Exposures on the Learning of L2 Binomials

Subjects: Linguistics

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While both *fish and chips* and *chips and fish* are perfectly grammatical phrases in English, native speakers are much more likely to say the former than the latter. For second language learners, this poses a considerable challenge: they need to learn what grammatical utterances are more probable.

Keywords: formulaic language ; multiword sequences ; binomials ; self-paced reading ; second language learning

1. Introduction

While both *fish and chips* and *chips and fish* are perfectly grammatical phrases in English, native speakers are much more likely to say the former than the latter. For second language learners, this poses a considerable challenge: they need to learn what grammatical utterances are more probable (Pawley and Syder 1983). Lexical patterns like *fish and chips* are often referred to as formulaic language or multiword sequences and are ubiquitous in language. Corpus-based research shows that between 30% to 50% of language use is formulaic (e.g., Erman and Warren 2000; Kuiper 2004). Thus, L2 speakers need to learn a considerable amount of formulaic language.

Formulaic language differs in how much overlap there is across languages. For example, formulaic language can (1) overlap in meaning and form (e.g., the English collocation *warm reception* which has a word-for-word translation with the same meaning as an Arabic collocation *istigbal har*); (2) overlap in meaning but not in form (e.g., an idiom describing something as expensive in English is *costs an arm and leg*, and in Arabic, *kallaf dam qalbi* '*costs the blood of my heart*'); or (3) have no formulaic equivalent in the other language (e.g., the binomial *safe and sound* in English does not correspond to a binomial phrase in Arabic). In the present study, a formulaic sequence is considered congruent only if it has a word-for-word translation with the same meaning in the other language (i.e., the first category: overlap in meaning and form).

Investigations of L1-L2 congruency have become an increasingly important area in formulaic language research (for an overview, see Conklin and Carrol 2019). Previous research examining congruency has focused mainly on idioms (e.g., Beck and Weber 2016; Carrol and Conklin 2014, 2017; Carrol et al. 2016) and collocations (e.g., Wolter and Gyllstad 2011, 2013; Wolter and Yamashita 2017). Studies on these two types of formulaic language have demonstrated that when there is overlap between the two languages, processing is facilitated (Wolter and Gyllstad 2011, 2013; Yamashita and Jiang 2010; Carrol et al. 2016). On the other hand, when there is no L1-L2 correspondence, processing tends be disrupted (Wolter and Yamashita 2017), and learning becomes challenging (Peters 2016). However, little research has investigated the role of congruency in the learning and processing of binomial phrases (e.g., *salt and pepper*), which is the focus of the current research.

Binomials are "recurrent (frequent), familiar (conventional) expressions" consisting of two words from the same lexical class joined by a conjunction, where one word order is more frequent (e.g., *king and queen* not *queen and king*, and *fish and chips* not *chips and fish*) (Siyanova-Chanturia et al. 2011, p. 2). However, developing a sensitivity to the word order preference of binomials (e.g., *salt and pepper* not *pepper and salt*) can be challenging for L2 learners. Binomials differ from idioms and other formulaic language in many ways. For example, binomials are structurally more predictable and more frequent than idioms. Further, binomials are generally transparent such that the overall meaning can be computed from the parts, with transparent binomials being the focus of the current investigation. Notably, an important facet of binomials, in contrast to other types of formulaic sequences, is that a change of word order does not alter the meaning or result in syntactic irregularity. The flexibility in word order, without introducing confounds (e.g., unigram frequencies, syntactic and semantic properties), makes binomials a good choice for investigating the role of phrasal frequency in L2 acquisition (Siyanova-Chanturia et al. 2011).

