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Effects of context on implicit and explicit lexical knowledge: An event-related potential study

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ABSTRACT

Although much is known about how contextualized and decontextualized learning affects explicit lexical knowledge, how these learning conditions contribute to implicit lexical knowledge remains unclear. To address this problem, Korean high school students were instructed to learn 30 English words by reading meaningful passages (i.e., in context) and another 30 English words using a wordlist (i.e., out of context). Five weeks later, implicit lexical knowledge was gauged by reaction time and the N400 event-related brain potential component, and explicit lexical knowledge was assessed with an explicit behavioral measure. Results showed that neither learning type was superior to the other in terms of implicit lexical knowledge acquisition, whereas learning words out of context was more effective than learning words in context for establishing explicit lexical knowledge. These results suggest that the presence or absence of context may lead to dissociation in the development of implicit and explicit lexical knowledge.

1. Introduction

Much second language (L2) research has focused on whether novel words should be learned in context or out of context (Krashen, 1981, 1989; Oxford & Crookall, 1990; Laufer & Shmueli, 1997; Webb, 2007; Elgort, 2011). Learning words in context (*contextualized learning*) occurs when learners encounter and learn new words while engaged in meaningful activities such as reading books for pleasure. This also includes situations where learners encounter new words embedded in a sample sentence or several sample sentences, as in previous studies (e.g., Laufer & Shmueli, 1997; Baleghizadeh & Shahry, 2010). Given that novel words are not processed as individual units but as part of the overall meaning of the passage, words encountered in context are more likely to be linked with the meaning of the passage (Masson & MacLeod, 2000).

In contrast, learning words out of context (*decontextualized learning*) occurs when words are learned isolated from context. This type of learning typically entails rote memory of unfamiliar L2 target words and their familiar first language (L1) equivalents (i.e., definitions), through the use of flashcards or wordlists. Unlike first language (L1) learners who acquire most of their lexical knowledge through engagement with meaningful contexts, L2 learners rely heavily on decontextualized approaches such as wordlists, flashcards, and vocabulary notebooks that are either paper-based (Walters & Bozkurt, 2009; Chun, Choi, & Kim, 2012) or computer-assisted (Hirschel & Fritz, 2013).

However, decontextualized learning has come under strong criticism since the advent of communicative language teaching methods three decades ago. Many researchers claim that decontextualized learning contributes little to the speaking and writing skills of L2 learners (Krashen, 1989; Oxford & Crookall, 1990; Oxford & Scarcella, 1994; Nation, 2011). In addition, these researchers argue that words learned out of context are more likely to fade from memory, whereas words learned in context are better assimilated and retained, because of the cognitive effort required to infer word meanings. Folse (2004) also posited that learning words isolated from context can be unengaging to many learners.

Although contextualized learning has been strongly advocated by a number of vocabulary researchers (e.g., Krashen, 1989; Oxford & Crookall, 1990), research to date has demonstrated "little evidence indicating that context facilitates vocabulary learning" (Webb, 2007, p. 63). Many researchers have reported that learning words in context results in relatively small gains in lexical knowledge (e.g., Seibert, 1930; Dupuy & Krashen, 1993; Prince, 1996; Laufer & Shmueli, 1997). In contrast, learning words devoid of context led to sizable gains in lexical knowledge (e.g., Walters &

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Bozkurt, 2009; Elgort, 2011). For instance, Elgort (2011) examined how intentional learning of 48 novel words from word cards (i.e., without meaningful context) affected L2 vocabulary acquisition. Participants were 10 male and 38 female L2 learners of English in New Zealand, who ranged in age from 18 to 52 years old. Results based on form priming, masked priming, and semantic priming procedures showed that intentional learning of unfamiliar words promoted learning of representational and functional dimensions of lexical knowledge. Based on these findings, Elgort (2011) concluded that intentional learning through word cards is a very efficient means of acquiring novel L2 words.

The empirical studies cited above provide some evidence that decontextualized learning may be a more efficient means of acquiring L2 vocabulary than contextualized learning. However, these studies only used off-line, explicit measures of lexical knowledge and focused on how explicit lexical knowledge is acquired as a function of context. Therefore, little is known about how learning novel words in context or in isolation affects implicit lexical knowledge in L2 learners. Given that the development of implicit knowledge is the ultimate goal of L2 acquisition (DeKeyser, 2003; Ellis, 2005; Hulstijn & Ellis, 2005; Williams, 2009; Bowles, 2011; Sonbul & Schmitt, 2013), it is imperative to determine how contextualized and decontextualized learning conditions affect implicit lexical knowledge.

1.1. Definition and measurements of explicit and implicit lexical knowledge

Although there is no consensus among L2 researchers on the exact nature of explicit and implicit knowledge, consciousness is at the heart of the explicit–implicit knowledge distinction (Bialystok, 1981; Williams, 2009). Specifically, explicit knowledge is typically defined as intentional and declarative knowledge. In contrast, implicit knowledge refers to unconscious and procedural knowledge. Implicit knowledge is associated with effortless (i.e., fluent) and automatic processing (Segalowitz, 2003; Segalowitz & Hulstijn, 2005). In the present study, explicit lexical knowledge refers to the intentional and conscious retrieval of novel word meanings and the learners' ability to verbalize the meanings of novel words. In contrast, implicit lexical knowledge refers to the unconscious retrieval or processing of lexical information and the degree of processing fluency, that is, how unintentionally and automatically learners process the meaning of target words (Hulstijn & de Graaff, 1994).

