Cognitive Containment and Construction Design

Verbalization efficiency for three-participant events

In this paper we go beyond asking how speakers choose between pre-existing constructions, to ask why those constructions exist in the first place. Some linguistic tasks, such as verbalizing a one-participant event using a one-place (intransitive) argument structure construction, are evidently easy for speakers, pervasive in discourse, and cross-linguistically widespread. In contrast, verbalizing a three-participant event appears to be cognitively challenging, so that dedicated argument structure constructions with three core arguments (e.g. double-object ditransitive) are cross-linguistically rare. Paradoxically, three-participant verbalizations may be facilitated under certain well-specified discourse conditions; and the double-object ditransitive is fairly common in languages that provide the option. We explore this paradox by (1) clarifying what is cognitively difficult about verbalizing three-participant events; (2) identifying favorable conditions in the "discourse niche" associated with some, but not all, types of three-participant events; (3) identifying a strategy of Cognitive Containment for optimizing verbalization efficiency, which (4) motivates grammaticization of a dedicated construction with three core arguments, but only for semantically and pragmatically appropriate verbs.

We examine the double-object (*I gave em stickers*) and prepositional-object (*I give stickers to the kids*) dative constructions. To provide a structural and functional contrast with alternating *give*, we compare non-alternating *put*. We go beyond earlier discourse-functional (Thompson, 1995; 1997) and corpus-based studies of the dative alternation (Bresnan, Cueni, Nikitina & Baayen, 2007; Bresnan & Ford, 2010; Gries & Stefanowitsch, 2004; Wolk, Bresnan, Rosenbach & Szmrecsanyi, 2013) to target the role of prior discourse in establishing referent accessibility. We extract all instances of the verb *give* (n = 533) and *put* (n = 204) in the Santa Barbara Corpus (Du Bois, Chafe, Meyer, Thompson, Englebretson & Martey, 2000-2005), annotating their arguments for construction, verb, length, animacy, constituent order, person, grammatical role, prosodic phrasing, accessibility, and topicality. We analyze the data using linear mixed-effect regression, predicting, for each argument, its prior accessibility in the discourse. Preliminary results suggest that each construction results in a unique discourse profile of prior accessibility across the Agent-Recipient-Theme argument cohort. The effects we identify are not accounted for by the 'heavy-last' principle favored in many accounts of such alternations.

Key to our argument are two related ideas: verbalization efficiency and cognitive containment. Communicative efficiency is a longstanding, if poorly understood, component of functional explanations for linguistic structure in both functionalist (Bybee, 2007; Ferrer-i-Cancho, Bentz & Seguin, 2015; Givón, 1979; Levshina, 2018; Zipf, 1935) and psycholinguistic lines of research (Gibson, 1998; Gibson, Piantadosi, Brink, Bergen, Lim & Saxe, 2013; Hawkins, 2004; Jaeger & Tily, 2010; Piantadosi, Tily & Gibson, 2011). But before communication there is verbalization, a process that begins with pre-linguistic thought and culminates in the selection of the linguistic forms necessary to coordinate understandings between interlocutors (Chafe, 1977; Chafe, 1994). Though elusive and often overlooked, the verbalization process cannot be ignored in assessing overall linguistic efficiency, insofar as it brings together pre-linguistic and linguistic cognition, making simultaneous demands on the same resources of memory and attention. Following Gibson (1998), we recognize the need to assess both storage cost and integration cost, for working memory tasks like speech production. But we insist on one more: accessibility cost (Almor & Nair, 2007; Ariel, 2001; Arnold, 2010; Chafe, 1994). Integration implies items to integrate; and these must be cognitively available, which means they must be accessed. For double-object ditransitives, this means integrating the verb with each of its three arguments, each bearing a unique, conceptually integral, semantic relation to the verb. Recent research on working memory suggests that integration requires time-dependent sharing of attention across simultaneous tasks (Barrouillet, Gavens, Vergauwe, Gaillard & Camos, 2009; Oberauer, 2002). Assuming this applies to integrating verbs and arguments, this means the accessibility cost, especially for new information referents, must evaluated alongside integration cost.

Another overlooked issue is the link between cognitive integration and prosody. An exception is in the work of Chafe, who proposes that each intonation unit corresponds to a single focus of consciousness, serving to verbalize a single idea (Chafe, 1994). Recent corpus and experimental studies provide some empirical support. A corpus study of 64,000 intonation units showed that words with high bigram mutual information tend to co-occur within, rather than across, intonation unit boundaries (Wahl, 2015). An experimental study showed that chunking

by intonation units supports recall better than chunking by clauses (Simpson & Moscoso del Prado Martín, 2015). In the present study, we find that three-participants events with high accessibility costs tend to trigger a second intonation unit, consistent with the view that the intonation unit is a domain for cognitive integration.

The solution to the ditransitive paradox is complex, but strategic. We present the Cognitive Containment Hypothesis, a kind of resource-rational economic model of memory allocation (Lieder & Griffiths, 2019). We argue for a cost-effective accounting of trade-offs between costs in working memory for accessibility (Ariel, 2001; Arnold, 2010) and integration (Gibson, 1998); and the long-term costs of learning and sustaining (Futrell & Levy, 2017) a dedicated three-place construction. For "social" verbs like *give* that typically involve two human participants (Bresnan et al., 2007), the cost of accessing a new referent can be off-loaded to prior discourse, allowing for subsequent pronominalization at the lower cost of merely "refreshing" recently activated entities. In effect the accessibility costs are paid in advance, for two of the three arguments. *Put,* with just one human participant, lacks the offloading option, and fails to achieve the verbalization efficiency needed to support a dedicated double argument construction. The distinct selective pressures for social *give* vs. asocial *put* motivate the learning and retention of information structure strategies tied to the ditransitive grammatical construction (Brown, Savova & Gibson, 2012; Goldberg, 2014), and ultimately the emergence and grammaticization of new linguistic structure.

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