2. Congruency Effects

It is thought that L1-L2 congruency impacts formulaic language learning and processing. The majority of studies that investigated congruency have focused on idioms and collocations. Thus, studies on idioms and collocations will be reviewed to provide a background on the influence of congruency on formulaic language. Yamashita and Jiang (2010) explain that processing congruent collocations involves using ready-made links to L1 knowledge, which assists comprehension, whereas processing incongruent collocations is either more compositional and/or requires contextual cues to infer meaning, which requires more effort. Yamashita and Jiang say that when learning congruent collocations, L2 learners use links to L1 collocational counterparts to map the L2 collocational meanings. This yields faster recognition of L2 collocations that have an equivalent L1 collocation. For idioms, Carrol et al. (2016) put forth a similar explanation, emphasizing the role of cross-language priming. Specifically, when L2 learners encounter an L2 word, which comprises an initial part of a congruent idiom, its L1 counterpart word receives activation. The activation of the L1 word passes activation to the L1 idiom, as well as its L2 counterpart, which speeds up the recognition and processing of congruent idioms.

The majority of studies investigating congruency in formulaic language have focused on idioms, which are opaque or non-compositional formulaic language (i.e., overall meaning is not the sum of the meaning of the individual words like *kick the bucket*). For example, the study by Carrol et al. (2016) used eye-tracking to look at the processing of English-only idioms (not found in Swedish), Swedish-only translated idioms (not found in English), and congruent idioms (found in both languages). For native English speakers, the findings demonstrated the expected processing advantage for English-only and congruent idioms, but that advantage was not found for unfamiliar Swedish-only items. For Swedish learners of English, they found a processing advantage for congruent and Swedish-only idioms, but not for the English-only idioms.

Titone et al. (2015) investigated the effect of congruency on the processing of English idioms that varied in their cross-language overlap with French. English–French bilinguals read English sentences containing idioms or matched control phrases (e.g., *she lived/told a lie*) in a word-by-word presentation, where the final word was either in English or in French (e.g., intact condition: *he played with fire* vs. code-switched condition: *he played with feu*). Participants were asked to judge the meaningfulness of each sentence. They found that the code-switched condition was more disruptive for idioms than for control phrases, as indicated by judgment time. Importantly, increased cross-language overlap reduced response times for idioms in the code-switched condition.

Pritchett et al. (2016) investigated the effect of idiom congruency in a cued recall task. Russian–English bilinguals were exposed to adjective–noun idioms in English and/or Russian (e.g., English only: *blue blood*; English–Russian: *blue moon*; Russian only: *blue distances*). Following an exposure phase, participants were instructed to write down any phrases they could remember. Recall was significantly better for idiomatic phrases that existed in both languages than for phrases that only existed in one language.

In addition to idioms, evidence for congruency effects has been demonstrated in collocations. For example, Yamashita and Jiang (2010) asked native English speakers (monolinguals), Japanese ESL participants, and Japanese EFL participants to judge if phrases were acceptable in English when they were congruent collocations, existing in both languages (e.g., *heavy stone*), or incongruent, existing only in English (e.g., *kill time*). Native English speakers showed no difference in response times and accuracy for congruent and incongruent items. For Japanese EFL learners, incongruent items had longer response times and resulted in more errors compared to congruent items. The ESL learners behaved similarly to EFL learners in that they had more errors for incongruent than congruent items; however, the ESL response times resembled those of the native speaker group, with no difference between the two item types.

Wolter and Yamashita (2017) examined how knowledge of collocations in the L1 (Japanese) influenced the processing of collocations in the L2 (English), using an acceptability judgment task. The non-native speakers responded faster to Japanese–English congruent collocations than English-only incongruent collocations, while native speakers demonstrated equivalent performance across the conditions. Wolter and Gyllstad (2011, 2013) found a similar effect of congruency on collocation processing. They presented native English speakers and Swedish learners of English with congruent and incongruent collocations in a lexical/phrasal decision task. L2 learners had a processing advantage for congruent items compared to incongruent ones, while native English speakers demonstrated equivalent performance across those two conditions. It is important to note that not all studies have found an effect of congruency. For example, Leśniewska and Witalisz (2007) showed that Polish L2 learners of English did not have a preference for congruent collocations over incongruent ones in an acceptability judgment task.

Overwhelmingly, research has demonstrated that L1-L2 congruency facilitates the processing of collocations and idioms. It is important to note that this research has primarily focused on the effect of congruency on the L2 processing of formulaic language and not on its acquisition. Thus, whether congruency affects the learning of formulaic language remains largely unknown.

