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The Role of Socially-Mediated Alignment in the Development of Second Language Grammar and Vocabulary: Comparing Face-to-Face and Synchronous Mobile-Mediated Communication

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THE ROLE OF SOCIALLY-MEDIATED ALIGNMENT IN THE DEVELOPMENT OF SECOND LANGUAGE GRAMMAR AND VOCABULARY: COMPARING FACE-TO-FACE AND SYNCHRONOUS MOBILE-MEDIATED COMMUNICATION

by

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Under the Direction of YouJin Kim, PhD

ABSTRACT

Decades of research has shown that speakers mutually adapt to each other's linguistic behaviors at different levels of language during dialogue. Recent second language (L2) research has suggested that alignment occurring while L2 learners carry out collaborative activities may lead to L2 development, highlighting the benefits of using alignment activities for L2 learning. However, despite the notion that speakers linguistically align in interactions happening in socially-situated contexts, little is known about the role of social factors in the magnitude and learning outcomes of alignment occurring in L2 interaction. The purpose of the study was to examine the pedagogical benefits of alignment activities for the development of L2 grammar and vocabulary during peer interaction across two different interactional contexts: Face-to-Face (FTF) and synchronous mobile-mediated communication (SMMC; mobile text-chat). The target

vocabulary items included 32 words and the target structure was a stranded preposition construction embedded in an English relative clause. Furthermore, this study investigated whether social factors (i.e., L2 learners' perceptions of their interlocutor's proficiency, comprehensibility of the interlocutor's language production, and task experience with the interlocutor) and cognitive factors (i.e., individual differences in language aptitude, cognitive style, and proficiency) would modulate alignment effects. Ninety-eight Korean university students were assigned to either the FTF or SMMC group. They completed two alignment activities in pairs, three measurement tests (pre-, post-, and delayed post-test), various cognitive ability tests, and perception questionnaires over four weeks. Results indicated that alignment occurred at the structural and lexical levels in FTF and SMMC modes, but also that structural alignment was facilitated significantly more in the SMMC mode when compared to FTF. However, there was no significant modality effect on the degree of lexical alignment. Findings also demonstrated beneficial role of alignment activities in L2 grammar and vocabulary learning, irrespective of the modality. Furthermore, results suggested that language proficiency and explicit language aptitude were significantly associated with structural alignment driven learning. Learners' perceptions did not show a significant impact on the degree of alignment and learning outcomes. Implications for the benefits of interactive alignment activities for L2 development and the effect of modality, social factors, and cognitive factors are discussed.

INDEX WORDS: Socially-mediated alignment, Linguistic alignment, Structural alignment, Lexical alignment, Synchronous mobile-mediated communication, Mobile learning

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DEDICATION

This dissertation is dedicated to my father and mother, who instilled in me the joy of reading, writing, and learning.

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1 INTRODUCTION

Building on Long's Interaction Hypothesis (Long, 1996), the importance of interaction for second language acquisition (SLA) has been attested in a variety of instructional contexts including foreign and second language (L2) classrooms as well as computer-mediated communication contexts (Gass & Mackey, 2014; Mackey, Abbuhl, & Gass, 2012). Interactive tasks have been used in these studies to elicit interaction data as well as to test any theoretical claims about the role of different aspects of interaction (e.g., feedback, modified output, noticing) in L2 learning.

Recent L2 interaction research has adopted psycholinguistic models of linguistic alignment from first language (L1) research to investigate whether linguistic alignment occurs in conversations involving L2 speakers as in L1 dialogues, and if so, whether linguistic alignment that occurs during interactive tasks can be used to account for how L2 learning takes place during communicative interaction (e.g., McDonough, Neumann, & Trofimovich, 2015). Based on psycholinguistic models of linguistic alignment (e.g., Interactive Alignment Model, the Lexicalist Residual Activation Account, the Implicit-Learning Account), SLA researchers have viewed linguistic alignment as a psycholinguistic phenomenon that causes speakers to adjust their language to those of their conversation partners. Linguistic alignment can occur at various levels of linguistic components including lexis and grammar via implicit priming mechanisms. Priming is the easier availability of words and syntactic structures that have been pre-activated through related items, e.g., by the interlocutor (Meyer & Schvaneveldt 1971). Moreover, the processes of alignment at different levels (e.g., words, structure, meaning) interact in such a way that increased alignment at one level leads to increased alignment at other levels (i.e., alignment percolates between levels) (Menenti, Pickering, & Garrod, 2012). On the basis of the notion that

mutual alignment may ease language production in dialogues, such that they put up a lower cognitive load than monologues (Michel, Kuiken, & Veddar, 2012), researchers have suggested that L2 learners may also benefit from linguistic alignment because attentional resources are freed up by alignment processes in a dialogic task condition (Michel, 2011). However, despite growing interest in examining whether linguistic alignment effects are moderated by a range of social factors in L1 alignment literature (i.e., socially-mediated linguistic alignment; Weatherholtz, Campbell-Kibler, & Jaeger, 2014), the socio-cognitive approach to linguistic alignment has received little attention in L2 research.

An increasing number of L2 studies have investigated the application of a priming paradigm to L2 from interactionist perspectives in order to see if linguistic alignment (operationalized as priming) occurring during L2 interactions can facilitate L2 development (e.g., Jung, Kim, & Murphy, 2017; Kim & McDonough, 2008; McDonough et al., 2015; Michel & Smith, 2017). Such research has demonstrated that alignment can be elicited through collaborative communicative activities which have potential for providing sustained practice of target linguistic features. Findings of previous research have shown that interactive activities designed to elicit alignment with target language patterns (i.e., alignment activities) could be helpful for facilitating L2 learning as they help learners develop mental representations of the target linguistic features (McDonough et al., 2015; Trofimovich, McDonough, & Foote, 2014). For example, the efficacy of collaborative alignment activities has been demonstrated for various L2 learning outcomes including grammar (e.g., McDonough et al., 2015) and pronunciation (e.g., Jung et al., 2017), indicating the potential benefits of interaction occurring during alignment activities for L2 learning. Additionally, only one study to date (Trofimovich, McDonough, & Neumann, 2013) has shown that alignment occurred to a greater extent when learners were

provided with integrated auditory and structural primes, supporting the notion that alignment at one level enhances alignment at another level. However, it has yet to be examined whether other types of integrated primes such as integrated lexical and structural primes also promote alignment effects, which may, in turn, affect the magnitude of alignment at both lexical (lexical alignment) and structural levels (structural alignment). Lexical alignment refers to the tendency for speakers to repeat each other's lexical choices. And structural alignment is the tendency for speakers to produce a specific syntactic construction that recently occurred during communicative interactions.

Drawing on previous L2 alignment research, the current study aimed to examine the occurrence of linguistic alignment at the level of lexical and grammatical choice in oral and written modalities and the effects of alignment on the learning of L2 grammar and vocabulary. Furthermore, this study also investigated whether certain social factors (i.e., L2 learners' perceptions of their peer interlocutor) and cognitive factors (i.e., individual differences in cognitive abilities such as language proficiency, cognitive language aptitude, cognitive style) would modulate any effects.

Of several theoretical approaches to linguistic alignment developed in psycholinguistics, L2 researchers have focused on the interactive alignment model (IAM; Pickering & Garrod, 2004; McDonough et al., 2015), the lexicalist residual activation account (Pickering & Branigan, 1998), and the implicit-learning account (Bock & Griffin, 2000; Chang, Dell, & Bock, 2006; Shin & Christianson, 2012). In these psycholinguistic accounts, linguistic alignment is characterized as largely automatic and not under the conscious control of the speaker. More specifically, researchers have argued that because linguistic alignment is caused by an automatic perception-behavior link, the likelihood that interlocutors engage in the same linguistic behaviors

automatically increases through merely perceiving each other's linguistic behavior (Dijksterhuis & Bargh, 2001; Garrod & Pickering, 2004; Unger, 2010) and that social factors should not affect the degree of alignment (Garrod & Anderson, 1987; Krauss & Pardo, 2004).

Decades of psycholinguistic research have been devoted to understanding the implicit cognitive processes involved in the development of aligned linguistic representations. However, there has been a recent recognition in L1 psycholinguistics literature that linguistic alignment is essentially a socio-cognitive phenomenon involving a vast range of cognitive as well as social factors (e.g., Branigan, Pickering, Pearson, McLean, & Brown, 2011; Lev-Ari, 2016; Pirie, 2010). Accordingly, a growing interest has emerged in L1 alignment research as to how the cognitive mechanism of alignment is mediated by a range of social factors (i.e., socially-mediated linguistic alignment; Weatherholtz et al., 2014). Based on the sociolinguistic account demonstrating the meaningful impact of social factors on speakers' alignment behaviors (i.e., the Communicative Accommodation Theory [CAT]; Giles & Powesland, 1975; Giles, Coupland, & Coupland, 1991), researchers have demonstrated that interlocutors tend to converge or diverge on shared linguistic behaviors during social interaction as a function of their beliefs, attitudes, and sociocultural conditions. (e.g., Branigan, Pickering, Pearson, & McLean, 2010; Branigan et al., 2011; Weatherholtz et al., 2014). Within the framework of CAT, alignment in conversation can be interpreted as the interlocutors' desire (whether overt or tacit) for social integration, solidarity, and identification, whereas an absence of alignment may indicate speakers' intention to maintain distance with the interlocutor or desire to differentiate themselves from the interlocutor (Trofomovich & Kennedy, 2014). Overall, findings of previous L1 alignment studies have suggested that the extent to which L1 speakers linguistically align may be mediated by their perceptions or beliefs about their interlocutors, such that, for example, positive perceptions (e.g.,

perceiving the interlocutor as being linguistically competent or believing that the interlocutor belongs to the same social group with the speaker) resulted in a greater degree of alignment in a dialogue (Branigan et al., 2011).

Within the realm of SLA, some researchers have claimed that alignment constitutes a crucial aspect of L2 acquisition and that it is important to broaden our perspective beyond cognitive factors to include social factors in the investigation of alignment (Atkinson, Churchill, Nishino, & Okada, 2007). In contrast to the psycholinguistic models, which ascribes successful communication between interlocutors mainly to alignment in mental states, the socio-cognitive approach to alignment not only looks at the role of mental states but also goes beyond by incorporating social factors into the alignment process to shed light on how L2 develops in the course of interaction. By including social factors in the investigation of linguistic alignment occurring in L2 interaction, the role of interaction in L2 learning processes can be scrutinized in a more in-depth manner, thus enriching the interaction approach to SLA (Wang & Wang, 2015). Within the broad approach that views alignment as a phenomenon of interlocutor adaptation at both social and cognitive levels, language development is conceptualized as a gradual, interactive alignment of the speaker with a socio-cognitive learning environment. For instance, L2 learning may occur as a learner aligns with the teacher during interactions that take place in a classroom in terms of the linguistic complexity of utterances, choice of words and grammatical structures, body gestures, and the rate of speech (Atkinson et al., 2007; Churchill, Nishino, Okada & Atkinson, 2010). This view of L2 learning that encompasses both social and cognitive dimensions of alignment appears to be promising for explaining how L2 develops within social interactions by means of alignment processes (Trofimovich & Kennedy, 2014). While an increasing volume of L1 research has investigated linguistic alignment as a socio-cognitive

phenomenon rather than a purely psycholinguistic one, the concept of socially-mediated linguistic alignment has not been empirically examined in SLA. Accordingly, little is known about how the cognitive mechanisms of linguistic alignment are mediated by social factors. The current study sets out to explore the role of social factors in the extent to which L2 learners align at the lexical and structural levels during task-based interactions and the learning outcomes of the alignment activities. Previous research has proposed perceptions of the interlocutor's language competence and task performance as social factors that may affect linguistic alignment effects in L2 dialogues (Costa, Pickering, & Sorace, 2008). Thus, the social factors included in this study are L2 learners' perceptions of their interlocutor with respect to the interlocutor's language proficiency, comprehensibility of the interlocutor's language production, and task experience with the interlocutor.

As to the context of interaction, the majority of L2 alignment studies have focused on spoken interactions during alignment activities, and little attention has been paid to the effect of modality on learners' performance on such tasks. More specifically, despite the notion that linguistic alignment takes place in written communication in the same way that it does it spoken dialogues, little has been done concerning the occurrence of alignment in L2 written discourse and its role in L2 development. Thus data are limited regarding the role of different modalities of communication in the helpfulness of alignment activities for L2 development. Of different types of written discourse, the current study focuses on L2 learners' text-chat interaction via smartphones.

As technologies advance, mobile technologies have emerged as tools to support L2 learning (i.e., synchronous mobile-mediated communication [SMMC]). Researchers have suggested that the use of mobile devices holds potential to the design and implementation of

interactive language activities (Lys, 2013). Of various mobile devices, smartphones have received much attention in the literature due to their unique features such as easy and immediate access to language resources and use of various mobile applications for communicative language practices such as instant messaging applications and language learning applications (Bozdoğan, 2015). For example, with smartphones, learners can access learning materials more easily and participate in collaborative language activities synchronously anytime, anywhere, which would, in turn, allow rapid development of L2 skills (Kim & Kwon, 2013). Furthermore, various resources and tools of smartphones have been claimed to encourage learners to be more motivated, autonomous, situated, and socially interactive (Kukulska-Hulme & Shield, 2008). Researchers have indicated that smartphones could help create new learning opportunities as well as new learning environments in SLA settings (Godwin-Jones, 2011), suggesting that smartphones have the potential to become a more integral part of language learning courses as opposed to the more supplemental role often assigned to computer labs (Stockwell, 2007). However, despite its increasing popularity and potential as an L2 learning tool, only a few studies have investigated the implementation of language activities on smartphones using an instant messaging application featuring text-chat and its effectiveness on L2 development (e.g., Pellerin, 2014). Moreover, no study to date has examined L2 learners' performance on alignment activities in text-chat interaction via smartphones or compared learners' alignment behaviors in the face-to-face (FTF) and SMMC contexts. More importantly, given that many previous studies have used smartphones for relatively short-term tests or a one-shot experiment, the usefulness of smartphones for long-term learning outcomes has yet to be learned (Chwo, Marek, Wu, 2018). To address these research gaps, the present study aimed to examine the benefits of using

interactive alignment activities between peers for the development of L2 vocabulary and grammar in two different interactional contexts: FTF and SMMC.

In addition to investigating the effect of modality on the degree of linguistic alignment and its learning outcomes, this study examined how individual differences in cognitive abilities (i.e., cognitive factors) may affect the extent to which L2 peer interlocutors align in terms of their choices of words and grammatical forms and the development of L2 vocabulary and grammar. Recent L2 alignment research has found a significant relationship between some cognitive factors and the degree of linguistic alignment. For instance, McDonough and Fulga (2015) showed that the mental representation of the relevant target linguistic features (i.e., prior knowledge of the target feature) must exist for alignment to take place in L2 dialogues. Similarly, L2 proficiency was also found to have a significant effect on the alignment effects such that learners with high proficiency tended to profit from the alignment activities to a greater extent as compared to less proficient L2 learners (Kim, Jung, & Skalicky, under review; Kim & McDonough, 2008). Attention has also been paid to the relationship between working memory capacity and alignment effects and the findings did not provide strong evidence for the role of working memory. For example, while working memory did not mediate the role of structural alignment in the subsequent production of target grammatical structures (McDonough & Kim, 2016; McDonough & Trofimovich, 2016), aligned production of the target features was significantly affected by working memory, only when the prime sentences were adjacent to prompts (i.e., no lags between a prime and a prompt). As described thus far, only a paucity of L2 research has examined the role of cognitive factors in alignment effects and subsequent production of target linguistic features. Moreover, very few cognitive factors have been a focus of previous L2 alignment research and the findings are not straightforward in that some

manipulative factors (e.g., lags between primes and prompts) can intervene the effect of a cognitive factor (e.g., working memory) in the degree of linguistic alignment. Therefore, more studies are necessary to advance our understanding of the role of other components of cognitive abilities in the degree of linguistic alignment and its learning outcomes. To this end, the current study examined whether and to what extent some cognitive factors affected L2 learners' alignment behaviors at the lexical and structural levels and the subsequent production of the target words and grammatical structure.