Explicit lexical knowledge is the conscious knowledge of lexical information. It has been measured through *direct, off-line* techniques such as translation (Hulstijn, Hollander, & Greidanus, 1996), recall (Laufer & Rozovski-Roitblat, 2011), recognition tasks (Bowles, 2011), untimed lexical decision tasks (Ellis, 2005), and multiple-choice vocabulary tests (Rott, 1999; Tekmen & Dakoğu, 2006). In the present study, explicit lexical knowledge was assessed by a vocabulary translation test in which participants were asked to write down the meaning of target words.

Implicit lexical knowledge is unintentional, non-reflective, and automatic knowledge that learners process without awareness. Therefore, it has been assessed using *indirect, on-line* measures. In the present study, we used reaction times (RTs) and event-related potentials (ERPs) as indicators of implicit lexical processing. RTs are an index of speed of processing in terms of the elapsed time between the presentation of visual or auditory stimuli and the subsequent response (e.g., a button press), and have been used to tap into unintentional and automatic processing of lexical information, that is, the degree of fluent lexical processing (Williams, 2009; Elgort, 2011). Given that conscious and deliberate efforts require more processing time, shortening of RTs can be taken as an index of automatic processing or a comparatively higher degree of implicit knowledge (Ashcraft & Radvansky, 2010).

ERPs are online electrophysiological brain responses to visual or auditory stimuli such as congruent and incongruent word pairs. ERPs have been used by many researchers as a reliable and viable indicator of implicit knowledge (Hahne & Friederici, 2001; Friederici, Steinhauer, & Pfeifer, 2002; McLaughlin, Osterhout, & Kim, 2004; Tocowicz & MacWhinney, 2005; Osterhout, McLaughlin, Pitkanen, Frenck-Mestre, & Molinaro, 2006; Morgan-Short, 2007; Williams, 2009). Unlike functional magnetic resonance imaging (fMRI) and positron-emission tomography (PET), ERPs provide excellent temporal resolution of language processing (Tokowicz & MacWhinney, 2005; Batterink & Neville, 2011; Malins et al., 2013). Williams (2009, p. 325) claimed that "Neurological measures perhaps provide the most promising approach to the identification of automatic processing" because ERP responses are generated "within a few hundred milliseconds of semantic and syntactic violations and so are not likely to be the result of conscious thought processes".

Among the various ERP components, the present study focuses on the N400, which is a negative-going deflection with a posterior and bilateral distribution (Kutas & Hillyard, 1980). The N400 is typically elicited around 300 ms and peaks at around 400 ms (hence the term "N400") after the onset of an anomalous stimulus such as semantically incongruent word pairs (e.g., *planet-coffee*) compared with congruent word pairs (e.g., *planet-earth*).

1.2. The N400 effect

Extant evidence suggests that the N400 is a sensitive marker of lexical and semantic word knowledge (McLaughlin et al., 2004; Mestres-Missé, Rodriguez-Fornells, & Münte, 2007; Batterink & Neville, 2011). However, the exact nature of the N400 has been debated. To date, two major accounts of the N400 have been proposed: (a) *semantic integration* of a critical word with the current context and (b) *retrieval* of lexical information stored in long-term memory (for review, see Lau, Phillips, and Poeppel (2008); also Swaab, Ledoux, Camblin, and Boudewyn (2012)).

According to the *semantic integration* account, the N400 may be associated with "the process of semantic integration of the critical word with the working context" (Lau et al., 2008, p. 921). For example, the N400 amplitude is larger in a semantically incongruent sentence relative to a semantically congruent sentence because integration of a critical word with the incongruent sentence is more difficult than with the congruent sentence. According to Batterink and Neville (2011), this integration process may be dependent upon conscious awareness and explicit lexical knowledge. In other words, the N400 effect may reflect a contextually-dependent explicit memory process. Specifically, these researchers investigated neural correlates of real-time meaning acquisition of novel English words (pseudowords) presented in a discourse-level context (a story). Participants ($N=21$) were adult learners who were monolingual native speakers of English. Data from the explicit recognition task showed that correctly recognized target words evoked an N400 effect, whereas incorrectly recognized ones failed to elicit the N400 effect. During the recognition task, more emphasis was placed on accuracy rather than speed of response. Based on these results, Batterink and Neville (2011) concluded that the N400 reflects a semantic integration process that may rely on explicit representation of word meanings.

According to the *retrieval* account, the N400 effect indexes "facilitated activation of features of the long-term memory representation that is associated with a lexical item" (Lau et al., 2008, p. 921), suggesting that the N400 may reflect an implicit memory process. Likewise, Kutas, Van Petten, and Kluender (2006, p. 669) have concluded that "N400 amplitude is a general index of the ease or difficulty of retrieving stored conceptual knowledge