

Development of an Online Lesson Targeting Noncentral Prepositional Senses

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This paper puts forth ten principles for designing online lessons targeting the semantics of polysemous function words such as prepositions. The principles are also applicable more generally to online lessons targeting polysemous constructions. The paper begins with an overview of the learning problem presented by prepositions and the treatment of this word class within the Cognitive Linguistics framework. The main body of the paper then discusses the ten principles, using examples from an online lesson that taught the noncentral senses of prepositions to Japanese university students. The conclusion considers several outstanding questions that need to be addressed in future research.

Introduction

As a word class, prepositions occur frequently in English. In fact, 11 prepositions (*of, in, to, for, with, on, by, at, from, into, and about*) occur over 1,000 times per million words in the British National Corpus (Leech et al., 2001), and the most frequent six prepositions account for around three-quarters of all prepositional use. To get a sense of what this signifies, a novel contains around 100,000 tokens (i.e., running words), so these 11 prepositions could each be expected to appear over 100 times in a single novel. In spite of this frequency, prepositions are

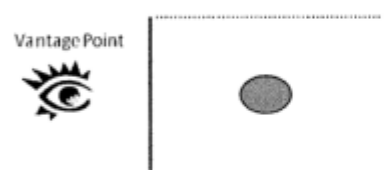
notoriously challenging for L2 learners (Mueller, 2022). This difficulty likely stems from several factors, including many prepositions' low phonological salience (Preciado-Sánchez & Moreno-Vega, 2024), the highly polysemous nature of core prepositions (Tyler & Evans, 2003; Tyler et al., 2011), mismatches in how different languages extend core prepositional senses (Mueller, 2012), and the ineffective learning strategies adopted by some L2 learners and popular textbooks (Mueller, 2025). Crosslinguistic differences between a learner's first language and the target language can affect routes of acquisition, as shown in previous research. For example, Mueller (2012), through his comparison of native-speaker corpora and a learner corpus, has shown that non-native speakers (NNSs) generally use fewer prepositions in their writing. This likely reflects NNSs' difficulties in acquiring the precise semantics of this word class but may also reflect the relatively minor role that forms analogous to English prepositions (e.g., noun affixes) play in many languages.

In Cognitive Linguistics, the senses of spatial prepositions are typically analyzed in terms of a landmark element (also called the ground), a trajector element (also called the figure), and the vantage point (Tyler & Evans, 2003). The *landmark* is the background element, typically relatively immobile, that serves to locate the trajector. The *trajector*, on the other hand, is typically a smaller and more mobile element that is the focus of attention. The *vantage point* is the point from which a spatial scene is viewed. The full explication of the sense of each preposition must go beyond purely topological features to also consider functional features. For example, when we say *The apple is in the bowl*, this implies that when we move the bowl, the apple will move along with it. If we construct an artificial situation where the apple is also tied to a string hanging from the ceiling, native speakers' intuitions will be that the preposition IN is less suitable, even though the apple and bowl remain in the same topological relationship (Coventry & Garrod, 2004; Coventry & Guijarro-Fuentes, 2008; Garrod et al., 1999).

Researchers employing the Cognitive Linguistics framework often use abstract diagrams in their analyses, and they have also used these diagrams to convey the semantics of prepositions to language learners (Tyler, 2012a, 2012b). The basic sense of the preposition IN can be depicted as in Figure 1. This schema would be evoked by a sentence such as *The ball is in the box*, in which case, the box would serve as the landmark, the ball as the trajector, and a perspective from outside of the box as the vantage point.

Figure 1

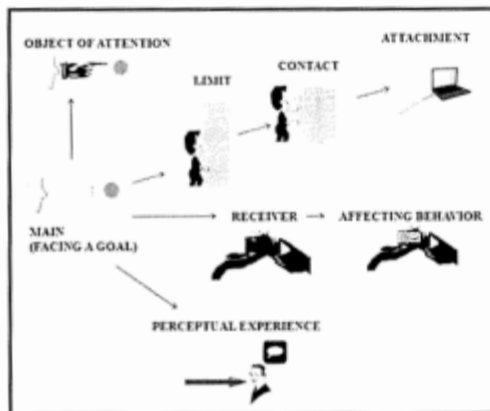
A CL Diagram Depicting the Containment Schema Underlying the Preposition IN