Among the different types of cognitive abilities, cognitive aptitude for language learning was a focus in this study. Given the potential association between alignment effects and cognitive aptitude for language learning (Ferreira & Bock, 2007), the current study measured a learner's language aptitude using the LLAMA test (Meara, 2005). The LLAMA test consists of four learning tasks based on input which is presumably independent of test-takers' L1: vocabulary learning, sound recognition, sound-symbol correspondence, and grammatical inferencing, or inductive learning of form-meaning mappings. Cognitive style is another cognitive factor that this study examined. SLA researchers have demonstrated that two bipolar dimensions of cognitive style, the rational–analytical and experiential–intuitive cognitive styles, are relevant to L2 learning (Granena, 2013, 2016; Linck et al., 2013). A rational–analytical style refers to the tendency to rely on logic and analysis as an approach to information processing whereas an experiential–intuitive cognitive style refers to the tendency to rely on intuition and holistic thinking as an approach to information processing. A rational–analytical style has been found to be more related to explicit cognitive processes and abilities whereas an experiential–intuitive cognitive style is related to implicit cognitive processes and abilities (Granena, 2016). Building on these previous findings regarding the relationship between cognitive factors and L2

learning, the current study sets out to investigate whether cognitive aptitude for language learning, the rational–analytical and the experiential–intuitive cognitive styles as well as language proficiency affect the occurrence of linguistic alignment and the subsequent learning effects.

The motivation for the current study was to provide a more comprehensive understanding of the linguistic alignment phenomenon in L2 dialogues by examining the relationship of social factors to the cognitive dimension (priming) of linguistic alignment, thereby contributing to the development of an integrated theory of socially-mediated linguistic alignment in the field of SLA. Furthermore, this study aimed to increase our understanding of whether and how the socio-cognitive mechanisms of linguistic alignment can be used as tools for learning and teaching L2 vocabulary and grammar, particularly when pairs of L2 peers carried out alignment activities for an instructional purpose. Given that previous research has suggested that learners' individual differences in cognitive style, cognitive aptitude for language learning, and L2 proficiency may affect L2 performance as well as learning outcomes, this study is also interested in exploring whether such cognitive factors may impact the degree of linguistic alignment that takes place while L2 learners carry out a communicative activity and the learning outcomes from alignment activities. Finally, drawing on the notion that linguistic alignment can occur in both FTF spoken dialogue and text-based interaction (Branigan et al., 2011; Hartsuiker et al., 2008), the current study examined the influence of two different modalities (Face-to-Face [FTF] and Synchronous Mobile-Mediated Communication [SMMC]) on the magnitude of linguistic alignment and subsequent production of target words and grammatical structure.

1.1 Organization of the Dissertation

The current dissertation consists of six chapters. Chapter 1 (the present chapter) is a general introduction which discusses the major research issues and aims of this dissertation. Chapter 2 reviews relevant theories and previous empirical studies related to the current study. The methods used for investigating the research issues are described in Chapter 3. Chapter 4 is devoted to reporting the results, and Chapter 5 discusses the results and the contributions of the study. Finally, Chapter 6 addresses the study's limitations, draws some conclusions and makes several suggestions for future study.

2 LITERATURE REVIEW

This chapter begins by introducing the concept of linguistic alignment and outlining the theoretical frameworks that have informed linguistic alignment research in both L1 and L2 literature. Two theoretical frameworks presented in this chapter include Interactive Alignment Model (Pickering & Garrod, 2004) and Implicit Learning Account (Bock & Griffin), which have underpinned and guided much of L1 and L2 alignment research. Empirical research on linguistic alignment are reviewed following the introduction of the theoretical frameworks. Review of L1 research precedes that of L2 alignment research. In the review of L2 alignment literature, particular focus was on SLA research from the cognitive-interactionist perspective. Then three moderating factors on linguistic alignment effects – modality, social factors, and cognitive factors - are introduced and relevant L1 and L2 alignment research are reviewed for each of the moderating factors.

2.1 Overview of linguistic alignment

Linguistic alignment refers to the process by which interlocutors converge with their conversational partner on a number of different linguistic levels (Slocombe et al., 2013). Previous research has suggested that linguistic alignment is pervasive in dialogue as speakers mutually adapt to each other's linguistic behaviors without explicit negotiation and/or control of the language they use (Foltz, Gaspers, Meyer, Thiele, Cimiano, & Stenneken, 2015). In other words, when two people verbally interact, their levels of linguistic representation align by co-activating similar linguistics features. This adaptive behavior occurs through the course of a dialogue or a series of dialogues (Branigan, Pickering, Pearson, McLean, & Nass, 2003; Pearson, Hu, Branigan, Pickering, & Nass, 2006; Pickering & Garrod, 2004). The term *linguistic alignment* denotes the tendency for interlocutors to imitate each other's language choices, such

as their use of specific lexical terms or grammatical structures (Garrod & Pickering, 2004). Many other terms have also been used to discuss the alignment phenomenon, which include "accommodation" (Fais, 1996), "convergence" (Brennan, 1996), "entrainment" (Garrod & Anderson, 1987), "matching" (Niederhoffer & Pennebaker, 2002), "repetition" (Cleland & Pickering, 2003), and "priming" (Ferreira & Bock, 2006).

Among these terms, *alignment* and *priming* have been used interchangeably in many of the previous studies. In particular, *priming* has been prevalently used in much of L2 research to refer to the phenomenon of using a particular linguistic feature given prior exposure to the same feature. (e.g., Ellis, 2012; Jung et al., 2017; McDonough et al., 2015). However, the observed phenomena, which were referred to as priming effects in previous research, are actually alignment effects; the priming mechanism is a hypothesized cause of linguistic alignment, which may lead to two distinct questions – 1) does linguistic alignment occur and 2) if it does, is it caused by priming? (Howes, Healey, & Purver, 2010). More specifically, priming refers to enhanced processing of a stimulus due to prior exposure and the priming mechanism is proposed to underlie interlocutors' tendency to re-use linguistic features that their conversation partners used in the preceding utterances (Ni Eochaidh, 2010). In this regard, the term *alignment* is deemed to encompasses the underlying psycholinguistic mechanism of priming as well as its actual linguistic manifestation (Michel & Smith, 2017). Therefore, in the present study *alignment* was chosen over *priming* and other alternative terms to refer to the linguistic alignment phenomenon. However, in this review of previous research, whichever term the author(s) of previous studies employed is used, unless the two terms (i.e., alignment and priming) denoted a different construct.

Past research has shown that interlocutors constantly demonstrate linguistic alignment in spoken as well as computer-mediated written interaction in order to achieve successful communication (Pickering & Garrod, 2006; Wachsmuth, de Ruiter, Jaecks, & Kopp, 2013) because it may contribute to communication success. Interlocutors re-use not only each other's words (Garrod & Anderson, 1987; Brennan & Clark, 1996; Bortfeld & Brennan, 1997) and grammatical structures (Branigan, Pickering, & Cleland, 2000; Branigan et al., 2010) but also converge on common phonetic realizations of words (Clarke & Garrett, 2004; Pardo, 2006), and common accent and speech rate (Giles et al., 1991). Of the language domains where alignment behaviors are represented, syntactic and lexical features of language are deemed linguistic whereas acoustic-prosodic features (i.e., pronunciation, speech rate) are considered as paralinguistic or extralinguistic (Hu, 2011). Of particular interest to the current study is linguistic alignment at the syntactic and lexical levels, and therefore, studies on the alignment phenomenon with respect to sentence structure (i.e., structural alignment) and word choice (i.e., lexical alignment) are selectively reviewed and discussed in this literature review. Structural alignment refers to a tendency wherein interlocutors produce a specific syntactic construction that recently occurred during communicative interaction in which the speakers have been participating, rather than an alternative construction that could be used to express the same meaning (Bock, 1986; McDonough & Trofimovich, 2009; Pickering & Ferreira, 2008). Structural alignment is believed to occur when structural and lexical information of the prime (i.e., a specific grammatical construction that occurred in the previous discourse) becomes activated, and thus facilitates the activation and employment of a parallel language form at a later point in the discourse (McDonough & Chaikitmongkol, 2010). Lexical alignment refers to the tendency for speakers to copy each other's lexical choices when referring to a particular object (Foltz et al., 2015).

Brennan and Clark (1996) stated that as interlocutors coordinate their perspectives, they tend to adopt the same expressions to refer to an object under discussion in dialogue.

2.2 Theoretical accounts of linguistic alignment

Researchers across different fields have proposed a number of different theoretical approaches to explain the mechanisms underlying linguistic alignment in dialogue. For example, research in psycholinguistics has tried to understand alignment within the framework of the interactive alignment model (IAM) (Pickering & Garrod, 2004), lexicalist residual activation account (henceforth, the lexicalist account; Pickering & Branigan, 1998), or in terms of the implicit learning account (Bock & Griffin, 2000). First, within the IAM framework, alignment refers to dynamic matching between the mental states where interlocutors adopt comparable representations relevant to the dialogue including lexical, structural, and semantic representations as well as the situation model (Pickering & Garrod, 2004). Communication becomes successful when similar situation models are constructed by interlocutors in the course of interaction (Pickering & Garrod, 2006). To do so, interlocutors align on situation models. In other words, convergence in language use in the course of interaction helps interlocutors arrive at a common situation model. Since alignment on situation models is not explicitly negotiated, it is hypothesized to arise automatically from alignment at local levels (e.g., linguistic alignment) via priming mechanisms which are deemed implicit (i.e., unconscious) in nature (Howes et al., 2010). As the central mechanism of alignment, priming is believed to bring about aligned linguistic representations (Garrod & Pickering, 2007), reflecting implicit cognitive procedures, which operate with little or no conscious awareness. Thus, interlocutors are usually unaware that priming has taken place (Pickering & Garrod, 2004) and very rarely notice alignment of linguistic form (Branigan et al., 2010). Substantial evidence suggests that interlocutors converge

on common language patterns in the course of interaction to arrive at a common situation model or to establish common ground[1]. Underlying this concept is the idea that conversation is a joint activity wherein interlocutors work together to establish joint understanding, as interlocutors "share many aspects of their representations of the situation under discussion" (Branigan, Pickering, Mclean, & Cleland, 2007, p. 164). One determiner of successful conversation is the extent to which the interlocutors align their language use by representing the same linguistic elements at various levels (i.e., lexical, syntactic, phonological) in the course of interaction (Garrod & Pickering, 2007; Pickering & Ferreira, 2008).

People may achieve understanding by aligning their language at various levels such as lexical, structural, and phonological because the re-use of language patterns across interlocutors is argued to be a powerful repetition-driven cognitive mechanism that supports successful interaction (Trofimovich, 2016). This alignment becomes evident during conversation when interlocutors adopt and repeatedly use each other's language patterns. For example, speakers engaging in communication tasks tend to re-use each other's lexical content and phrasal structures across turns as they work to construct a common understanding as part of interaction (e.g., Garrod & Anderson, 1987). Researchers have demonstrated that one's prior language experience impacts subsequent language processing in such a way that recent exposure to a linguistic structure increases the activation level of the corresponding representation in memory (Trofimovich & McDonough, 2011). The increased activation of that particular structure leads to an increased probability of reusing the same structure on subsequent occasions when speakers have to choose between possible alternatives. In other words, speakers tend to employ language

[1] Common ground is part of the background knowledge shared between conversation partners (Clark & Marshall, 1981). Common ground deals with "what my interlocutors and I have in common when it comes to our cultural, linguistic, and other backgrounds" (Mey, 2008, p.256).

forms and meanings featured in discourse samples to which they have been previously exposed (McDonough & Trofimovich, 2009).

The other two dominant psycholinguistic approaches include the lexicalist account (Pickering & Branigan, 1998) and the implicit-learning account (Bock & Griffin, 2000; Chang et al., 2006). Unlike IAM, these two accounts focus solely on structural priming. Moreover, distinctions are not necessarily made between (*structural*) *priming* and *alignment.* Rather, *structural priming* is defined as a cognitive repetition phenomenon whereby prior exposure to specific syntactic structures influences a speaker's subsequent language comprehension or production (McDonough & Trofimovich, 2009). The lexicalist account and implicit-learning account differ, however, in their assumptions about the influence of lexical variables on structural priming and about the nature of priming processes (i.e., residual activation or learning) (Hartsuiket et al., 2008). Specifically, while the lexicalist account predicts enhancement of structural priming effects caused by lexical overlaps between a prime and target (Pickering & Branigan, 1998), the implicit-learning account predicts that structural priming takes place independently of the mental lexicon (Chang et al., 2006).

The lexicalist account emphasizes the role of lexical representations in a speaker's choice of syntactic structure. According to this account, processing a prime sentence would activate a lexical-syntactic node that represents a certain syntactic choice, and if that node is more active than its alternative will have an increased probability of selection (Pickering & Branigan, 1998). Proponents of the lexicalist account claims that when processing a prime sentence involving a certain verb and structure (e.g., the verb "give" with a prepositional object dative "Mary gives a book to John"), the link between the relevant verb lemma and lexical-syntactic node (i.e., combinatorial node roughly corresponding to the argument structure of a verb) would become

more active. Because of this link between a verb and lexical-syntactic node, the lexicalist account predicts a lexical boost of priming. Lexical boost occurs when content words in a prime match those in the target. In this account, the lexical boost to structural priming is due to residual activation of the lemma node (e.g., give), the lexical-syntactic node (e.g., prepositional object dative), and the link between them (Cai, Pickering, Yan, & Branigan, 2011). For example, if the target sentence uses the same verb "give" as the prime sentence, there should not only be priming because of the lexical-syntactic node's (prepositional object dative) residual activation, but also because of the extra activation traveling from verb to combinatorial node via the active link. Thus, there should be more priming when prime and target have the same verbs than different verbs. Empirical findings have shown that while structural priming is unaffected by the repetition of closed-class vocabulary such as prepositions and verbal morphology (Bock, 1989; Pickering & Branigan, 1998), overlaps in certain open-class words (e.g., the main verbs) between prime and enhances structural priming effect.

The implicit-learning account shares with IAM the assumption that linguistic alignment is the consequence of the relative activation of semantically equivalent structures. Similar to IAM, this account argues that (1) syntactic processing normally occurs outside of awareness in the assembly of sentences (Bock, 1986), (2) speakers tend to produce fairly complex sentences (Bock & Loebell, 1990), and (c) speakers' repetition behavior is procedural and unintentional (Bock & Griffin, 2000). However, the implicit-learning account differs from IAM in terms of the mechanism that gives rise to linguistic alignment. Focusing exclusively on alignment at the structural level, proponents of this account posits that differential activation of alternating structures, which results in structural alignment, is caused by adaptation and implicit learning mechanisms (e.g., Bock & Griffin, 2000; Chang et al., 2006). The implicit-learning account

proposes that speakers make tacit predictions about upcoming words in what they will hear. If the speakers find their predictions erroneous (i.e., the predicted output and actual output are different), they make changes to the system that generated the predictions and adjust their structural-decision rules. In the implicit-learning account, structural priming is a consequence of adaptation with the goal to minimize the expected prediction error that speakers experienced while processing subsequent sentences (Jaeger & Snider, 2013). This account also posits that structural priming is a byproduct of a larger function of human cognition: language acquisition (Malhotra, Pickering, Branigan, & Bednar, 2008).

2.3 Empirical L1 research on linguistic alignment

Empirical research has been conducted to demonstrate the occurrence of linguistic alignment in dialogues between L1 speakers. For instance, Branigan et al. (2000) demonstrated that participants structurally aligned with their interlocutor played by a scripted confederate even though they could not see the confederate. More specifically, in a picture description and –matching task, participants tended to repeat a prepositional-object structure (e.g., the boy giving a toy to his mother) or a double-object structure (e.g., the boy giving his mother a toy) immediately after hearing the confederate use a corresponding structure. Moreover, researchers have suggested that alignment of representations at levels that are not meaning-based (e.g., syntax, pronunciation) plays a fundamental role in alignment of semantic representations (e.g., lexicon) (Pickering & Garrod, 2004). In this account, alignment of each level of linguistic representation may lead to alignment at other levels in such a way that structural alignment enhances lexical alignment (Cleland & Pickering, 2003; Branigan et al., 2010). In addition, Cleland and Pickering (2003) found that speakers tended to use a complex noun phrase containing a relative clause (RC) (e.g., the dog that's black) more often after hearing a

structurally similar noun phrase than after hearing a simpler noun phrase (e.g., the black dog). Furthermore, this tendency was stronger when the head nouns used by the participants were semantically related to those used by the confederate. For example, after hearing the confederate say "the dog that's black" in the precedent utterances, the participants were more likely to use the same RC structure to describe a black cat than a black knife. These findings provide evidence that alignment at one level leads to similar behaviors at another level.

