, several theories propose that attention is closely linked to the grammatical structure whereby grammar is viewed as a set of rules that govern how linguistic elements are organized and combined to convey both lexical-semantic and referential meanings. For example, the choice between syntactic alternatives can be influenced by the speaker's attentional focus. In English, if the speaker wants to highlight the agent and background the patient, they may select the active voice frame for a spoken sentence describing a transitive interaction between them. Conversely, if they want to emphasize the patient and background the agent, they may choose to use the passive voice frame. The foundational research in this area was conducted by Russell Tomlin who focused on the role of attention in the grammatical organization of spoken sentences. In his several papers (Tomlin 1995, 1997), Tomlin demonstrated that visually salient referents tend to occupy prominent syntactic roles, e.g., the sentential Subject. In the original study participants observed and described an unfolding interaction between two fish ending by one fish eating the other. An explicit visual cue accompanied either the agent or the patient fish throughout the trial. The grammatical voice of the participants' descriptions of the target event (one fish eating the other) varied reliably as a function of the cue direction in such a way that the cued referent was consistently mapped on the Subject slot thus triggering the choice between an active- and a passive-voice frames. In other words, attentional cueing of a referent (either the Agent or the Patient) resulted in the assignment of the Subject-role to this referent and triggered the resulting choice between active and passive voice.

Studies that followed used updated versions of the **perceptual priming** paradigm developed by Tomlin. These newer studies targeted languages other than English (Hwang, Kaiser 2015; Myachykov and Tomlin 2008; Myachykov et al. 2010; Pokhoday et al. 2019) as well as structural frames other than active vs passive (e.g. Gleitman et al. 2007; Montag and MacDonald 2014). Some of these studies also investigated how perceptual priming of syntactic choice interacts with the well-documented lexical and syntactic priming effects (Myachykov et al. 2012). Several important findings can be summarized. First, the speaker's attentional focus on the described scene's elements is a reliable predictor of the choice between syntactic alternatives felicitously describing the perceived event. Second, this ten-

dency is not limited to transitive sentence frames and to a subset of languages with strictly incremental and analytical syntactic organization. Third, perceptual primes are potent enough to determine syntactic choice alongside linguistic predictors, such lexical and syntactic primes within a parallel and highly interactive production system. Fourth, languages that prefer word order rather than syntactic alternation in mapping the pragmatic structures onto sentential ones tend to rely on the former mechanism in order to represent the speaker's attentional focus in sentential configuration. For example, the speaker may use a fronted constituent to highlight its importance in the message. At the same time, this choice between **positional** and **grammatical-role** assignment mechanisms is likely to represent a continuum whose exact balance varies from language to language (Myachykov et al. 2018). Fifth, some studies using perceptual priming paradigm indicate that the speaker's attentional focus and the relative degree of the memorial activation of the referential information (**conceptual accessibility**) play different roles in the sentence production process: While these two priming effects (conceptual accessibility and perceptual priming) may be confounded, attentional focus predicts the syntactic choice and word order to a higher degree while conceptual accessibility determines the speed, with which the sentence is produced measured as sentence and individual constituents' onset latencies (Myachykov et al. 2018). Sixth, the speaker's attentional focus needs to be modelled alongside and in combination with other non-linguistic predictors of syntactic choice including event orientation (Esaulova et al. 2020; Pokhoday et al. 2019) and referential configuration (Schlenter and Penke 2022).

Overall, existing literature elucidates both the validity of the attentional factors in their capacity to bias syntactic choice and constituent linearization as well as the dynamic and interactive nature of this interface system supporting a constant interplay between non-linguistic and linguistic determiners of the speaker's syntactic choices. At the same time, further research is necessary to investigate in detail both the architectural and the chronometric properties of an interactive sentence generation system where the final product – the sentential configuration – reflects an integral sum of both linguistic and non-linguistic forces. Some of the most important questions are the following. First, it remains largely unclear how other general cognitive processes including memory and affect interplay with the purely perceptual and attentional processes in their ability to affect sentence organization. Second, a vast majority of existing studies continue to use English as their target language with just few studies using languages other than English. As a result, it remains unclear whether our current understanding of the attention-grammar interface is relatively universal or largely determined by the idiosyncrasies of the individual language's grammatical systems. Third, while the studies within the research programme briefly reviewed above have firmly placed attention among the important determinants of syntactic choice, (1) the exact chronometry and (2) the

underlying neurocognitive foundations of the interface remain uncertain. Future studies will help to advance these and other relevant research questions.

In conclusion, the interplay between attention and syntax highlights the close relationship between language, cognition, and communication. By studying how attention and syntax interact in different contexts and across different languages, researchers can gain valuable insights into the nature of language processing and how it is shaped by cognitive factors.

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