Neurolinguistic evidence for independent contributions of verb-specific and event-related knowledge to predictive processing

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Evidence suggests that comprehenders predict upcoming verbal arguments (e.g. Altmann & Kamide, 1999) and that mismatches between predicted and encountered arguments cause processing disruption (Federmeier, 1999; Speer & Clifton, 1998). However, the source of these predictions is controversial. Some argue that event-related conceptual knowledge is used to anticipate likely upcoming arguments: verbs activate event representations, which in turn activate entities that commonly participate in such events (e.g., McRae et al., 2001). Others argue that verbs' selectional restrictions underlie predictions for possible upcoming arguments: verbs impose semantic constraints on their arguments, facilitating any argument that satisfies those constraints (Boland, 2005).

The current study suggests that these two sources of argument predictions may be dissociated following brain damage. Unimpaired older adults (n=36) and adults with left-hemisphere damage and aphasia (n=11) performed self-paced reading and sentence-final acceptability judgments on stimuli from Warren and McConnell (2007). Sentences contained a critical NP (underlined in 1), which was either a plausible argument of the verb (1a), a highly implausible/unlikely but possible argument (1b), or an impossible argument that violated the verb's selectional restrictions (1c). We interpret reading times and acceptability judgments as indexing the degree of processing disruption associated with a mismatch between the encountered argument and the verb's argument prediction.

If semantic predictions are generated in the left hemisphere (e.g. Federmeier, 2007), adults with aphasia may show less disruption for prediction-violating arguments than unimpaired adults do. If argument predictions arise from knowledge about likely event participants (McRae, et al., 2001), adults with aphasia should show similar disruption in the implausible and impossible conditions, because norming indicated that these arguments were similarly unlikely. If selectional restrictions independently contribute to argument predictions (Boland, 2005), performance on the impossible and implausible conditions may differ, because only impossible arguments violate selectional restrictions.

Acceptability judgments (2) revealed a significant interaction between group and condition ($p<.05$): unimpaired adults were more likely to reject impossible than implausible arguments ($p<.05$), whereas adults with aphasia were marginally more likely to reject implausible than impossible arguments ($p=.06$). Furthermore, unimpaired and aphasic adults' rejection rates for implausible arguments did not differ, but aphasic adults rejected impossible arguments less often ($p=.05$). These results suggest that aphasia disrupts the use of selectional restrictions more strongly than event-related knowledge (cf. Myers & Blumstein, 2005). Unimpaired and aphasic adults read implausible and impossible arguments more slowly than plausible ones (3). (The fact that unimpaired older adults showed no RT differences between the anomalous conditions is interestingly different from Warren & McConnell's eye-tracking findings with young adults, but seems to be driven by the behavior of high-WM participants in the self-paced reading task; they showed little RT dissociation among conditions.) Interestingly, individual aphasic adults' reading-time patterns differed: individuals with temporal-lobe damage showed smaller reading- time differences across conditions than individuals without temporal involvement. This finding provides preliminary localization evidence suggesting that temporal-lobe areas are especially important for prediction and rapid integration of arguments. Together, these findings indicate that selectional restrictions and event knowledge may contribute independently to verbal argument prediction.

(1) Stimuli from Warren & McConnell (2007; | marks self-paced presentation regions)
a. Maria | used | a knife | to chop | the | large | carrots | before dinner | last night. (*Plausible*)
b. Maria | used | some bleach | to clean | the | large | carrots | before dinner | last night. (*Implausible*)
c. Maria | used | a pump | to inflate | the | large | carrots | before dinner | last night. (*Impossible*)

(2) Proportion of rejections, acceptability judgment

	Controls:	Adults with aphasia:
(a)	10%	26%
(b)	89%	85%
(c)	96%	77%

(3) Mean reading times, critical noun (in msecs)

	Controls:	Aph. (temporal):	Aph. (no temporal):
(a)	946	1252	1026
(b)	1042	1244	1129
(a)	1055	1333	1214