Evidence supporting the implicit-learning account comes from a range of studies showing the occurrence of priming over several trials or lags (Bock & Griffin, 2000; Chang et al., 2006; Hartsuiker et al., 2008), persistent priming effect over 20 minutes (Boyland & Anderson, 1998), long-term structural priming after training (Kaschak & Borreggine, 2008), and child language acquisition over a block of trials (Huttenlocher, Vasilyeva, & Shimpi, 2004). For example, Bock and Griffin (2000) investigated priming effects by manipulating whether speakers heard and repeated 0, 1, 2, 4, or 10 intervening neutral sentences between the prime sentence and the target picture. They found that the structural priming effect was not influenced by lags between prime and target, and structural alignment was about as robust in a lag 10 trial as when the prime sentence immediately preceded the target picture (lag 0). This enduring priming effect has been claimed to constitute evidence that structural priming is an important characteristic of implicit learning (Ferreira & Bock, 2006). Bock and Griffin also showed that participants produced the primed sentence and generalized the same structure to new utterances without any explicit attention to the form of the priming sentences, indicating there is longer-term adaptation in the cognitive learning mechanisms for sentence creation.

A set of observations supporting the implicit-learning account is from the *inverse-preference* effect. Chang and his colleagues have attempted to explain linguistic alignment in

terms of the sensitivity of learning to a structure's overall preference in the language (i.e., the error-based learning mechanisms; Chang, 2002; Chang et al., 2006). They claim that there is an asymmetry between a learner' current state of knowledge of a structure and learning of that structure. More specifically, when something is poorly known, it should be subject to greater learning, whereas when something is already well known, it should be subject to less learning. For instance, because active structures (e.g., *He broke the vase*.) heavily outnumber the alternative passives (e.g., *The vase was broken by him*.) in everyday language use, passives are more likely to undergo more learning per processing event than actives as a function of their degree of preference. Empirical evidence has been provided in numerous studies to suggest that structures that are generally less preferred or less common may exhibit greater structural priming compared to more preferred or more common structures. Furthermore, research has found that even the same structure exhibits greater syntactic persistence when it is produced in a context in which it is less preferred, compared to a context in which it is more preferred (Ferreira, 2003).

All three theoretical frameworks for linguistic alignment - IAM, the lexicalist account, and the implicit-learning account - presume that linguistic alignment is at least partially an automatic response to recent experience, rather than a strategic interactional phenomenon (Weatherholtz et al., 2014). Furthermore, provided that linguistic alignment is an automatic process, it is assumed to be relatively impervious to factors derived from the social context in which interaction takes place, such as speakers' attitudes towards the interlocutor, social group membership, etc. (Branigan et al., 2004). Support for an automatic view of alignment comes in part from the pervasiveness of linguistic alignment phenomena across different contexts, populations, and modalities: in laboratory tasks (Bock, 1986; Pickering & Branigan, 1998), in naturally occurring conversations (Gries, 2005), in adults (Bock, 1986), in children (de Marneffe,

Grimm, Arnon, Kirby, & Bresnan, 2012), and in both spoken (Bock, 1986) and written languages (Pickering & Branigan, 1998).

2.4 Linguistic alignment and SLA research

To date, a substantial body of alignment research has investigated speakers' linguistic alignment behaviors to describe different aspects of interactions between fully competent speakers of a language (e.g., L1 speakers; Garrod & Pickering, 2009). However, given that a high proportion of dialogues involving an L2 learner is common, recent research has begun to explore whether the basic tenets of psychological accounts of linguistic alignment can be extrapolated to conversations in which one of the interlocutors uses an L2 (L2-L1 dialogue) or in which both are using an L2 (L2-L2 dialogue) (e.g., Costa et al., 2008; Purmohammad, 2015). Within the field of SLA, as it is widely acknowledged that L2 learning may occur while learners engage in dialogue that involves interpersonal, communicative, and cognitive processes (Slobin, 1997), researchers have recently begun to examine linguistic alignment in light of priming mechanisms, particularly within the IAM framework (e.g., Trofimovich et al., 2013; McDonough et al., 2015). Motivated particularly by cognitive-interactionist SLA perspective, much of such research has investigated priming as a pedagogical intervention (e.g., McDonough, 2006; Kim & McDonough, 2008). More specifically, as a tool to elicit aligned language, priming has been found to facilitate the development of alignment in different aspects of language (e.g., morphology, syntax, phonology, lexicon) by triggering the use of various forms of language (Michel & Smith, 2017). Findings of previous studies have demonstrated that alignment occurred between L2 speakers while carrying out collaborative tasks on a variety of language features including noun and verb morphology (e.g., Marsden, Altmann, & St. Claire, 2013), syntactic structure (e.g., McDonough et al., 2015), and pronunciation (e.g., Jung et al., 2017). Because the

current study aims to examine structural and lexical alignment, this review focuses on relevant L2 alignment studies conducted in interactionist contexts.

One line of L2 alignment research has focused on the fundamental question of whether priming, manifested as alignment, occurs in L2 speech and comprehension (e.g., Collentine & Collentine, 2013; Frenck-Mestre & Prince, 1997; Gries, 2005). On the other hand, growing attention is being given to the application of the priming paradigm to L2 pedagogical concerns, especially from the cognitive-interactionist perspective. Table 1 presents a summary of L2 alignment research from the cognitive-interactionist perspective.

Table 1 Summary of L2 Linguistic Alignment Research

Study	Target Linguistic Feature	Context	Alignment Effect
McDonough (2006)	English prepositional and double-object datives	ESL in the US	Only for prepositional datives
Kim and McDonough (2008)	English passives	Korean EFL	Yes
McDonough and Kim (2016)	English passives	Korean EFL	Yes
Behney and Gass (2013)	Italian relative clauses	Italian in the US	Yes
Trofimovich, McDonough, and Neumann (2013)	English word stress and relative clauses	Canadian (Quebec) ESL	Yes
McDonough, Neumann, and Trofimovich (2015)	English passives, relative clauses, and adverbial clauses	Canadian (Quebec) ESL	Only for relative clauses and adverbial clauses
McDonough, Kielstra, Crowther, and Smith (2016)	English relative clause	Canadian (Quebec) ESL	Yes
Kim, Jung, and Skalicky (under review)	English stranded preposition construction in relative clause	Korean EFL	Yes
McDonough and Mackey (2006)	English question formation	Thai EFL	Yes
McDonough and Mackey (2008)	English question formation	Thai EFL	Yes

McDonough and Chaikitmongkol (2010)	English *wh*-questions	Thai EFL	Yes
McDonough and De Vleeschauwer (2012)	English *wh*-questions	Thai EFL	Yes
Marsden, Altmann, and St. Claire (2013)	French verb inflection	French in the UK	Yes
Michel and Stiefenhöfer (2013)	Spanish subjunctives	Spanish in Germany	Yes
McDonough and Fulga (2015)	Esperanto transitive construction	Thai EFL	Yes when linguistic representations exist
Trofimovich and Kennedy (2014)	Similarity in sound	Canadian ESL	Yes
Trofimovich, McDonough, and Foote (2014)	English word stress	ESL in the US	Yes
Jung, Kim, and Murphy (2017)	English word stress	Korean EFL	Yes
Michel and Smith (2017)	English words (3-to-10 grams)	ESL in the US and UK	Yes
Michel (2018)	Word order in German complex sentences	German in the UK	No

As the occurrence of linguistic alignment in L2 interaction has been suggested as a learning device, L2 research has generally employed a pretest and posttest design in order to explore the benefits of alignment on L2 development (e.g., Kim & McDonough, 2008; McDonough, 2006; McDonough & Chaikitmongkol, 2010; McDonough, Kielstra, Crowther, & Smith, 2016). For instance, findings of previous L2 alignment studies have shown that learners often produced more aligned production than misaligned production of target linguistic features when there is alternation between two constructions with similar meaning, such as double-object and prepositional datives (McDonough, 2006; Shin & Christianson, 2012), active and passive constructions (Kim & McDonough, 2008), stranded prepositions (Conroy & Antón-Méndez, 2015) and relative clauses and prepositional phrases (Trofimovich et al., 2013). These studies often used a higher suppliance or accurate production rate of target features on the production-based posttest compared to the pretest as an evidence of benefits of alignment on L2

development. Of the different alignment types, structural alignment has been the most extensively studied in the L2 literature, whereas much less attention has been paid to alignment at the lexical level). Although the most extensive evidence for alignment relates to interlocutors' lexical choice in L1 research (Branigan et al., 2010), empirical research on lexical alignment in L2 interaction is limited. Furthermore, few, if any, studies examined the pedagogical benefits of lexical alignment for L2 vocabulary development. The current study focuses on these two types of linguistic alignment.

The majority of L2 alignment studies to date have been carried out to examine the occurrence of structural alignment in L2 interactions between a researcher and a learner-participant in a lab setting. The lab-based studies have advanced our understanding of which structures are more susceptible to the occurrence of priming and priming effects on learners' subsequent production of the target structure. For instance, McDonough (2006) used the confederate scripting technique, which was created by Branigan et al. (2000), to explore to what extent structural priming (manifested as alignment) occurs during conversational activities. Findings indicated that learners produced more prepositional-object datives when they had previously heard or produced the prepositional-object structures using a confederate script technique. In addition, several previous studies have investigated the impact of lexical items during structural priming activities between a researcher and a learner. Such research has demonstrated that shared lexical items in primes and prompts increase the occurrence of structural priming, which is referred to as the lexical boost (Pickering & Branigan, 1998). For example, Kim and McDonough (2008) demonstrated that learners of three different proficiency levels produced passive constructions significantly more often than alternative active constructions after they heard the researcher's passive primes containing the same verbs in the

preceding utterance. Kim and McDonough suggested that repeated use of the same lexical items in the primes and prompts may facilitate learners' immediate production of the target structure. Lexical boost is relevant to the current study because it is hypothesized based on previous findings of the lexical boost effect that structural alignment will occur to a greater extent when speakers use the same term with their interlocutor for a particular object. In their investigation of the relationship between priming effects and structural complexity, Behney and Gass (2013) found that the extent of priming effects is mediated by structural complexity such that priming of a simpler structure (subject relative clause [RC]) has a stronger impact (i.e., uptake is more likely) than priming of a complex structure (object RC) in terms of the quantity of primed production and the direction of the priming effect. Based on this finding, they suggested that priming in the form of extensive input may aid L2 learners during early stages of language acquisition. A recent study by McDonough et al. (2016) looked into the role of individual differences (i.e., statistical learning and working memory) and explicit memory (i.e., awareness) in the occurrence and persistence of structural priming. They confirmed previous findings not only of the positive impact of priming activities on L2 learners' subsequent production of target structures but also of the non-significant relationship between statistical learning, working memory, and structural priming. No evidence was found for the effect of awareness on learners' production of target structures.

In addition, classroom-based L2 structural alignment research has shed light on how to utilize interaction-based communicative alignment activities for L2 development. Unlike the majority of L2 alignment studies, the classroom-based studies have focused on interaction between L2 peers in order to explore whether learner-learner interaction that occurs during the priming activities leads to L2 development. For example, McDonough and Chaikitmongkol

(2010) demonstrated that collaborative syntactic priming activities could be useful in English as a Foreign Language (EFL) classroom when promoting learner production of wh-questions with supplied auxiliary verbs. Their findings suggested potential benefits of priming activities during learner-learner interactions in EFL classroom contexts. Another classroom-based study by Trofimovich et al. (2013) has investigated the notion that alignment of each level of linguistic representation (i.e., auditory and structural) may enhance alignment at other levels and alignment effects are greater when interlocutors receive primes in an integrated fashion. Their findings indicated that when auditory and structural primes were presented together in prime sentences (i.e., integrated auditory and structural primes), the target grammatical forms (relative clauses and passives) and word stress patterns (3-2 as in *compúter* and 4-2 as in *phenómenon*) were elicited to a greater extent, compared to stress- and structure-only prime conditions. Although Trofimovich et al. (2013) established the effect of integrated auditory and structural alignment in L2 interactions, other types of integrated alignment such as integrated lexical and structural alignment have yet to be examined in L2 research. The positive role of peer interaction in eliciting priming effects was also determined in McDonough et al. (2015). McDonough et al. confirmed the effectiveness of using collaborative priming tasks in English as a Second Language (ESL) classrooms in order to make it more likely that learners will use particular grammatical structures when multiple alternative structures are available for expressing the same information. Their findings suggested that linguistic forms with fewer possible alternatives (i.e., passives) tend to be more impervious to priming effects than less frequently used structures with a broader range of alternatives (i.e., RC).

As reviewed thus far, the majority of previous cognitive-interactionist SLA studies have focused on structural alignment, demonstrating that interactive alignment activities can facilitate

the subsequent production of target linguistic features including a range of grammatical structures (e.g., Kim & McDonough, 2008; McDonough et al., 2015). Alignment at various other levels of language, as well as its relationship to L2 development, has received relatively less attention from researchers. In particular, very few L2 interactionist studies have investigated lexical alignment, with Ni Eochaidh, 2010 and Michel and Smith, 2017 as notable exceptions. For instance, Ni Eochaidh (2010) investigated whether lexical alignment is driven by shared conceptualizations (conceptual alignment) or the repetition of word-form. To do so, Ni Eochaidh examined whether bilingual speakers align to the same extent within- and between-languages, with English as the dominant language and Irish as the non-dominant language. Results demonstrated that lexical alignment occurred when the participant and their partner used the same language (i.e., within-language), and when they spoke different languages (i.e., between-languages). However, the magnitude of lexical alignment was greater in within-language trials as compared to between-language trials. Based on these findings, Ni Eochaidh demonstrated that lexical alignment is primarily driven by conceptual alignment and enhanced by the repetition of word-form.

Focusing on lexical alignment effects in L2 peer interaction, Michel and Smith (2017) examined the extent to which L2 learners align their choice of words (3-to-10-grams) in written dialogues (i.e., text-chats) and whether lexical alignment in text-chats is related to their overt attention to particular lexical items using eye tracking technology. Their findings demonstrated that lexical alignment occurred in text-chats between L2 peers and that eye-tracking could be used to provide information about learners' attention to multi-word level during text-chat interactions. Furthermore, despite some evidence of overt visual attention to the words that interlocutors aligned on, the majority of instances of lexical alignment did not exactly match

with increased visual attention, which in turn may suggest that lexical alignment is not a product of conscious awareness. As such lexical alignment was found to occur during interactions between L2 speakers in both spoken and text-based contexts.

Additionally, whereas relatively more research has been conducted to investigate linguistic alignment between a researcher and a learner, alignment in peer interaction has been paid less attention in L2 alignment literature (McDonough & Chaikitmongkol, 2010; McDonough et al., 2015; Michel & Smith, 2017; Trofimovich et al., 2013). It may be possible that different observations are obtained from interaction between peers carrying out an alignment activity than from those between a researcher and a learner due to the different nature of the relationship between interlocutors. Finally, recent efforts have begun to explore the effect of integrated primes (e.g., auditory and structural primes presented in an integrated fashion) on eliciting target language forms (e.g., Trofimovich et al., 2013). However, we still lack an empirical understanding of whether alignment at a non-meaning-based level (e.g., structural) enhances alignment of representations at another level that is meaning based (e.g., lexical) in L2 interaction. Thus, empirical research is warranted to investigate how linguistic alignment occurs across different language dimensions such as syntax and lexicon during L2 conversational interaction and whether alignment effects are promoted when integrated primes are presented to interlocutors.

2.5 Moderating factors on linguistic alignment

As reviewed in the preceding sections, previous L2 research has focused on the role of the alignment paradigm in interaction-driven L2 development. To date, aside from determining the pedagogical benefits of interactive alignment activities in L2 development, researchers have manipulated experimental conditions and factors in order to explore the extent to which

linguistic alignment effects are mediated by different conditions and factors and to provide a better understanding of the alignment paradigm in SLA research. Of numerous factors investigated in prior research, relevant to the current study are modalities of interaction, cognitive factors (i.e., individual differences in cognitive abilities including language aptitude, cognitive style, and language proficiency), and social factors (i.e., perception of the interlocutor).