As Tyler and Evans (2003) have noted, the semantic analysis of prepositional senses has typically adopted one of three possible approaches. One approach is to regard each preposition as associated with a single sense that is modulated by context. One weakness of this approach is that it fails to account for the fact that two different languages with a preposition based on the same core sense can extend this central sense in different ways (Brenda & Mazurkiewicz-Sokołowska, 2022). Another approach, often encountered within textbook materials, is to regard the various senses of a preposition as distinct yet unrelated. In opposition to this approach, researchers adopting a Cognitive Linguistics framework have typically adopted analyses that view core English prepositions as possessing a number of distinct senses which are related (Brenda & Mazurkiewicz-Sokołowska, 2022:

Mueller, 2016; Tyler & Evans, 2004). Consider, for example, the polysemy network of common senses of the preposition TO as shown in Figure 2 (Tyler et al., 2011). As can be seen, each extended sense is related to at least one other sense. It should be noted that prepositional senses can also be based on metaphor (Navarro i Ferrando, 1999). For example, the “attachment” sense of TO (seen in phrases such as *connected to*, *stuck to*, *stapled to*, etc.) can also underlie metaphorical uses such as *married to* or *addicted to*.

Figure 2
The Polysemy Network for the Preposition TO



There have been numerous studies that have examined the effectiveness of explanations based on the Cognitive Linguistic framework for teaching the semantics of various aspects of English, including causatives (Mueller & Tsushima, 2019), modals (Tyler et al., 2010), phrasal verbs (Qin et al., 2022), and prepositions (Tyler et al., 2011). Most (but not all) of this research has shown that CL approaches are more effective than alternatives (Tyler, 2012b). In most

cases, CL instruction relies heavily on the use of diagrams to convey the abstract schemas underlying a target sense, and increasingly, such instruction has involved the use of CALL (computer-assisted language learning) lessons in which the instruction is self-paced and learners receive immediate feedback during practice (Wang & Zhao, 2024; Wong, 2022; Zhao et al., 2020).

Desirable Features of CALL Lessons Targeting Prepositional Senses

This paper describes the development of a CALL lesson targeting the noncentral senses of prepositions. The lesson, available online, involved two key phases: an instructional phase explaining the various senses of the target prepositions, and a practice phase in which the learners had to click on the preposition that best completed a fill-in-the-blank sentence. The development of the online lesson was guided by ten core pedagogical principles. These principles are discussed below, along with examples from the online lesson.

Principle 1. The lesson should teach the semantics of the target sense and not focus solely on collocational knowledge.

Conventional textbook treatments of prepositions often mistakenly assume that prepositional use tends to be random and unmotivated, and can consequently only be mastered through rote memorization. While the rote memorization of collocations involving the preceding verb (e.g., *connect to*, *yell at*, etc.) or following a noun (e.g., *on vacation*, *at noon*) can be helpful to a point (Mueller, 2017), the strategy ultimately fails since many verbs and nouns can collocate with more than one preposition. Moreover, when more than one preposition is possible, the choice of preposition almost always signals differences in construal of the situation. There is a difference, after all, between throwing a stick *at* a dog versus

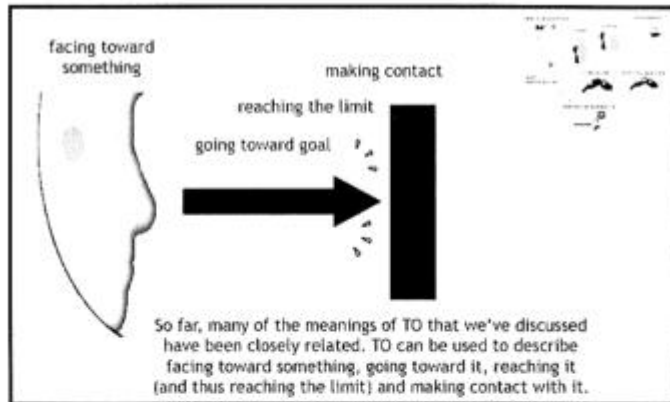
to a dog. The drawbacks of rote memorization are evident in many language learners' inability to supply the correct English preposition in phrases in which the collocation occurs with less frequency (Mueller, 2011).

Principle 2. Lessons should show how a sense is motivated by a more central sense in the preposition's polysemy network.

