Linking grammar and processing: The effect of animacy and verbal information on predictive eye-gaze in Dutch

Background With certain phenomena, animacy affects the grammaticality of structures in some languages, but only has an effect on preferences in language use in others. One way of analyzing such cases is to view them as two sides of the same coin: what is a hard constraint in one language acts as a soft constraint in the other (Bresnan et al., 2001; see Hawkins, 2004 for a similar view). In this paper we address one phenomenon that is amenable to such an interpretation: hierarchical interpretation of transitive sentences. In some languages, the interpretation (or availability) of transitive sentences is guided by an animacy hierarchy (human>animate>inanimate; e.g. Minkoff, 2000). For instance, in Fore (Papuan; Feltman, 1976), the interpretation of a transitive sentence is determined by this constraint, in the absence of other information. This constraint has been argued also to be operative during language comprehension in languages in which it has not attained grammatical status (see Bornkessel & Schlesewsky, 2006, for an overview). Evidence for this claim has been mainly adduced from measures after the two noun phrases have been processed and in verb-final structures. In this paper we discuss experimental data focusing on predictive processing and the effect of providing verbal information (selectional restrictions) in verb-initial sentences.

Present research In the past decade or so, evidence has accumulated that language users predict upcoming referents (e.g. Altmann & Kamide, 1999). Previous research has mainly focused on the prediction of a single argument based on the verb and one additional argument. We take this research one step further by investigating the anticipation of both arguments in a transitive sentence and how this is mediated by animacy and verbal information. To this end we crucially exploit the V2-property of Dutch, which makes it possible to provide the verb before its arguments when an adverbial expression occupies the sentence-initial position (the net result being a V-initial parsing situation).

Experiment We recorded eye-gaze patterns of 87 native speakers of Dutch, while they looked at a two-picture display containing an animate and inanimate character and listened to sentences with an XP-V-NP1-NP2-(Participle)-PP structure, in which NP1 can only be interpreted as the subject. We manipulated two factors: (i) ANIMACY CONFIGURATION of the NPs and (ii) VERB TYPE in V2-position: auxiliary (*heeft* 'has') or lexical (restricting subject to animate, or restricting object to animate). This resulted in four conditions:

1. XP-$\mathbf{V}_{\mathbf{AUX:}\boldsymbol{heeft}}$-$\text{NP1}_{\text{SU:anim}}$-$\text{NP2}_{\text{OBJ:inan}}$-$\text{ParticipleV}_{\text{lex}}$-PP
2. XP-$\mathbf{V}_{\mathbf{AUX:}\boldsymbol{heeft}}$-$\text{NP1}_{\text{SU:inan}}$-$\text{NP2}_{\text{OBJ:anim}}$-$\text{ParticipleV}_{\text{lex}}$-PP
3. XP-$\mathbf{V}_{\mathbf{LEX}}$-$\text{NP1}_{\text{SU:anim}}$-$\text{NP2}_{\text{OBJ:inan}}$-PP
4. XP-$\mathbf{V}_{\mathbf{LEX}}$-$\text{NP1}_{\text{SU:inan}}$-$\text{NP2}_{\text{OBJ:anim}}$-PP

Results and interpretation Our data suggest a clear effect of animacy and verbal information on both predictive processing and integration. The auxiliary verb *hebben* 'have' evokes an expectation for an animate character with a long lasting effect on parsing. Lexical verbs, on the other hand, anticipate an inanimate argument. We suggest that this is an effect of 'VP'-frequency. Even though NP1 was always the subject in our sentences, in everyday speech a lexical verb in V2-position is most frequently followed by an inanimate object (the subject being in sentence-initial position).

Overall, the pattern of results lends support to the cross-linguistic operation of an animacy constraint, even in languages in which it has not achieved grammatical status. In addition, this constraint seems to be in interaction with other types of information, just as in Fore. Following Minkoff (2000), we will discuss the link between processing effects and the theoretical analysis of animacy effects, focusing on the primitive status of the animacy hierarchy as a linguistic constraint.