2.5.1 Modality and linguistic alignment

In L1 alignment research, the linguistic alignment phenomenon has been observed in different types of interaction including face-to-face (FTF) communication and synchronous computer-mediated communication (SCMC). SCMC refers to real-time interaction (usually written) between people in a networked environment (Smith, 2005). The modalities used in these interactions are speech (FTF) and text (SCMC). Evidence for linguistic alignment has primarily been gleaned from FTF human interlocutors. However, as people are increasingly socializing via the Internet, particularly in textual communication such as text chat and instant messaging (IM), growing attention has been paid to speakers' alignment behaviors in text-based online interaction. Previous research has suggested that linguistic alignment can take place in written communication (text chat) as well as spoken interactions based on the notion that due to the modality-independent nature, different media through which a situation model is constructed do not lead to different mental representation of the same event (Zwaan & Radvansky, 1998; Hartsuiker et al., 2008). For instance, the level of understanding of an event does not differ when people hear it on the radio (i.e., aural input) or read it in a newspaper (i.e., written input).

Brennan (1996) investigated both speech- and text-based interactions between a human speaker and a computer to examine whether lexical alignment occurs to a similar extent in both modalities. Findings showed that participants were more likely to align with a computer in both

speech and text-based dialogues, particularly when their choice of term was explicitly corrected by the computer system. Brennan also found that memory played a significant role in lexical alignment such that speakers tended to align more when they referred back immediately to the same object than when they referred to it after reference to several other objects. Branigan et al. (2004) investigated linguistic alignment, particularly focusing on lexical alignment in a text-based dialogue. In their study, participants were told to interact with a human interlocutor or with a computer via a network connection, but in reality all participants interacted with a human interlocutor. During the text-chats, interlocutors were seated in different rooms so that they could not see each other and were thus more likely to believe what they were told about their conversation partners. Results showed that although lexical alignment occurred regardless of whether speakers believed they were interacting with a computer or with a human, the level of alignment was greater when participants thought they were interacting with a computer compared to a human interlocutor. This suggests that linguistic alignment happens in a written conversation, particularly using text-chats, and that text-based interaction may facilitate alignment at a greater level than spoken modalities. Hartsuiker et al. (2008) also investigated the effect of modality (written vs spoken) on structural priming effects by comparing participants' alignment behaviors in a text-chat and in oral interaction. Overall, their results replicated those of previous research found in spoken dialogue between human interlocutors (Branigan et al., 2000) in terms of the magnitude of structural priming and the effect of lexical boost, indicating commonalities between syntactic processing in the text-based and spoken dialogues. Hartsuiker et al. demonstrated that the similar results obtained in the two different modalities of dialogue seem to support the hypothesis that speaking and writing share the same syntactic processes (Cleland & Pickering, 2006).

Similarly, Branigan and colleagues (Branigan et al., 2010, 2011) examined whether linguistic alignment occurs in human-computer interaction. They also assessed the degree to which participants differentially engage in linguistic alignment depending on whether they believe their interlocutor is a person or a computer. To do so, these researchers employed the confederate scripting paradigm, in which participants played the picture describing/matching game on a computer either in a spoken or written mode. Even though the participants were told that they were interacting with either a human partner or a computer that was able to parse their descriptions, they in fact interacted with a pre-scripted computer program. Findings showed that participants tended to repeat the name for an object that their interlocutor had just used, in both text- and speech-based dialogues, and that this tendency was significantly stronger when they believed that their interlocutor was a computer than when they believed their interlocutor was a human. Moreover, participants tended to align more strongly with computer interlocutors that appeared more competent than with computer interlocutors that appeared less competent. Based on these results, Branigan and colleagues suggested that lexical alignment processes in typed or spoken dialog involving no other visible interlocutor are broadly similar to alignment processes in dialog between co-present interlocutors who use speech to communicate.

As reviewed thus far, prior research has shown that speakers systematically and effortlessly align their linguistic representations at different dimensions of language (e.g., lexis, grammar) during conversation. Furthermore, linguistic alignment has been found to take place across different modalities of interaction including text-based and speech-based dialogues and in both naturalistic and restricted (i.e., task-based) dialogues, demonstrating that linguistic alignment is a pervasive phenomenon in L1 conversation.

Based on the notion that alignment processes in typed dialogue are similar to those in oral interactions between L1 speakers (e.g., Chang et al., 2006), interest has recently grown concerning the use of alignment activities in synchronous text-based communication (i.e., text chatting) for L2 development. Behind this growing interest is the mounting evidence has demonstrated the effect of modality on L2 interactions (e.g., Ziegler, 2016). For example, previous research has suggested that text chatting not only bears characteristics of both written and oral communication but also can also offer an environment similar to FTF communication (see for review Ziegler, 2016). Specifically, SCMC research following the interactionist perspective has sought to investigate whether some key elements of interaction (e.g., noticing, feedback, negotiation of meaning) occur in networked text-based and voice-based interactions. Researchers have shown the helpful features of FTF interaction take place in SCMC (Chun, 2016; Sauro, 2011). Specifically, learners are provided with opportunities to interact, produce language, and modify their output in response to any communication difficulties, as well as respond to feedback from an interlocutor in an authentic communicative setting in SCMC (Chapelle, 2007). Furthermore, competencies acquired through online text chat practice can be transferred to oral practice (Chun, 1994). Research has also claimed that SCMC can provide learners with advantages over FTF interactions (Ziegler, 2016). Such advantages include increased opportunities for learners' attention to be drawn to the form of the language, and more time for them to understand and process what they hear. Additionally, learners' affective states have been found to be greatly enhanced in SCMC contexts as demonstrated by, for example, increased motivation (e.g., Warschauer, 1996), improved attitudes (e.g., Beauvois & Eledge, 1995), and reduced anxiety (e.g., Abrams, 2003). As such numerous studies have suggested benefits of using language activities for L2 development in text-based interaction via computers.

Despite these attested advantages of SCMC, only recently have L2 researchers begun examining whether alignment occurring in collaborative task-based, text-chat interaction may lead to L2 development (e.g., Kim et al., under review; Michel, 2018; Michel & Smith, 2017; Michel & Stiefenhöfer, 2013). Moreover, little attempt has been made to compare L2 learners' alignment behaviors in speech- and text-based interaction, and only a few studies have examined and/or compared linguistic alignment in task-based interaction across the two contexts. For example, Uzum (2010) found that L2 interlocutors demonstrated alignment during text-chat interactions in the domain of speed and fluency as well as their lexical and grammatical choices. Uzum highlighted that the reflexive feature of text-chat, such as scrolling back and forth through earlier statements, may have promoted the degree of alignment between speakers.

Michel and colleagues investigated linguistic alignment effects in SCMC during task-based peer interaction. Michel and Stiefenhöfer (2013) looked into whether structural alignment would occur on target grammatical features (i.e., Spanish subjunctives) while two L2 learners carry out communicative tasks via text-chat. They found that learners in the alignment condition not only created more obligatory contexts for subjunctives but also produced more subjunctives compared to those in the control condition. Similarly, in Michel (2018), L2 peers learning German carried out three communicative tasks online using a text-chat tool. Although structural alignment hardly occurred on the target structure (i.e., word order in German complex sentences), participants in a focal group interview mentioned that they noticed the target form when their interlocutors produced during chat interaction. This may indicate that the learners' explicit awareness of the form did not necessarily lead to their production of the form. The aforementioned studies have suggested that linguistic alignment takes place in text-based interaction (i.e., SCMC) when L2 learners carry out a language activity designed to elicit

linguistic alignment. However, since most of the previous studies have examined linguistic alignment in either spoken or written mode, the role of modality in linguistic alignment effects has largely been unknown. Recently, Kim et al. (under review) extended previous L2 alignment research by comparing the degree of structural alignment in FTF and SCMC and the effects of alignment on the development of L2 grammar in the two different contexts. Their findings indicated that the amount of primed production was significantly greater in the alignment condition compared to that in the control condition, regardless of interaction mode. Moreover, alignment effects were found to be greater in the SCMC mode and learners who carried out alignment activities with a researcher in SCMC outperformed those in the FTF group on both the immediate and delayed posttests. Based on the findings, Kim et al. suggested that structural alignment effects are mediated by the modality of communication and so are the learning outcomes from structural alignment activities. As this review of the aforementioned studies showed, empirical research comparing linguistic alignment effects in different modalities of interaction is limited and therefore, more robust evidence is required to elucidate the role of modality in the extent to which L2 speakers align in terms of their choice of words and grammatical structures. Moreover, despite increasing popularity of smartphones in L2 learning, extensive focus has been on text-based interaction via computers in the alignment literature and accordingly, it has yet to be examined the helpfulness of alignment activities in the learning of L2 when the activities are carried out online using text-chat apps of smartphones. If alignment activities are successfully implemented using smartphones, alignment activities can be accessed and carried out by L2 learners anytime, anywhere, free of charge, using their own smartphones, which can benefit them for L2 learning.

With rapid advances in mobile technology, Mobile-Assisted Language Learning (MALL) is quickly securing its place in L2 learning contexts, and the availability of the personal technology devices that learners possess makes it an attractive supplement to other forms of teaching and learning an L2 (Stockwell & Hubbard, 2013). The most notable feature of MALL is indeed the use of personal mobile devices that enable new way of L2 learning with continuous and spontaneous access and interaction across various learning contexts (Kukulsak-Hulme & Agnes, 2009). Other unique features of MALL include equitable use (delivery of content in the simplest possible format), flexible use (delivery of content in small chunks), tolerance for error (support for situated learning methods), and instructional environment (delivery of regular reminders, quizzes, and questions to students) (Brown & Cullligan, 2008; Elias, 2011). Previous research has demonstrated that MALL offers an environment where learners can ubiquitously negotiate meaning, reflect, and evaluate on their own performance through real-time interaction, which may help learners develop L2 proficiency (Andújar-Vaca & Cruz-Martínez, 2017).

Of different types of personal mobile devices such as Personal Digital Assistants (PDA), smartphones, tablet PC, growing attention has been given to smartphones in the literature (Chee, Yahaya, Ibrahim, & Hassan, 2017) due to their helpful functions that may benefit L2 learning; these include easy access to language resources without time and spatial constraints, as well as the use of mobile messaging apps for real-time communicative language practice. Such apps allow learners to achieve written communication by exchanging free text and image messages with their peers as well as with teachers. Previous research has demonstrated that text-based interaction through mobile messaging apps (i.e., synchronous mobile-mediated communication [SMMC]) may play a crucial role in L2 education because learners can co-construct learning through collaborative activities in both formal and informal educational settings conveniently

(see for a review Bozdoğan, 2015). SMMC refers to real-time communication between people made possible via mobile phones (Dixon, 2011). Therefore, further research is needed to examine whether alignment activities implemented in SMMC contexts would benefit learners for L2 learning and to shed light on how different modalities of communication affect the degree of alignment and L2 learning outcomes from alignment activities by comparing the alignment effects in two different interactional contexts: face-to-face (FTF) and synchronous mobile-mediated communication (SMMC).

2.5.2 Social factors and linguistic alignment: Socially-mediated linguistic alignment

In addition to modality, social factors have also been suggested to moderate the alignment effects, primarily in L1 psycholinguistics research. Decades of research has endeavored to understand alignment from a psycholinguistic approach, with primary focus on the cognitive mechanisms underlying language production that drive alignment. However, there is a recent recognition in the literature that linguistic alignment occurring during conversational interactions is essentially a socio-cognitive phenomenon (Trofimovich & Kennedy, 2014). Specifically, research has suggested that any conceptualization of linguistic alignment that does not incorporate social factors may be incomplete because, conversation is inherently susceptible to the influence of the social environment in which it happens (Unger, 2010). Accordingly, there have been increasing efforts to investigate the interaction of cognitive processes (e.g., attention, semantic access) and social factors in linguistic alignment. For instance, researchers have begun examining the effects of a range of social factors (e.g., interlocutors' relative status, perception of the interlocutor) that they suggest should also be taken into consideration in the investigation of linguistic alignment (Weatherholtz et al., 2014).

In L1 psycholinguistics literature, some scholars have proposed such an account of linguistic alignment that incorporates the role of social factors in linguistic alignment, particularly in terms of interlocutors' lexical choice (Branigan et al., 2010). According to that account, a speaker might choose to use a particular expression among several options in a process called *audience design* (Bell, 1984) because it is considered as the most appropriate expression to use for that particular interlocutor and may ultimately enhance communicative success (Clark, 1996). Clark (1996) suggested that speakers select linguistic expressions based in part on their beliefs about their interlocutors' *speech communities* (italics in the original) and the information that members of those communities are assumed to have access to (Fussell & Krauss, 1992). Speakers make judgments of their interlocutors' community membership on the basis of their linguistic knowledge (or proficiency) as well as direct personal experience with their interlocutors. For example, alignment can occur when a native speaker believes that his/her nonnative interlocutor can understand a particular expression either on the basis of his/her assumption that any nonnative speaker would understand the expression through the content or linguistic form that the nonnative interlocutor previously used during conversation. These beliefs are not static but change in the course of interaction as speakers may be continually adjusting their beliefs about the interlocutors throughout a dialogue (Branigan et al., 2010). According to this view, alignment involves both automatic and strategic components. Although alignment occurs largely due to implicit cognitive mechanisms (i.e., priming) (Pickering & Garrod, 2004), conscious strategic behavior of speakers can moderate linguistic alignment effects (Michel & Smith, 2017). For example, interlocutors may deliberately use the same words or grammatical structure that their partners used when they perceived that their partners are less proficient than themselves in order to make the conversation successful. As such, proponents of this view have

suggested that speakers' beliefs could affect their linguistic behaviors such as lexical choice in such a way that they align linguistically with their interlocutors in order to facilitate communication (Branigan et al., 2011).

Incorporating the role of social factors in linguistic alignment appears compatible with the Communicative Accommodation Theory (CAT) proposed by Giles and Powesland (1975). CAT posits that interlocutors converge or diverge on shared linguistic behaviors as a function of social factors (Giles, Coupland, & Coupland, 1991; Giles & Ogay, 2007). The most influential of the social factors may be the interlocutor (Bell, 1984). CAT scholars argue for the relationship between cognition and social context such that speakers internalize social representations of interlocutors who are associated with particular linguistic styles. Furthermore, within CAT, alignment in conversation can be interpreted as the speakers' desire (whether overt or tacit) for social integration and identification, whereas an absence of alignment and divergence may reflect their tendency to maintain distance, identity, or integrity with their interlocutors. For instance, during conversation, speakers tend to converge in their language use to minimize social distance (i.e., emphasize solidarity or convey liking) or facilitate communication, whereas they diverge when they want to increase social distance, accentuate distinctiveness, or show disdain.

The influence of social factors on linguistic alignment has been evidenced in a number of studies. Although the majority of evidence for the socio-cognitive view comes from research on phonetic and prosodic alignment, the role of social factors in the degree of alignment in other levels of language such as structural alignment and lexical alignment has also attracted attention in the literature. For instance, Balcetis and Dale (2005) investigated structural alignment by manipulating the interpersonal relationships between interlocutors. Participants conversed with a confederate who was either nice or mean, and found greater syntactic alignment for active,

passive, and prepositional object structures with the nice interlocutor compared to the mean interlocutor. Results of the study showed that speakers tended to align with their interlocutor to a greater extent when the interlocutor acted affably. Alignment was also enhanced when the interlocutor was unpleasant about participating in the communicative task (i.e., when the mood was negative). The speaker perceived the negative mood as a signal that the conversation was in danger of failure and therefore allocated more resources to establishing rapport via augmented levels of alignment. These findings indicate that the degree to which speakers engage in alignment may depend on social factors, such as whether their interlocutor's social behavior invites an affiliative response and how the interlocutor's attitude towards the conversation is perceived by the speaker. Lev-Ari (2015) examined the role of prestige (operationalized as intelligence), similarity (i.e., speakers being similar in the level of ability to complete the task), and liking of the interlocutor in the occurrence of structural alignment of Dutch speakers. Participants were asked to listen to a passage in which either a subject-verb or verb-subject order was used. Participants were told that the recorded message was from a student in the top 10 % or bottom 10 % (manipulating the prestige), or from a student that performed better than them, similar to them, or worse than them (manipulating similarity). Structural alignment was tested by having participants unscramble sentences. At the end of the task, participants rated how much they liked the speaker. Results showed that structural alignment was affected by prestige of the interlocutor and how much the interlocutor was liked by the speaker, indicating that the degree of alignment is modulated by social factors. Similarly, Weatherholtz et al. (2014) examined whether the magnitude of structural alignment is mediated not only by a particular grammatical structure that speakers are recently exposed to but also by social factors such as participants' perceptions towards socially different accents (standard US English, African-American English,

and Mandarin accented English) and similarity in political ideology. Their findings demonstrated that while structural alignment occurred to some extent as a result of an automatic process, independent of speakers' social perceptions, the degree of alignment was indeed influenced by their perceptions towards different accents and interpersonal similarity in terms of political orientation.