Learners are more likely to acquire and retain an extended sense of a preposition if they understand how the sense is motivated by a more basic sense that they already know. Consider, for example, a slide from the online lesson discussed in this paper (Figure 3) that shows the relationship between two of the extended senses of TO. Whereas the basic sense of TO involves moving towards a goal, this core sense is extended to instances in which one reaches a limit (e.g., *She filled the cup to the brim*), and the sense is then further extended to instances involving physical contact (e.g., *They stood shoulder to shoulder*). As was done in this lesson, the presentation of the polysemy network of a preposition is likely to be more pedagogically effective if it systematically moves from more central to more peripheral senses.

Figure 3

Sample CALL Slide Discussing Links Between Some Senses of TO



Principle 3. The lesson describes the criterial features that motivate the existence of a separate sense.

In the previous example, the CALL slide (Figure 3) explains how TO can denote physical contact. This can be reinforced through examples showing how TO is used even when there is no motion toward a goal. In some cases, there may be certain additional constraints on how a specific sense is utilized within specific linguistic constructions. For example, the "contact" sense of TO often appears in collocations involving the repetition of body parts (e.g., *nose to nose*, *face to face*, *mouth to mouth*, etc.) although this is not always the case (compare the somewhat archaic expression *cheek to jowl*).

Principle 4. Initial examples involve high-frequency collocations that express the prototypical sense.

When designing materials to teach prepositions, we must decide which collocations should be presented first. For example, the “attachment” sense of TO can be exemplified using a wide range of collocations (e.g., *attached to*, *connected to*, *taped to*, *addicted to*, etc.) Ellis and O’Donnell (2012) point out that the most frequently occurring exemplars (e.g., *attached to* and *connected to*, in this case) tend to embody the prototypical meaning of the semantic category, and that learning is therefore optimized (in the case of both first- and second-language acquisition) through initial encounters with this prototypical usage. For this reason, CALL lessons should be designed so that the initial examples involve the most prototypical collocations for each target sense (e.g., “attached to” or “connected to” can be presented in the initial example sentence for the “attachment” sense of TO).

Principle 5. The lesson describes how the sense can be metaphorically extended.

The lesson should present learners with multiple example sentences demonstrating how a target sense is used, with less prototypical examples appearing later in the lesson. When applicable, these should then be followed by examples showing how the target sense is metaphorically extended. Quite often, a metaphorical extension is based on the functional aspects of the sense. For example, one functional entailment of a trajector being *in* a landmark is that the trajector tends to remain in place (which is one of the main reasons human beings put objects in containers). This tendency to remain in place motivates the metaphorical extension of IN to situations in which a person tends to remain within a certain state of mind (e.g., *in love*). Lessons should therefore explicitly discuss how functional entailments

underlie metaphorical extensions of prepositional meaning.

Principle 6. The lesson should show how the sense can be distinguished from easily confused senses of other prepositions.

Learners can develop faulty or imprecise understandings of prepositional senses which are often based on crosslinguistic transfer from their first language. They can also show patterns of avoidance, using alternative expressions when a prepositional phrase would be more natural (Mueller, 2012). To assist their development of more native-like representations, CALL lessons can explicitly contrast a target sense of a preposition with the senses of other prepositions that are close in meaning. Such contrasts can be provided in both the initial instructional phase and in the practice phase. Ideally, the choice of which contrasts to show in a lesson should be based on patterns of error observed within a particular learner population.

Principle 7. Visual aids should accompany textual elements.

Example sentences should be accompanied by images whenever possible. This can be justified on several grounds. First, it reduces the risk that learners will misinterpret the example sentences. Second, it makes the target meanings more salient and thus more memorable.

Principle 8. Standardized visual elements should be used to help learners classify different examples as belonging to the same sense.

As shown in Figure 1, diagrams are often used to convey the abstract schema underlying prepositional meanings. These diagrams can be repeatedly used

throughout a CALL lesson so as to provide learners with a visual mnemonic helping them to develop a mental category corresponding to the target sense, as it occurs within various example sentences. In other words, the diagrams can remind the learners that multiple examples are associated with the same abstract sense. The diagrams used in much of the CL literature tend to be highly abstract. Those used for pedagogical purposes can be slightly more concrete and transparent so that they are more readily interpretable and easy to remember.

Principle 9. Learners are required to apply their newly acquired knowledge to low-frequency collocates.

As previous research (e.g., Mueller, 2011) has shown, learners can often supply the correct preposition for a sentence based solely on their knowledge of common collocations. To verify that learners have actually mastered a target sense, it is therefore important to test their knowledge using less frequently occurring collocations during the practice phase of instruction. For example, a lesson targeting the “attachment” sense of TO should include some test sentences using low-frequency collocations involving the target sense (e.g., *glued to*, *nailed to*, etc.) Ideally, some of these sentences should include collocations that did not appear within the prior instruction.