3. Reading Exposure and Frequency Effects

Studies on individual word learning have shown that a number of factors influence learning gains from reading, such as contextual cues (e.g., Webb 2008), the spacing of encounters (e.g., Nakata and Elgort 2021), L2 proficiency (e.g., Tekmen and Daloglu 2006) and the frequency of encounters of the new item (e.g., Pellicer-Sánchez and Schmitt 2010). A number of studies have also shown that L2 learners can acquire formulaic sequences during reading, with the frequency of encounter being an important factor in learning gains (e.g., Alotaibi et al. 2022; Pellicer-Sánchez 2017; Sonbul and Schmitt 2013; Webb et al. 2013). For example, Durrant and Schmitt (2010) showed that two exposures to a collocation in a read-aloud task generated better performance in a subsequent recall task than a single exposure by ESL learners. Furthermore, Webb et al. (2013), who modified a short story by incorporating multiple instances of the same collocation (i.e., from 1 to 15), found that more encounters resulted in better learning gains for their EFL participants. Much of language learning research describes the frequency of encounter as playing a key role in learning (Uchihara et al. 2019).

In sum, studies on formulaic language have demonstrated the effect of congruency on processing and the benefit of frequency of encounter on learning. However, little is known about the combined effect of congruency and the frequency of encounter on transparent formulaic language such as binomials.

4. Binomials Phrases

A key type of formulaic language that has been understudied is binomials. Studies on binomial processing have focused mainly on the effect of phrasal frequency on processing by comparing binomials to their reversed forms (Siyanova-Chanturia et al. 2017; Siyanova-Chanturia et al. 2011). Overall, such studies show that binomials elicit faster processing than their reversed forms (e.g., *time and money* vs. *money and time*) for native English speakers and higher proficiency non-native speakers. The advantage is thought to be due to phrasal frequency and entrenchment in memory of the lexical pattern.

Conklin and Carrol (2021) used eye tracking to investigate the processing of novel binomials by native speakers, which were presented one to five times in reading passages in an experimentally defined forward form (e.g., *wires and pipes*), and subsequently were presented in the reversed form (e.g., *pipes and wires*). Forward forms demonstrated a processing advantage over their reversed forms after four exposures, suggesting that native speakers developed sensitivity to the conventional word order of binomials during reading. Sonbul et al. (2023) aimed to replicate the Conklin and Carrol study with non-native speakers but found no advantage of the forward forms over their reversed ones. The two studies suggest that non-native speakers may require more exposures than native speakers to develop sensitivity to the preferred word order of binomials.

Alotaibi et al. (2022) investigated whether different input modes (reading-only, listening-only, and reading-while-listening) and the number of exposure (2, 4, 5, and 6 occurrences) had an effect on binomial learning for non-native speakers. The results demonstrated that reading-only and reading-while-listening led to greater gains than listening-only. There was also some evidence for an effect of the number of exposures: novel binomials that occurred more were perceived as more familiar.

To date, a study by Du et al. (2021) is the only one to examine the effect of congruency on binomial processing. In this study, L1-Chinese L2-English and L1-English L2-Chinese bilinguals (both immersed in an L2 environment), and English monolinguals took part in a lexical decision task to examine priming effects for congruent binomials (e.g., *knife and fork*), English-only binomials (e.g., *salt and pepper*), and Chinese-only translated binomials (e.g., *wisdom and strength*). L1-Chinese L2-English bilinguals showed priming for congruent but not English-only binomials, while L1-English L2-Chinese bilinguals demonstrated no priming effects. English monolinguals showed priming effects for the two types of English binomials. Notably, none of the groups showed a processing advantage for Chinese-only binomials. The authors argued that the L1 may be inhibited in immersion contexts, and this might explain the weak congruency effect and absence of an L1 effect for English–Chinese bilinguals who were studying Chinese in China.

The Alotaibi et al. (2022) and Sonbul et al. (2023) studies did not address the congruency effect, and the Du et al. (2021) study did not address the frequency effect on binomial learning and processing. It remains an open question whether

congruency and frequency of encounter affect binomial learning, which is the focus of the current research.

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