A body of research focused on speakers' beliefs or perceptions of their interlocutor as a mediating factor in the occurrence and magnitude of lexical alignment. Previous research has shown that speakers' beliefs about their interlocutor (e.g., beliefs about the interlocutor's cultural communities [Clark, 1996], and language proficiency [Bortfeld & Brennan, 1997] affected the extent to which they lexically align. In addition, Fussell and Krauss (1992) indicated that speakers' beliefs about their interlocutors may impact "the form and communicativeness of their messages" (p. 379). For example, Brennan and Clark (1996) proposed that speakers establish *conceptual pacts* with their interlocutors and reach a consensus on referring expressions throughout iterations. Conceptual pacts refer to a temporary agreement about how an object or idea speakers are referring to is to be conceptualized. These conceptual pacts arise from previous choices that speakers made during a conversation and are thus temporary and flexible (Foltz et al., 2015). Results showed that speakers chose their wording depending on the specific conversation partner they were conversing with and that speakers created a new conceptual pact in order to accommodate to a new conversation partner. Previous research on language style matching also supports an interaction between linguistic alignment at the stylistic level (i.e., alignment on the use of function words) and social factors. For instance, Gonzales, Hancock, and Pennebaker (2010) found a positive relationship of alignment on lexical choice to group cohesiveness and task performance. In their study, participants were assigned to work in small

groups on an information search task in either a spoken or (computer-mediated) written mode. Findings showed that the more speakers liked their group members, the more their function words aligned during both FTF and CMC conversations. Furthermore, as speakers aligned in their word choice to a greater extent, they were more successful in completing the task.

Branigan et al. (2011) investigated whether lexical alignment in dialogue is mediated by their beliefs about their interlocutors in two different modalities of dialogue: text- and speech-based dialogue. The participants were told that they were communicating with either a human interlocutor or a computer. In an interactive labeling task, the participants were asked to select pictures according to their interlocutor's descriptions and name pictures so that their interlocutors could choose the right pictures. Their findings demonstrated that speakers tended to repeat their interlocutor's choice of referring expressions in both types of dialogues. However, the degree of alignment varied depending on the participants' beliefs about the communicative capability of their interlocutors. Specifically, they showed a stronger tendency to align with computer than with human interlocutors, and with computers that were presented as less capable than with computers that were presented as more capable. Based on their findings, the researchers concluded that the tendency to align appears to be mediated by beliefs, with the relevant beliefs relating to an interlocutor's perceived communicative capacity and language proficiency. Such partner-specific effects are assumed to fall out of normal memory processes, wherein interlocutors represent as a conjoint cue information about a linguistic expression and the person with whom the expression was used, so that the presence of that particular interlocutor activates that particular expression (Horton & Gerrig, 2005).

These results presented above seem to suggest that existing theories need to be expanded to account for the joint and spontaneous influence of social and cognitive factors on alignment

for a more comprehensive understanding of linguistic alignment behaviors. Despite the accumulated evidence in L1 alignment literature for social mediation of linguistic alignment, relatively less is known about the effect of social factors on the magnitude of linguistic alignment in dialogues involving L2 learners.

Drawing on CAT, Beebe (1980) argued that L2 speakers' linguistic style-shifting (i.e., linguistic alignment and divergence) was a function of the social and psychological distance between interlocutors. The social distance becomes small when the interlocutors perceive themselves as being equal in terms of their identity, speech community membership, power, etc. In this case, speakers align in their language use with the speech norms of their interlocutors to emphasize solidarity and facilitate communication. On the other hand, the distance gets large when one of the interlocutor is in a superior position to the other. In this case, speakers shift in style away from their interlocutors (diverge) in order to assert the identity of their own social group.

Costa et al. (2008) speculated that alignment in dialogue between two L2 speakers is likely to be reduced because of negative beliefs about the interlocutor's language knowledge. More specifically, L2 speakers may fail to align or only partially align with their interlocutor who they perceive as being less proficient than themselves. In this case, L2 learners need to monitor their language to a greater extent to make sure that their L2 interlocutor understands the messages correctly due to his/her incomplete knowledge of the target language. This monitoring process imposes additional cognitive burden on the speaker, resulting in lesser alignment between L2 speakers. In contrast, there can be occasions where alignment is promoted in L2 dialogue. Researchers have suggested that L2 learners adjust the amount of attention they pay to language form, which results in style-shifting or variation, depending on the identity and role of

their interlocutor (e.g., Tarone, 1988, 2007). For example, L2 learners tend to produce a vernacular style of speech (unmonitored style) in a conversation wherein they focus more on meaning than on form (e.g., conversations with L2 peers). The vernacular style may include nonnative-like forms or informal, colloquial linguistic variants (Tarone, 1983). However, when conversing with someone who they perceive as being in a superior position to themselves in terms of language knowledge and status, (e.g., teacher, researcher), L2 learners may produce a more careful style because they paid more attention to language. In this regard, L2 learners are thought to devote conscious attention to the language forms produced by their L2 interlocutor with higher proficiency during a conversation. This attention may lead to a stronger tendency to align with the more proficient L2 speakers, compared to less proficient L2 interlocutors, because L2 speakers with high proficiency may be seen as reliable sources of the target language (Gass, 2003). If L2 speakers repeat new words or expressions used by a more proficient speaker, those new lexical items may later be available in their lexicon later as a result of the repetition process (Purmohammad, 2015).

Similarly, Philp (2015) suggested that the quality and outcome of peer interaction may be affected by a range of social factors such as relationship between peers, perception of others, and attitudes. Geeslin (2015) also emphasized the role of the interlocutor's social characteristics in the language input that an L2 learner receives as well as the output that the learner produces. She proposed that a speaker may modify his/her speech in response to the characteristics of the interlocutor (proficiency as well as social and personality traits) throughout the interaction. Most of these hypotheses about the role of social factors in linguistic alignment effects have yet to be tested, and only a few studies have investigated the effects of various social factors on the alignment behaviors in L2 interactions.

Motivated by the claim that alignment is a phenomenon of interlocutor adaptation at both social and cognitive levels (Pickering & Garrod, 2013), Trofimovich and Kennedy (2014) explored the effect of perceived (and actual) similarity between interlocutors on the degree of pronunciation alignment between L2 speakers. To address both cognitive and social dimensions of alignment, they measured similarity with respect to linguistic (differences in language backgrounds), cognitive (fluency, as a reflection of automaticity of language production processes), and social dimension (e.g., interlocutor perception of speaker's effectiveness). This study not only provided evidence that alignment occurs at the pronunciation level when two L2 interlocutors carry out an interactional task, it also demonstrated that a greater similarity between interlocutors may lead to greater linguistic alignment. More specifically, findings showed that L2 interlocutors tended to align with their interlocutors to a greater extent, as rated by native speaker listeners, when they were perceived as being more similar in terms of linguistic characteristics (e.g., fluency, complexity of language) and affective/personal characteristics (e.g., communicative effectiveness [a speaker's clarity and efficiency in communicating ideas], attractiveness [desirability and pleasantness of a speaker as a potential interaction partner]).

With particular respect to the relationship of alignment to L2 learning, Atkinson et al. (2007) have adopted a socio-cognitive approach, which incorporates social and environmental factors into the mental states involved in the alignment process. They further suggest that alignment occurring through interaction between human agency (i.e., people's cognitive states and overt bodily actions and emotions) and environmental affordances (i.e., social contexts) constitutes a crucial aspect of L2 development. Atkinson et al.'s view of learning as social and cognitive alignment seems compatible with both cognitive approaches to linguistic alignment (IAM; Garrod & Pickering, 2009; Pickering & Garrod, 2004) and social psychological research

on accommodation (CAT; Giles et al., 1991; Giles & Ogay, 2007). However, although researchers have claimed that the socio-cognitive approach to alignment appears to be very promising for conceptualizing L2 development, the aforementioned hypotheses have yet been extensively tested in L2 research on linguistic alignment, particularly in the syntactic and lexical dimensions, and thus, evidence to support these proposals awaits empirical investigations. To address this issue, the current study investigated the extent to which linguistic alignment, specifically alignment on particular words and structures, is moderated by a range of social factors including perception of the conversation partner in terms of proficiency, comprehensibility, and task experience with the partner (i.e., likeability, comfort, and pleasure). Additionally, unlike previous studies investigating the relationship between perceptions of the interlocutor's language ability and linguistic alignment effect, the current study included pre-experiment sessions in which participants could develop perceptions of their interlocutor's language ability over a period of time, irrespective of task type.

2.5.3 Cognitive factors and linguistic alignment

In addition to examining the effect of modality and social factors, individual differences in cognitive abilities such as cognitive language aptitude, cognitive style, and language proficiency (i.e., cognitive factors) have been examined as moderating factors on L2 linguistic alignment effects. Based on the widely-held notion that structural alignment is a form of implicit learning (Chang et al., 2006), recent L2 alignment research has begun to examine the role of cognitive factors in the occurrence and magnitude of linguistic alignment. Of different cognitive abilities that may influence L2 learners' alignment behaviors, the following have been investigated in previous L2 alignment research: prior knowledge of target linguistic features

(pre-existing linguistic representations of target features), language proficiency, auditory pattern discrimination abilities, statistical learning, and working memory capacity (see Table 2).

Table 2 Alignment Studies Examining Cognitive Factors in L2 Linguistic Alignment

Study	Context	Target Structure	Cognitive Factor	Significant Effect
McDonough and Fulga (2015)	Thai EFL	Esperanto transitive construction	Prior knowledge of target linguistic features	Yes
Kim, Jung, and Skalicky (under review)	Korean EFL	English stranded preposition construction in relative clause	Prior knowledge of target linguistic features	Yes
			Working memory	No
			Proficiency	Yes, only for subsequent production
Kim and McDonough (2008)	Korean EFL	English passives	Proficiency	Yes
Bernolet, Hartsuiker, and Pickering (2013)	Dutch EFL	English genitives	Proficiency	Yes
McDonough, Kielstra, Crowther, and Smith (2016)	Canadian (Quebec) ESL	English relative clause	Statistical learning	No
			Working memory	No
McDonough and De Vleeschauwer (2012)	Thai EFL	English *wh*-questions	Working memory	No
			Auditory pattern discrimination abilities	Yes
McDonough and Kim (2016)	Korean EFL	English passives	Working memory	Yes, only when primes and targets are adjacent in the priming activity

Previous research investigated the extent to which L2 learners should have pre-existing linguistic representations of target features in order for alignment effects to take place (i.e., prior knowledge of target linguistic features). For instance, in order to investigate whether L2 learners can be primed to produce a novel linguistic pattern with or without detection of the target form,

McDonough and Fulga (2015) conducted experiments with learners who have little familiarity with the transitive construction in Esperanto due to the lack of a corresponding structure in their L1. They found that learners' detection of the linguistic form was required for the occurrence of alignment. This finding suggests that alignment effects may depend on the existence and strength of the mental representation of the target linguistic feature, supporting the notion that linguistic representations must exist for alignment to occur. Similar picture was obtained as to the role of prior knowledge of the target grammatical structure in the degree of structural alignment in a recent study by Kim et al. (under review). Kim et al. investigated whether structural alignment effects would be mediated by a range of learner characteristics such as prior knowledge of the target grammatical structure, language proficiency, and working memory capacity in two different modalities including SCMC and FTF. Their findings demonstrated that L2 learners' prior knowledge of the target structure was facilitative of the occurrence of structural alignment, regardless of modality. Moreover, prior knowledge of the target structure was also found to modulate the role of structural alignment in the learning of that particular structure.

Similar to the knowledge of target structures, the role of learners' overall proficiency in alignment effects has been of interest in L2 research. For example, Kim and McDonough (2008) investigated the effect of L2 proficiency as well as the beneficial role of verb repetition (i.e., lexical boost) on the primed production of English passive constructions during a collaborative alignment activity with a researcher. Findings showed that the proportion of the target structure production increased together with the learners' L2 proficiency, indicating a positive relationship of L2 proficiency with structural alignment effects. In addition, Bernolet, Hartsuiker, and Pickering (2013) investigated the influence of L2 proficiency on shared syntactic representation in L1 Dutch-L2 English bilinguals. Their findings demonstrated that between-language priming

was stronger for more proficient L2 learners, suggesting that as L2 learners become more proficient, the representations of the target structure (S-genitives) for the learners' L1 and L2 are collapsed into a single language-neutral representation shared between the two languages. Kim et al. (under review) also found that language proficiency had a significant impact on the learning outcomes, but only for the participants who carried out the alignment activities in the SCMC context. Specifically, learners with higher proficiency were benefitted from the alignment activities for the development of L2 grammar as represented by their scores on the production tests. Based on their findings, Kim et al. suggested that learners with high proficiency might be able to retain the information better than those with low proficiency for both short- and long-term learning. Although L2 learners' language proficiency has been suggested as one of the significant cognitive factors that impacts alignment effects, it is not always controlled in L2 alignment research, and only a few studies have examined the interaction between language proficiency and linguistic alignment effects systematically using valid proficiency measures (e.g., cloze test).

McDonough and De Vleeschauwer (2012) investigated the role of auditory pattern discrimination abilities in mediating the relationship between syntactic priming and second language (L2) development. Thai learners of English carried out two sets of syntactic priming activities with either low-type-frequency prompts or high-type-frequency prompts. Results indicated that learners with high auditory pattern discrimination abilities tended to produce more primed production of the target structure (i.e., *wh*-questions with obligatory auxiliary verb), particularly in high-type-frequency prompts condition. This finding suggests that auditory pattern discrimination abilities has a facilitative role in the learning of L2 grammar through alignment activities.

McDonough et al. (2016) focused on two individual differences (i.e., statistical learning [the implicit learning ability to extract a grammatical rule from the aural input that learners are sequentially exposed to] and working memory) and explicit memory (i.e., awareness) in the occurrence and persistence of structural priming (manifested as alignment). The statistical learning test was adapted from Gómez (2002) and working memory capacity was assessed using the Wechsler Adult Intelligence Scale (WAIS-III) and the digit span backwards task (Psychological Corporation, 1997). While they found a positive impact of priming activities on L2 learners' subsequent production of target structures, there were no significant relationships between statistical learning, working memory, and structural priming. Furthermore, although the participants who explicitly mentioned RCs (i.e., the target structure) during an exit interview did not produce more RCs than the other participants, they did have higher working memory and statistical learning scores. Their findings suggest that while differences in statistical learning and working memory may be related to the participants' explicit awareness of the target structure, they were not correlated with their primed or subsequent production.

On the contrary, different findings were obtained as to the relationship between working memory and structural priming, when intervening turns were manipulated between primes and targets. For example, McDonough and Kim (2016) found a positive relationship between working memory measured using a running span test (Broadway & Engle, 2010) and L2 learners' primed production of English passives when the prime sentences were adjacent to target picture descriptions (i.e., prompts). However, when primes and targets were separated by two to five filler sentences, working memory was no longer significantly related to the amount of L2 learners' primed production in the priming activity, similar to the findings in McDonough et al. (2016). Moreover, working memory was not found to be related to the subsequent production

of passives, regardless of the number of intervening turns manipulated in the study. Overall, findings of McDonough et al. (2016) and McDonough and Kim (2016) did not provide strong evidence for the role of working memory in primed production of the target structure. In particular, the non-significant effect of working memory on the subsequent production of passives seem to demonstrate that that there is no significant relationship between working memory capacity and the implicit learning that may occur via the priming paradigm.