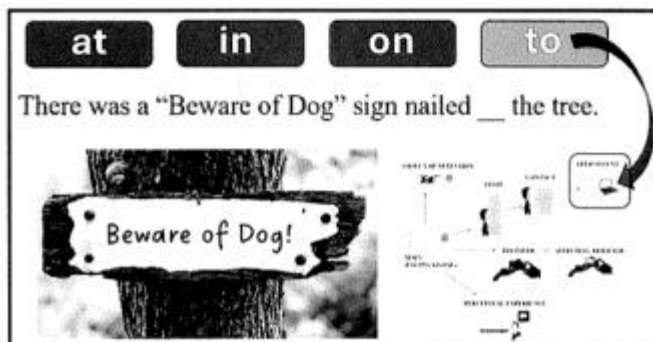
Principle 10. Learners should practice and receive immediate corrective feedback.

One difficulty plaguing language learning within naturalistic contexts is that learners often do not receive feedback when they make errors in their production (Li, 2010). This can be remedied in instructional settings, especially when CALL applications are used. From a general perspective, learners acquiring

English prepositions must develop associations between linguistic form and a semantic category. To do this, they need to form an appropriate semantic category corresponding to each prepositional sense. Research on category learning has demonstrated that the implicit learning of perceptual categories is greatly enhanced if learners receive feedback within a narrow window of approximately 2.5 seconds (Maddox et al., 2003). This presumably reflects working memory constraints related to procedural learning. While the applicability of these research findings on perceptual category learning to the acquisition of semantic categories may be problematic, it seems likely that language learners are affected by similar working memory constraints.

A sample slide from the practice phase of the CALL lesson is shown in Figure 4. As can be seen, the learner is presented with a fill-in-the-blank sentence and four choices (the correct preposition and three alternatives that appear frequently in learners' errors with the target sense). After pressing on the correct response, the learner hears a pleasant chime and is shown where the target preposition appears within the polysemy network of TO.

Figure 4
Slide Showing Positive Feedback on Sentence Targeting the "Attachment" Sense of TO



When learners selected the incorrect response in the online lesson, they immediately heard a buzzer sound and were shown an explanation of why their response was wrong (Figure 5). They read an explanation (in their L1) that explained why their chosen response did not work for the given context. In the example in Figure 5, the learner chose FOR instead of TO. The Japanese feedback explains that FOR is used in contexts in which the statement concerns objective fact and therefore does not work for the given sentence, which concerns a subjective impression (Mueller, 2016).

Figure 5

Sample Slide Showing the Response to an Incorrect Response During Practice Phase

at for to with

This milk tastes strange ___ me.

この文は「for」を使えば、客観的なものになる。例えば、私が「チョコレートは天に良い」と言えば、誰かが「チョコレートは天に悪いと思う！」と反対することができる。しかし、私が牛乳を飲んで味の印象を述べた場合、私にとっての味は私にしかわからない。

The preposition lesson discussed in this paper was created using Adobe Captivate. The Captivate program interface resembles PowerPoint, and the program allows the embedding of sound and other elements. It is also possible to put in alternative slides that appear based on each learner's response. However,

it is also possible to create this sort of lesson in PowerPoint, and these lessons can be saved as html and then placed on a website. Finally, it is possible to create this sort of lesson using html. For those who are not familiar with html, ChatGPT can create basic webpages. If one creates a lesson this way, one will just need to be careful about how to name and link the separate html pages. All of these techniques assume that one has access to web space.

Conclusion

This paper has discussed ten basic principles that guided the development of an online lesson targeting the senses of English prepositions. Those who would like to see the lesson or make it available to their students can find a link to the lesson on my webpage (<http://charlesmmueller.com/resources.html>). These lessons have certain advantages since learners can move through them at their own pace and can receive specific feedback based on their own patterns of error. A large body of research now shows the benefits of CL-based pedagogy (Tyler, 2012b) and the benefits of CL lessons delivered through CALL applications (Wong et al., 2018). Unfortunately, most of the empirical work that has examined the effectiveness of such lessons has reported learning as measured by immediate posttests or delayed posttests given a few weeks after a lesson is completed. Future research should also examine whether this learning persists, and whether students benefit from more sustained interventions in which learning is repeatedly reinforced at regular intervals throughout a course.

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