As reviewed thus far, divergent findings have been reported for the relationship between linguistic alignment effects and a range of different cognitive factors. Specifically, prior knowledge of target linguistic features, language proficiency, and auditory pattern discrimination abilities had a positive impact on the extent to which L2 learners structurally aligned with their interlocutors and/or the learning of target grammatical structures. On the contrary, overall statistical learning and working memory capacity were not found to have a significant role in the degree of linguistic alignment or (see Table 2 for a summary of findings). Given that only a paucity of research has examined the role of cognitive factors in alignment effects and that implicit learning is an ability with meaningful individual differences linked to language processing and learning (Schmit, 2012), further investigations are called for to explore whether alignment effects are associated with other cognitive factors than those examined in previous research.

Among cognitive factors that have yet to be examined in L2 alignment literature, cognitive aptitude for language learning (i.e., language aptitude) is of particular interest to the current study. Language aptitude is defined as a set of cognitive and perceptual abilities that predispose individuals to learn well or rapidly in a given amount of time and under given conditions (Carroll & Sapon, 2002). It has been claimed that aptitude matters for older learners

across all conditions of learning - implicit, explicit, and incidental - due to the same basic cognitive abilities, including noticing and rehearsal involved in all learning (Robinson, 2002). Given that linguistic alignment has multiple cognitive bases encompassing both implicit learning and explicit memory (Ferreira & Bock, 2007), language aptitude is assumed to moderate the extent to which L2 learners align in their use of language, particularly in terms of words and grammatical structures. Cognitive style is another cognitive factor that the present study was focused on. Cognitive style has been studied in relation to those dichotomous dimensions (e.g., analytical vs. holistic; reflective vs. impulsive; rational vs. experiential) (e.g., Witteman, van den Bercken, Claes, & Godoy, 2009). Among various bipolar dimensions, SLA researchers have focused on the rational–analytical and the experiential–intuitive cognitive styles (Granena, 2013, 2016; Linck et al., 2013). A rational–analytical style refers to the tendency to rely on logic and analysis as an approach to information processing whereas an experiential–intuitive cognitive style refers to the tendency to rely on intuition and holistic thinking as an approach to information processing. A rational–analytical style has been found to be more related to explicit cognitive processes and abilities. On the other hand, an experiential–intuitive cognitive style has been shown to be more related to implicit cognitive processes and abilities. Building on previous research regarding the relationship between cognitive language ability and cognitive style, the current study set out to investigate whether the rational–analytical and the experiential–intuitive cognitive styles differentially affected the occurrence of linguistic alignment.

In sum, much less has been discovered in L2 research about linguistic alignment effects in peer interactions and across FTF and SMMC settings. Therefore, data are limited regarding L2 learners' alignment behaviors in peer interaction and the effect of different modalities of interaction in L2 learning. Additionally, lexical alignment has received very little attention in

cognitive-interactionist SLA research, and accordingly, the role of lexical alignment in L2 vocabulary development is under investigated. If lexical alignment turns out to be beneficial for L2 vocabulary development, the lexical alignment paradigm can be incorporated into L2 curriculum and pedagogy. Furthermore, despite the mounting evidence for the role of social factors in the magnitude of linguistic alignment in L1 literature, little has been learned about how linguistic alignment effects are moderated by social factors (i.e., speakers' perception of their conversation partner) in L2 learning contexts, particularly when L2 peers carry out interactive alignment activities. Finally, this study adds to previous research by investigating the relationship between linguistic alignment effects and cognitive factors related to language aptitude, cognitive style, and language proficiency.

2.6 The current study

To address the research gaps highlighted in the previous section, the current dissertation aimed to examine the role of socially-mediated linguistic alignment in the development of English vocabulary and grammar in FTF and SMMC contexts. The study was guided by the following research questions:

(1) To what extent does linguistic alignment occur at lexical and structural levels while L2 peers carry out interactive activities?

As to the effect of moderating factors:

(1)-1 Do learners' alignment behaviors differ in the two different modalities of interaction (FTF and SMMC)?

(1)-2 To what extent do learners' perceptions of their interlocutors with regard to proficiency, comprehensibility, and task experience affect the degree of linguistic alignment?

(1)-3 To what extent learner individual differences (cognitive language aptitude, cognitive style, and language proficiency) affect the degree of linguistic alignment?

(2) To what extent do the communicative alignment activities facilitate the learning of the target words and structures?

As to the effect of moderating factors:

(2)-1 What is the role of the modality of interaction (FTF and SMMC) in the development of the target grammatical structures and lexical items?

(2)-2 To what extent do learners' perceptions of their interlocutors with regard to proficiency, comprehensibility, and task experience affect the learning outcomes?

(2)-3 To what extent do learner individual differences (cognitive language aptitude, cognitive style, and language proficiency) affect the learning outcomes?

3 METHOD

3.1 Study design

The study employed a quasi-experimental design to assess the effects of linguistic alignment on the learning of 32 target words and grammatical structurer (i.e., stranded preposition structure in a relative clause) in FTF and SMMC contexts. This study involved pre-experimental sessions and experimental sessions. The pre-experimental sessions were conducted in order for participants in the experimental group to develop perceptions of their conversation partner's language abilities. The research design for the experimental sessions included pretests, two treatment sessions for the experimental groups, immediate posttests, and delayed posttests. An interview followed after the three meetings for the experiment only with those who were invited by the researcher. The dependent variable for research question (RQ 1) and its three sub-questions concerning the effects of mediating factors on the magnitude of alignment was the degree of alignment operationalized as the number of instances of aligned production. Fixed effects included modality (FTF vs. SMMC), language proficiency score measured using cloze test, cognitive aptitude style score (a rational-analytical and experiential–intuitive style), language analysis test score, LLAMA test score (LLAMA B, E and F and LLAMA D), social factors (participants' perceptions of their interlocutor in terms of proficiency, comprehensibility of the interlocutor's language production, and task experience with the interlocutor), and demographic information (i.e., age, sex, and length of study). For the second RQ and its sub-questions concerning the learning effects of the alignment activities, the dependent variable was subsequent learning effect of the alignment activities measured by learners' performance in the pretest, immediate posttest, and delayed posttest. The same fixed effects used for RQ 1 were

included in addition to time (pretest, immediate posttest, and delayed posttest) and group (experimental vs. control).

3.2 Participants

Participants included 98 Korean EFL students (69 women) who were enrolled in a variety of undergraduate programs (e.g., English, Chemistry, Business, Music, Computer Science) in South Korea. Their ages ranged from 19 to 26 years, with a mean of 21.36 (*SD* = 1.65). All participants reported that they had received English instruction both inside and outside the formal school system. At the time of data collection, the average length of English study was approximately 10 years and 3 months with a maximum of 20 years, 2 months and a minimum of 6 years. Of the 98 students, 37 students served the role of a confederate so their data were not included for analyses. The remaining 61 students were assigned to either control (n= 24) or experimental groups (n=37).

The experimental and control group had an unequal number of participants because the experimental participants were recruited from the classes that the researcher was teaching in the Spring semester of 2017 in order to administer the pre-experiment sessions. The experimental group was further divided into either the FTF or SMMC group. The 24 participants in the control group were recruited through class visits, flyers, and word-of-mouth from the same school with students of the experimental groups. Interested students were asked to complete the pre-experimental survey and a proficiency test before setting up meetings for the experiment so that the student pairing could be determined based on proficiency prior to the experiment sessions. Because the control participants did not participate in the pre-experiment sessions, they did not have opportunities to develop perceptions of their interlocutor. Therefore, pairing of control participants was done by the researcher based on their proficiency test scores so that two students

with differing proficiency levels could be paired up (e.g., high proficient-low proficient). All control participants completed two sessions of communicative activities, measurement tests, and surveys. All participants were financially compensated for their participation.

3.3 Target linguistic features

The current study had two target linguistic elements: 32 lexical items for vocabulary acquisition and relative clauses for grammar. With respect to the lexical alignment, past L1 research has shown that interlocutors converged in the same terms when given two choices while carrying out an interactive task (Branigan et al., 2011). More specifically, even when a speaker was presented with a disfavored term for an object by his or her interlocutor (e.g., *coach* instead of *bus*), the speaker was more likely to align with the interlocutor by using the same disfavored term. A pool of synonym pairs consisting of highly favored words and fully acceptable but highly disfavored words (e.g., *sofa* and *couch*; *basket* and *hamper*) were taken from Snodgrass and Vanderwart (1980) and the word pool on the basis of Korea's National English Curriculum (Ministry of Education, Science & Technology [MEST], 2009), which provides a list of academic words that are suggested to be taught to Korean learners of English in formal educational settings. Of the synonym pairs included in the study, the 32 disfavored words were targeted as the participants had yet to learn at the time of data collection whereas the participant knew the correct meaning and use of the counterpart 32 favored words. Only the disfavored words were provided as primes throughout the task performance as target words (see Appendix A for all target words).

The target grammatical structure of the study was one type of English relative clause (RC), the stranded preposition in RC. Overall, the RC has received considerable attention in both L2 and L1 literatures. Due to its frequency and usefulness in daily language use, the importance

of RC acquisition has been emphasized in SLA research (Izumi, 2003). In previous L2 structural priming research, the RC has been suggested to demonstrate cumulative priming effects by virtue of the inverse preference or inverse frequency effect. More specifically, because an RC tends to be produced relatively less often compared to its alternative structures (e.g., prepositional phrases), structural priming is likely to occur to a greater extent (McDonough et al., 2015).

RC structures have been found to pose processing difficulties for L2 learners and, accordingly, a large body of available research sheds light on such difficulties and offers proposals for how to teach and learn RCs more effectively (e.g., Gass, 1982; Izumi, 2003). Of particular interest concerning the processing difficulties of RC structures is the attested processing asymmetry among different types of RCs. From the field of linguistic typology, Keenan and Comrie's (1977) proposed accessibility hierarchy (AH) may account for the processing asymmetry of different types of RCs in terms of an ordering of grammatical relations:

subject > direct object > indirect/oblique object > genitive > comparative

Simply put, if a language can relativize obliques, it can also relativize direct and indirect objects and subjects. If a language can relativize objects, it can also relativize subjects, but not necessarily obliques (Kwon, Gordon, Lee, Kluender, & Polinsky, 2010).

When applied to SLA as a universal hierarchy used to predict the difficulty order of RC acquisition, the AH has been tested with L2 learners under both laboratory and classroom conditions (e.g., Behney & Gass, 2013, Eckman, Bell, & Nelson, 1988; Gass, 1982, Kim, 2015). Research findings demonstrated that RC types higher on the hierarchy (subject RC) were acquired earlier than the ones lower on the hierarchy. Moreover, even when instructed only on direct object RCs, learners were likely to generalize their learning to subject RCs, but not vice versa (e.g., Eckman et al., 1988; Gass, 1982). Previous research has shown that greater priming

effects occurred for less frequently used linguistic forms or developmentally more advanced forms (e.g., McDonough & Mackey, 2008). In order to shed light on this claim, the present study focused on the English oblique (prepositional) RC, in which the object of a preposition is relativized, among the different types of RCs. The target structure of the study was the English stranded preposition in RC or an oblique RC, in which the object of a preposition is relativized in an example sentence (1):

(1) This is something (which) you boil water **with**.

More specifically, among the different types of structures that can be constructed for oblique RCs (i.e., pied-piping, stranded preposition; see examples below), the stranded preposition structure was of particular interest to the current study. Of a range of prepositions that can be used in stranded preposition RCs, four prepositions were chosen, which were found to be more commonly used in a stranded construction than in other alternative structures (e.g., pied-pipping) according to corpus analysis: with, on, in, and from (Biber, Johansson, Leech, Conrad, & Finegan, 1999; Dimitriadis, 2007).

The stranded preposition structure has proven challenging for L2 learners to acquire (Conroy & Antón-Méndez, 2015). For example, research has found L2 learners frequently omit a stranded preposition in oblique RCs, resulting in the null preposition ('null prep'), as in (2) in the example:

(2) Null prep: *That is the child (who) I played yesterday.

(3) Stranded preposition: That is the child (who) I played **with** yesterday.

(4) Pied-piping: That is the child **with whom** I played yesterday.

Bardovi-Harlig (1987) demonstrated that L2 learners may go through an initial interlanguage stage of (2) null prep before they acquire (3) stranded prepositions, and eventually acquire (4)

pied piping. In Example (3), only the relative pronoun ‘who’ is moved to the beginning of the relative clause with the preposition ‘with’ stranded at the end of the clause (i.e., preposition stranding). Even when the relative pronoun is omitted, the preposition is left at the same position, making the sentence grammatically correct.

Furthermore, previous research has suggested that L2 learners generally face difficulty in acquiring the stranded preposition construction, irrespective of L1 backgrounds and proficiency levels (Conroy & Antón-Méndez, 2015). Furthermore, stranded prepositions have been found to be resistant to instruction (Sadighi, Parhizgar, & Saadat, 2004), and learners’ use of null prepositions in RCs continues until later stages of L2 development, when they have already established knowledge related to the correct use of prepositions with verbs in non-stranding contexts (Hokari & Wakabayashi, 2009). One of the major sources of learner difficulty that has been pointed out in previous research is the contrast between L1s and L2s. Accordingly, stranded preposition RCs can be particularly difficult for Korean learners of English due to typological differences between Korean and English, particularly for RCs and verb argument constructions using prepositions. For example, Korean does not have prepositions, but instead has postpositions as equivalents, as shown in Example (5):

(5) 나는 어제 그 아이와 놀았다.
na-nun ecey ku ai-wa nol-ass-ta
I-TC yesterday the child-with play-PST-DC
“I played with the child yesterday.”

Furthermore, unlike English, RCs are pre-nominal in Korean and the use of a postposition depends on the type of sentence where the postposition is contained. Specifically, although postpositions are compulsory in both declarative and interrogative sentences in Korean, they must be omitted from the corresponding RC, in which an object of postposition is relativized as shown in (6):

(6) 이것이 내가 일하는 건물이다.
ikes-i nay-ka ilha-nun kenmwul-ita
this-NM I-NM work-RL building- DC
"This is the building I work in."

Therefore, postposition stranding is not permitted in Korean RCs and there is no equivalent structure for stranded prepositions in English RCs (Klein, 1993). It can be assumed that this may cause difficulties for Korean learners of English in acquiring the structure of stranded preposition RCs.

3.4 Materials

This section presents the materials used in the current study. The materials include interactive activities that the participants carried out in the pre-experiment sessions and the alignment activities used in the treatment sessions. Also included are measurement materials, proficiency test, language aptitude tests, and surveys.

3.4.1 Communicative activities for the pre-experiment sessions

The purpose of the pre-experiment sessions was two-fold: to familiarize learners with communicative activities and to help learners develop perception of their peer's English performance (i.e., overall proficiency and comprehensibility of their speech). During the pre-experiment sessions, each student was paired up with the same partner for two communicative activities. The two activities included an information-exchange activity and a decision-making activity. Topics of the activities were chosen considering students' interests and ability to talk about the current, previous, and future events in English. Half of the students performed the activities in the FTF mode while the remaining half completed them in the SMMC mode. Each activity took about 20 minutes.

The information-exchange activity was designed to require the students to discuss presidential candidates for the upcoming presidential election (Keck & Kim, 2014). All pairs

worked on the same information-exchanges activity, which included a set of pictures (n=12) numbered 1 through 12 that represented important life events of the two candidates. Each dyad member got half the pictures (one student received pictures numbered 1, 3, 5, 7, 9, and 11 for candidate A, and the other received 2, 4, 6, 8, 10, and 12 for candidate B). Each pair was asked to take turns to discuss the two candidates and decide who would be considered more qualified to be president. The task outcome was to prepare a report form to present to the entire class based on the information collected between learners.

For the decision-making activity, each pair was provided with two different travel booklets – one for Rome and the other for Tokyo – which included information for flight options, lodging, transportation, food, and tourist attractions. The pairs were asked to discuss which city they would like to travel during their summer break. They were required to compare the two cities using all the information provided in the two booklets and decide where to visit in the summer. As a task outcome, each pair was asked to write a short report, in which they should describe their travel plan for the city that they chose to visit and present it to the class.

3.4.2 Collaborative alignment activities

In order to elicit production of the target linguistic features, two communicative alignment activities were adapted from those developed by Branigan, Pickering, Pearson, McLean, and Nass (2003) and Branigan et al. (2004). The target grammatical structure and words were embedded within the activities. The alignment activities were two-way picture-description activities, in which learners described a target object shown in a picture and chose a picture between two that matched their interlocutors' description after hearing a prime from confederate-learner participants. Successful completion of the activity culminated in the interlocutors' collaborative attainment of communicative goals (i.e., describing and identifying

the pictures). The picture description activities were designed to encourage the learners to practice their integrated (i.e., listening and speaking) language skills while carrying out speaking activities with the peers. The alignment activities were carried out orally by the students in the FTF group and via a mobile instant messaging application on a smartphone by those in the SMMC group. The learners did not receive any explicit information about the target structure and lexical items as well as what they would be tested on during the activities.

Each alignment activity consisted of 16 target and 16 filler items. A target word and target grammatical structure (a stranded preposition RC) were integrated in each target (prime) sentence so that alignment effects could be enhanced. The target item was made up of a set of two pictures (one showing the target object and the other showing an unrelated object) for the prime and one more picture showing the target object in a different context for the prompt part. While the confederate-learner used a fully acceptable-but-disfavored name for the target object in the prime, the participant-learner was able to choose between a favored or fully acceptable-but-disfavored word to refer to the same object presented in a different picture. As mentioned in the previous section, the disfavored name was the target noun in this study. For example, one item consisted of the target picture of an *axe*/*hatchet* (*axe* being the favored name and *hatchet* being the disfavored name), a distractor picture of a woman hanging a picture on a wall, and another target picture of an *axe*/*hatchet* in a different context follows (see Appendix B for more sample items including a filler item and Appendix C for all the prime sentences and expected responses from learners). The sample item below shows how each item was carried out between a confederate-learner and participant-learner:

Example 1: Sample interaction sequence during alignment activity

1. Confederate-Learner: “A *hatchet* is something you split timber with.”

2. Participant-Learner:

(looking at a picture containing a hatchet and another picture of an unrelated object)

"B is a picture of a hatchet."

A	B
	

3. Confederate-Learner: "Correct, you're right. Now it's your turn."

4. Participant-Learner:

(looking at a picture containing a hatchet in a different context; verb *chop* is presented in the prompt)

"(if alignment occurs) A *hatchet* is something you chop wood with.

A	B
	

5. Confederate-Learner:

(looking at a picture containing a hatchet in a different context and a distractor picture)

"It's B. B shows a hatchet."

For each activity, confederate-learners presented a prime word (i.e., a disfavored name; target word) embedded in a stranded preposition RC (i.e., the target grammatical structure) to describe the object in the target picture to the participant-learner (line 1). As shown in the sample interaction sequence above, the participant-learner was asked to choose a picture from the target and distractor picture that matches the confederate-learner's description between the target and distractor picture (line 2). The confederate-learner gave feedback to the participant-learner by saying "that is correct" or "no, that is not the right picture" (line 3). Then, the participant-learner described the same object presented in a different picture by using a given prompt word (verb "*chop*") (line 4). If the participant-learner aligned with the confederate-learner, s/he was expected to use the target word (i.e., disfavored name of the object) in the accurate pattern of the stranded preposition RC as embedded within the confederate-learner's preceding utterance as opposed to other types of possible alternative structures such as a null prep structure. Finally, the confederate-learner chose a picture that matched the participant-learner's description (5).

3.4.3 Measurement materials

To assess learners' improvement in their use of the target grammatical structure and words, both productive and receptive tests were developed in three different versions. Tests for grammatical knowledge included the sentence production test and grammaticality judgment test (GJT). Vocabulary knowledge was measured using the word production test and word translation test. Each version of the measurement tests served as either the pretest, immediate posttest, or delayed posttest. Between the grammar and vocabulary test, the vocabulary tests were introduced first. In addition, in order not to prime learners to use the target structure or words in the measurement test, the production test (i.e., sentence production test, word production test) was administered before the receptive test (i.e., GJT, word translation test).

To control for test order effects, the order of the three versions of the tests was counter-balanced across participants. Furthermore, the contents of the sentence production test and GJT were different across the three versions. For the word production test, different pictures were used to elicit learners' production of the target objects' names. However, it was unavoidable to use the same words in the word translation tests to test the learning of the target (disfavored) words, which might have caused practice effects. To minimize practice effects, different fillers were used across the three versions of the word translation test. All of the measurement tests were pilot tested with Korean learners of English to ensure the clarity of sentences and pictures.

3.4.3.1 Sentence production test

The sentence production test was designed to assess learners' productive knowledge of relative clause structures in an interactive context. An object was presented in a picture along with its name in each item in this test for the participants to describe using a verb provided to them as in the sample item below:

Example 2: Sample item of the sentence production test

Verb	Target noun
sip	thermos

Expected response from a learner: *A thermos is something you sip coffee from*.

In this test, participants were instructed to use the verb provided in each item and describe the object in the picture to the researcher. Learners in the FTF group were required to orally produce a sentence to best describe the object whereas the SMMC participants typed the answer on their own smartphone. They were not given any instructions with regard to the potential sentence structures they could construct. Each of the three versions of the sentence

production test included 12 items, with three items targeting each of the four prepositions used in the alignment activities (i.e., *with, from, in,* and *on*). Three different versions were developed, and none of the target nouns and prompt verbs were repeated across the three versions. The target nouns and verbs included in the sentence production test as well as expected responses are presented in Appendix D.

3.4.3.2 Grammaticality judgment test

The grammaticality judgment test (GJT) was designed to test learners' receptive knowledge of the target grammatical structure. A total of 9 target items (5 correct and 4 incorrect) and 9 distractors were included in the test. For this test, participants were asked to judge the 18 sentences as grammatical or ungrammatical by marking "*correct*" or "*incorrect*" after each item. The option of "*I don't know*" was also available so that students would not randomly guess the answer even if they were unsure about the grammaticality of the sentences. They were also asked to provide a correction and explanation of the ungrammaticality for any items that they rated "*incorrect*". The GJT was paper-based for all participants. Three different versions were created to be used as a pretest, immediate posttest, and delayed posttest. Consistent with the alignment activities, only four prepositions including *with*, *on*, *in*, and *from* were used in the test items. Moreover, none of the test sentences were repeated across the three versions. All three versions of GJT are presented in Appendix E.

3.4.3.3 Word production test

Learners' productive vocabulary knowledge was measured by using the discrete-item word production test created by Shintani (2013). In each version of the test, individual participants were asked to label 32 flash-cards representing the target nouns. The researcher elicited learners' production of the target words by saying "What's this?" The pictures in the

flash cards were different from the ones used in the alignment activities in order to avoid familiarity effect. Furthermore, because pictures used in three versions of the word production test were all different, a total of 96 pictures were shown to each participant, with 32 pictures being used in pretest, immediate posttest, and delayed posttest. The word production test was administered orally face-to-face between the researcher and each participant.

3.4.3.4 Word translation test

A word translation test was developed to assess learners' receptive knowledge of the target vocabulary items. Each version of the word translation test included 128 words in total with 64 words used in the alignment activities (i.e., 32 synonym pairs of highly favored and disfavored words) and 64 distractors. While the 64 words from the alignment activities were the same across the three versions of the test, different distractors were chosen from the word pool of MEST and used in each version. Participants were instructed to translate, in writing, each word into Korean and no time constraints were imposed in the test.

3.4.4 Proficiency test

To assess learners' language proficiency, the C-test, which measures learners' ability to retrieve a known word form from memory using contextual cues about its meaning (Elgort, 2017). The C-test was invented by Klein-Braley and Raatz (1984) on the basis of the cloze test (Jafapur, 1995). Unlike the cloze test, which is made from one text and can bias results for those who already know the subject matter of the text, the C-test usually includes three to five different texts. Each text contains 15–25 items and deals with a different topic with around 75 to 100 words (Norris, 2006). Words in the first sentence are not deleted for participants' comprehension. After the first sentence, the second half of every other word is deleted, but words with only one letter are skipped (Connelly, 1997). If a word has an odd number of letters, the

larger half is deleted. Every deleted letter was replaced by a dash (Jafapur, 1995). Participants read three short passages with different themes, in each of which some words were partially taken. And then they were required to fill in missing words within each passage (see example below).

Example 3: Part of test passage 1 in the cloze test

Police are looking for a man in connection with this morning's bank robbery in Hong Kong. It is known that the sus___[1] is a man in his ea___[2] thirties, is lightly built, and i_____[3] about five feet eight inches ta___[4].

Several SLA researchers have asserted that the C-test is an effective measure of overall language proficiency and that the C-tests are useful for EFL learners for research purposes (e.g., Dörnyei & Katona, 1992; Eckes & Grotjahn, 2006; Grotjahn, 1986; Klein-Braley, 1997). The C-test is relatively easy to develop, and its administration and scoring is simple and quick (Lee-Ellis, 2009). Furthermore, research has demonstrated not only its high reliability but also objectivity of scoring (e.g., Klein-Braley & Raatz, 1984) and its alleged measure of integrative use of language (e.g., Klein-Braley, 1997). With regard to the concurrent validity, previous research lends support to the notion that the C-test measures the same latent variable that other types of institutionalized proficiency tests measure. For instance, a moderate to high correlation was reported between C-Test scores and the TOEFL (r = .55 to .91), the TOEIC (r = .62), and the Oxford Placement Test (r = .83) (Eckes & Grotjahn, 2006). However, L2 researchers did not reach a unanimous consensus on the use of C-tests to measure general language proficiency. For instance, some researchers have argued that C-tests would be more suited to measuring micro-level skills such as spelling, punctuation, word choice rather than global proficiency (e.g., Cohen, Segal, & Weiss, 1984; Stemmer, 1991). Appendix F provides the entire C-test.

3.4.5 Language aptitude tests

3.4.5.1 The LLAMA test

The current study measured a learner's cognitive aptitude for language learning using the LLAMA test (Meara, 2005). The LLAMA, which is a computer-based, language-independent test battery, which relies on picture stimuli and verbal materials adapted from a British Columbian indigenous language and a Central American language. The following four subtests are included in LLAMA: LLAMA B, a test of vocabulary learning that requires learning associations between pictures and words; LLAMA D, a test of sound recognition that requires previously heard sound sequences to be identified in new sequences; LLAMA E, a test of sound–symbol associations that requires forming novel sound–symbol associations; and LLAMA F, a test of grammatical inferencing that requires inducing the rules governing a set of phrases in an unknown language (Granena, 2016). The subtests B, D, and F have been found to tap into cognitive abilities in the domain of explicit and attention-driven cognitive processes including explicit inductive learning ability, rote memory ability, and analytical ability. These cognitive abilities have been suggested to be particularly relevant to learn a language intentionally through reasoning, deliberate hypothesis testing, and memorization (Granena, 2016). On the other hand, the subtest E was found to measure aptitude for implicit learning. The subtest E has been validated as a measure of implicit language aptitude, which includes abilities in the general domain of implicit cognitive processes such as implicit memory and implicit inductive learning ability (Granena, 2013; Yilmaz & Granena, 2016). The score for each of the LLAMA subtests ranges either between 0 and 100 (LLAMA B, E, and F) or between 0 and 75 (LLAMA D). All the subtests were automatically scored for each participant, and feedback was provided after each

response in the form of an acoustic signal. The final score was shown to the participant upon completion of each subtest.

3.4.5.2 Language Analysis test

The Language Analysis subtest of the Pimsleur Language Aptitude Battery (PLAB) (Pimsleur, 1966) was also employed to measure the learners' language analytic ability. The Language Analysis subtest is a measure of explicit inductive language ability. The Language Analysis subtest is similar to LLAMA F in that both measures learners' grammatical inferencing ability. However, the Language Analysis subtest has been found to allows learners to use reading comprehension ability and problem-solving strategies when inducing grammatical rules from the stimuli (Albert, 2006). In this test, the participants were provided with a small set of language data in an unknown language together with corresponding English translation. Following the language data, 14 short English sentences were presented, each with four possible translations into the unknown language. The participants were asked to choose the correct translation using the language data as a reference. The Language Analysis test used in this study is provided in Appendix G.

3.4.6 Surveys

Two sets of surveys were developed for the current study: a pre-experiment survey and an interlocutor perception survey. All the questionnaires included in the surveys were administered in Korean to prevent problems associated with participants' misunderstanding of the questions and/or statement in the questionnaires.

3.4.6.1 Pre-experiment survey

The pre-experiment survey was administered prior to the alignment activity in order to collect information about individual participants. Included in the pre-experiment survey were: 1)

a background questionnaire asking each learner's self-assessed proficiency as well as basic demographic items such as age, sex, age of starting English education, and length of English education (Appendix H), and 2) cognitive style questionnaire (a Rational Experiential Inventory [REI]; Pacini & Epstein, 1999). The REI consisted of 37 questions asking participants to evaluate the manner in which they believe they make decisions. Evaluations were made of statements like "I try to avoid situations that require thinking in depth about something" on a scale of one to five (1 =Definitely NOT true of myself, 5 = Definitely true of myself). A complete list of the REI questions is set out in Appendix I.

3.4.6.2 Interlocutor perception survey

In order to measure their perception of the interlocutor with regard to language proficiency, comprehensibility, and task experience, participants completed an interlocutor perception survey after the second session of the alignment activity. A proficiency rating scale was created following Lim's (2007) analytic speaking criteria, which assesses speaking proficiency based on fluency, pronunciation, vocabulary, grammar, and interactional strategy. The comprehensibility rating rubric was developed following Tanner and Landon (2009). Students were instructed to mark 4 if they had no difficulty understanding their interlocutor, whereas 0 should be given to those who they could barely understand. The interlocutor perception survey also included scales to measure several dimensions of participants' task experiences with the interlocutor in terms of likeability, comfort, and pleasure (Kim & Mutlu, 2014). The likeability scale included 8 items (e.g., "I found completing the task with my partner was easy") that measures the extent to which participants liked (found to be easy, straightforward, and painless) the experience of carrying out the task with the interlocutor. The comfort scale included 6 items (e.g., "Doing the collaborative task with my partner was

uncomfortable for me") that captures participants' level of comfort in performing the task with the interlocutor. Eight items (e.g., "Doing the collaborative task with my partner was fun to me") made up the pleasure scale and measured the extent to which participants were satisfied with their experience in enjoyable and emotional terms. Participants' responses to all items were captured using five-point rating scales ranging from "Strongly disagree" to "Strongly agree." The English version of the interlocutor perception survey is presented in Appendix J.

3.5 Interviews

Upon completion of the two alignment activity sessions, interviews were conducted on a one-on-one basis with students who were invited to participate by the researcher. Data from the interviews were used primarily to supplement the perception questionnaire. Ten participants from the two experimental groups (i.e., 5 from the SMMC group and another 5 from the FTF group) were invited to the interviews. The interviews were designed to probe into students' perceptions of their interlocutor's proficiency, comprehensibility as well as task performance with the interlocutor. Furthermore, the interviews were expected to help understand participants' inclination for linguistic alignment during the alignment activities. Interview questions were created based on their responses in the interlocutor perception survey and alignment behaviors in the two sessions of the alignment activity so that more in-depth information could be collected through the interviews and used as a supplement to the survey result. The interviews occurred in a quiet room on the research site and were recorded using a digital voice recorder. Each interview lasted approximately 20 minutes.

3.6 Procedures

3.6.1 Pilot experiments

Prior to conducting the actual experiment, the alignment and measurement materials underwent multiple revisions through several pilot experiments with both native speakers and Korean EFL learners. Specifically, two pilot experiments were conducted with 3 native speakers, all of whom were graduate students majoring in Applied Linguistics. The primary purpose of these pilot experiments with native speakers was to check the legitimacy of the sentential and lexical stimuli. Adjustments to the language and wording were made based on the native speakers' feedback. Only the sentences that were considered natural were included in the materials for the actual experiment. For the lexical stimuli, words that were considered archaic or rarely used by native speakers were discarded to ensure the authenticity of the experimental materials. Additionally, the native speakers were asked to describe each picture included in the materials to make sure that the pictures could successfully elicit the use of target words and grammatical structure from native speakers.

After testing the materials with native speakers and making necessary revisions, two pilot experiments were carried out with 5 Korean EFL learners in order to determine whether the alignment materials and test items in the measurement tests would be suitable for the selected group of participants in terms of content and language level. It is important to note that the pilot experiments were conducted with a separate group of EFL students with similar age and educational levels as the final participants to avoid giving the study participants a preconceived idea of what they would be expected to do in the actual experiment. The pilot experiments with EFL learners enabled the researcher to have an overview of how the alignment activities and measurement tests would materialize. Any sentence stimulus that the pilot participants had

difficulty comprehending were paraphrased to suit their level of understanding. In addition, any lexical stimulus which the pilot participants knew the meaning and usage were discarded because the aim of this study was to investigate whether alignment activities would be beneficial for L2 learners to acquire words that they had not already known. Therefore, the pilot experiment with EFL learners helped control for the lack of prior knowledge of the target words on the part of the study participants and identifying new or unfamiliar words for inclusion in the alignment and measurement materials.

3.6.2 Procedures of the study

The procedure of the data collection is described in Figure 1.

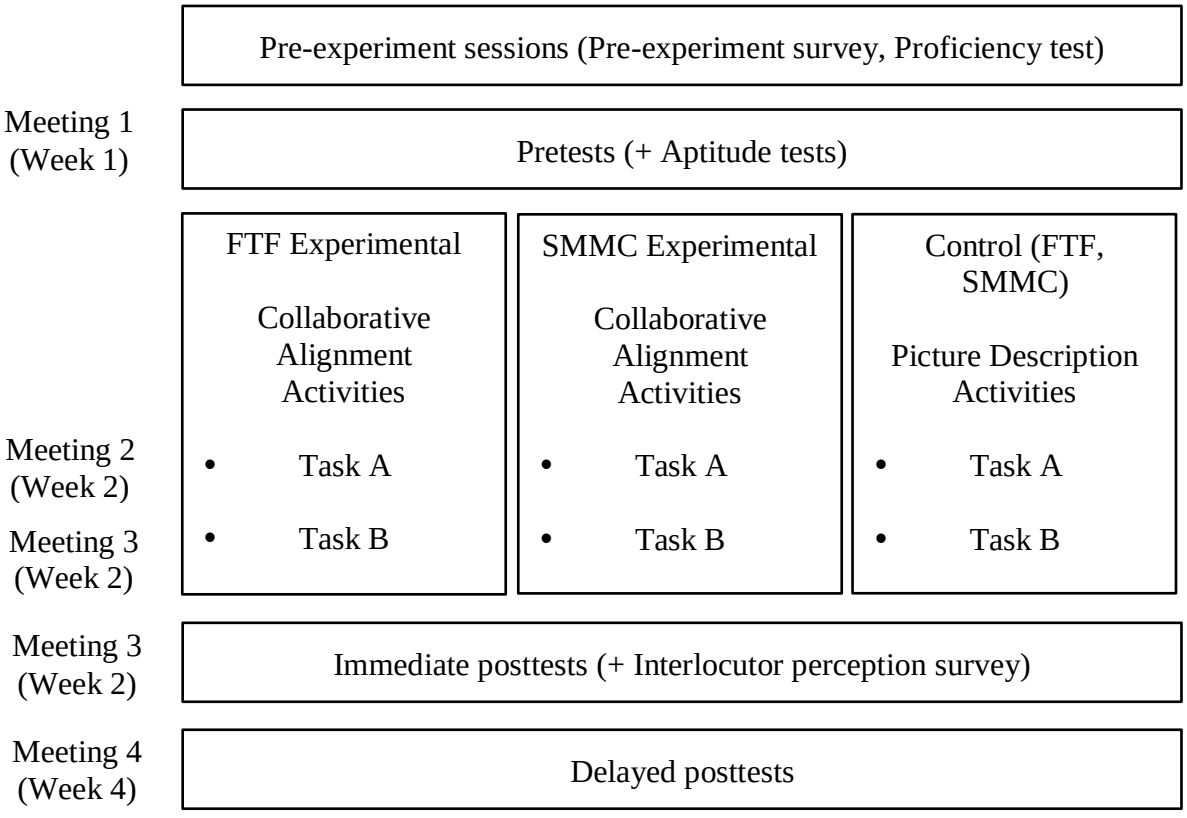

Figure 1 Procedure of the Study

As shown in Figure 1, before the experiment began, two pre-experiment sessions, which were designed for helping participants develop perceptions of their interlocutor, were conducted over a period of one month with potential experimental participants. The pre-experiment sessions were designed as part of the students' regular curriculum, which all students had to complete regardless of their participation in the study. However, the experiment was completely unrelated to the course requirements and conducted outside the classroom. Only those who expressed interest in the study were invited to participate.

Students were divided into two groups – FTF or SMMC - based on their familiarity and preference of using a mobile instant messaging application. The FTF group (n = 38) orally carried out the activities using a voice recorder provided by the researcher whereas the SMMC group (n = 36) performed them in a written mode via text-chat using their own smartphones. Pairing was done prior to the pre-experiment sessions by the researcher in such a way that students in each pair had different proficiency levels in English as demonstrated by their overall performance in class and scores in an English proficiency test. Random partner assignment was not considered as ideal for this study because students with similar proficiency were not supposed to be paired up. By pairing students with different proficiency, this study could examine if the participants' perceived differences in language abilities affected the linguistic alignment effects.

Each student performed a communicative activity every two weeks over a month (two activities in total) with the same partner assigned by the researcher. The two activities included an information-exchange activity, in which two students took turns sharing information about a given topic to reach an agreement and a decision-making task, in which learners interacted in order to make a travel plan. Upon completion of each activity session, students completed a pre-

experiment survey about their experience with the activity and perceptions of proficiency and comprehensibility of their partner using a subset of the perception questionnaire (question 1 and 2 only). Only those who showed interested in the experiment were invited to participate in the experiment. Participants in the control group were recruited outside the class and did not do the pre-experiment sessions.

The experiment, which included the alignment activities and measurement tests, was carried out over a four-week period in a laboratory setting (see Figure 1). The pre-experiment survey and proficiency test were completed after the pre-experiment sessions for the experimental participants. The control participants visited the research lab to complete the demographic questionnaire and proficiency test for participant pairing before the experiment began. Aptitude tests and pretests were administered to all participants during the first week. Two alignment activities and immediate posttests were completed in the second week. For the alignment activities, some of the participants played a confederate role in the alignment activity (i.e., a learner-participant who is scripted to produce one or other form as the prime but poses as another naïve participant; McDonough, 2006) and assigned an interlocutor either with lower proficiency or with higher proficiency. Each learner pair was offered two alignment sessions on two consecutive days, and the immediate posttests along with the interlocutor perception survey were administered right after the second alignment activity. Each learner performed the delayed posttests two weeks after the immediate posttests. The pre-experiment survey and proficiency test took approximately 30 minutes. The aptitude tests and pretests took about 30 to 40 minutes. The alignment activity required 20 to 40 minutes to complete.

The researcher met each pair of the participants in a classroom set up for the experiment. The experimental participants were assigned to either the FTF or SMMC group. Both FTF and

SMMC experimental groups performed the same interactive alignment activities. Students in the FTF group were paired up to carry out the activities orally, whereas participants in the SMMC group were put into pairs to communicate in separate rooms via a mobile instant messaging application on a smartphone called KakaoTalk (https://www.kakaocorp.com). Both experimental groups were given different activities on the first and second meetings. The interactions made between the learners in the FTF group were recorded using a digital audio recorder and the SMMC group's written interactions were converted as a text file on the application. The control participants were also randomly split into FTF or SMMC group. Participants in the control group completed a different type of a communicative activity than the alignment activities, in which they took turns describing pictures to their partners either orally (the FTF control group) or using KakaoTalk (the SMMC control group). The immediate posttests and interlocutor perception survey followed right after the second session of the experiment for all participants. Interviews were conducted only with selected participants upon completion of the interlocutor perception survey. The interviewees were invited on the basis of their alignment behaviors in the alignment sessions and test performances on the pretest and immediate posttest. The delayed posttest was administered two weeks after the immediate posttest.

3.7 Data coding

The production of stranded preposition RCs during the treatment sessions and pretest and posttests was analyzed in terms of suppliance following previous research (Conroy & Antón-Méndez, 2015). Production of a stranded preposition RC was scored by assigning 1 point for the suppliance of a stranded preposition. A stranded preposition RC was considered well-formed when it contained the correct antecedent and stranded preposition with no resumptive pronoun, as in *A blender is something you mix ingredients with*. Because omission of the relative pronoun

is permitted in RC, it was deemed correct as long as all the other elements were appropriately used to form a stranded preposition RC. Errors not pertaining to a stranded preposition RC construction (e.g., articles, tense, agreement) were ignored. Table 3 displays the two categories for coding stranded preposition RC data along with examples for each category.

Table 3 Coding Categories for Stranded Preposition RC Data

Score	Structure	Example
0	Subject relative clause without a stranded preposition	This is something that measure ingredients.
	Relative clause requiring, but not including, a stranded preposition	This is something you boil water.
	Object relative clause	This is something you use to boil water.
	Adverbial relative clause	This is something where actors perform.
	Relative clause with a resumptive pronoun not requiring a preposition	This is something singers sing a song here.
	Relative clause with a resumptive pronoun and unacceptable preposition	This is something we boil water with this.
	Relative clause with a resumptive pronoun and acceptable preposition	This is something students study in here.
1	Relative clause with an unacceptable preposition stranded	This is something that we can boil water on.
	Relative clause with an acceptable preposition stranded	This is something we can boil water with.

Learner responses in the GJT were scored based on whether the answer was correct and the learner correctly located the error in the sentence. For grammatically correct items, 1 point was assigned when participants were able to determine the accuracy of each sentence (correct vs. incorrect). For incorrect items, 1 point was given only to the responses where they accurately located the errors. In other words, 0 point was given if they failed to spot the errors although they correctly identified that the sentence is grammatically incorrect. A possible total score for the grammaticality judgment test was 9 points.

Learners' production of words in the alignment activities and word production test was coded as aligned (1 points) if learners used the same word to label the target object in the given picture as that just used by their interlocutors, or as misaligned (0 point) if they used a different

but appropriate word or if they produced a word that did not describe the target object correctly. For the word translation test, correct translation of the words was assigned 1 point. All incorrect translation was assigned 0 point. A possible total score for the word production test and word translation test is 32 points.

3.8 Statistical analysis

Prior to performing statistical analyses for the alignment data, principal components analysis (PCA), a variable-reduction technique, was conducted to arrange variables into separate components (factors) based on how strongly correlated variables are with each other. For the current study, results of PCA determined if the four subtests included in the LLAMA language aptitude tests (i.e., LLAMA B, D, E, and F) should be collapsed into larger variables or principal components, and, if so, to provide weighted scores that could then be used as independent variables in statistical models. The same PCA procedures were used to examine if the three subcomponents of the perception questionnaire (participant's perception of the interlocutor's language proficiency in terms of fluency, vocabulary competence, and grammatical competence) could be grouped into separate components. Weighted scores for the component(s) were to be used as fixed effect(s) in the subsequent statistical analyses.

In addition to PCA, three reliability analyses were conducted to measure internal consistency reliability of questionnaire items for each of the following three questionnaires: experiential cognitive style, rational cognitive style, and perception of task experience. If the questionnaire items are found to be strongly associated with one another, representing the relevant construct (experiential cognitive style, rational cognitive style, and perception of task experience), an average score for each participant can be used as an independent variable.

Statistical analysis of data was carried out in SAS 9.4 (SAS Institute Inc., Cary, North Carolina, USA) In order to systematically answer the research questions, generalized linear mixed-effects models (GLMM) with a logit link function (i.e., logit mixed-effects models) were developed to analyze binary categorical data. These logit mixed-effects models (henceforth, logit mixed models) offer methodological advantages over the use of traditional regression and analysis of variance (ANOVA) analyses (Baayen, Davidson, & Bates, 2008; Jaeger, 2008). First, mixed-effects models allow for the inclusion of participant-level and item-level factors in a single unified analysis and therefore, the analysis does not require averaging over participants or items (Boyd & Goldberg, 2012). Mixed-effects models additionally allow for non-independence of data, which means that one participant or item can contribute more than one data point per condition, allowing for an analysis of raw data points rather than a single mean score per participant, as would occur in traditional ANOVA methods. Furthermore, the fixed effects component of a mixed-effects model can contain multiple independent variables of interest to the researcher, including categorical predictors (e.g., aligned vs. misaligned), continuous predictors (e.g., age), or a mixture of the two. Mixed models also include random effects in order to account for variation attributed to individual differences amongst participants and items. Finally, mixed-effects models are robust in the presence of several problems known to affect ANOVA validity including unequal N sizes, missing data, non-normality, and heteroscedasticity (Quene & van den Bergh, 2008). As such, mixed-effects models allow for more accurate interpretations of the influence of specific effects when attempting to measure the influence of a predictor variable on an outcome variable (Baayen et al., 2008).

Several logit mixed models were constructed to systematically answer the research questions. The first logit mixed model was constructed to answer RQ 1, which concerns the

linguistic alignment effects. RQ 1 examined the extent to which linguistic alignment occurred during L2 peer interaction in FTF and SMMC mode and the mediating effects of modality (RQ 1-1), social factors (RQ 1-2), and individual differences in cognitive abilities (RQ 1-3). In total, two logit mixed models were developed for the two types of alignment: structural alignment and lexical alignment. The amount of structural and lexical alignment was measured separately to address RQ 1 for each of the respective constructs. Following previous research (e.g., Jung et al., 2017; McDonough et al., 2015; Trofimovich et al., 2014), successful alignment effects refer to learners' production of the target linguistic features after hearing the interlocutor's production of the identical grammatical structure (for structural alignment) or the same word (for lexical alignment).

The dependent variable for research question (RQ 1) and its three sub-questions concerning the effects of moderating factors on the magnitude of alignment was the degree of alignment operationalized as the amount of aligned production of the target linguistic feature in the alignment activities. The fixed effects included modality (categorical; FTF vs. SMMC), social factors (continuous; participants' perceptions of their interlocutor with respect to proficiency, comprehensibility, and task experience), and cognitive factors (continuous; cognitive style, aptitude for explicit and implicit language learning, language analysis ability, and English proficiency) as well as participants' demographic information (i.e., sex, age, length of English study). Prime type (prime vs. non-prime; if alignment occurred following a prime or a non-prime) was also entered as a fixed effect only in the structural alignment model in order to account for instances where participants used a stranded preposition in RC after hearing a filler sentence without the target structure. Cognitive style was subdivided into the rational-analytical (rationality) and the experiential-intuitive cognitive styles (experientiality). Individual

participants' rationality and experientiality scores were entered into the model to examine the relationship between cognitive style and structural alignment effects. Based on the results of PCA, the aptitude variable had two components including aptitude_explicit and aptitude_implicit, which were included as separate factors representing the participants' explicit language aptitude and implicit language aptitude, respectively (Saito, Suzukida, & Sun, 2018). Participant and item were included as random intercepts. A random slope of item was added to the random effect of participant.

To address the research questions concerning the role of alignment activities on L2 development (RQ 2) and the moderating role of modality (RQ 2-1), social factors (RQ 2-2), and individual differences in cognitive abilities (RQ 2-3) on the learning effects, four logit mixed models were fitted to the measurement data from sentence production task, GJT, word production test, and word translation test. For the second RQ and its sub-questions concerning the learning effects of the alignment activities, the dependent variable was subsequent learning effect of the alignment activities measured by learners' performance in the pretest, immediate posttest, and delayed posttest of the measurement tests (i.e., sentence production test, GJT, word production test, and word translation test). For all the mixed models, time (pretest, immediate posttest, and delayed posttest) and group (experimental vs. control) were included as fixed effects in addition to the variables used in the alignment models. Additionally, a two-way interaction between time and group and a three-way interaction between time, group, and modality were also included in the analysis. The random effects included random intercepts by participants and items (i.e., test items of the measurement test). A random slope of item was added to the random effect of participant.

To present results, the solution for fixed effects and type III tests of fixed effects were used to infer the statistical significance of fixed effects and interactions on each dependent variable. For significant interactions between fixed effects of particular interest to the study, *a posteriori* pairwise comparisons of least-square mean values were conducted. Results of the pairwise comparisons tested whether any learning effects carried over from the treatment sessions.

4 RESULTS

4.1 Grouping variables into separate components: Principal Component Analysis (PCA)

To reduce the number of variables and to avoid redundant predictors, A PCA was conducted on the four subtests of the LLAMA language aptitude test (LLAMA B, D, E, and F). Results of PCA indicated that a Bartlett's test of sphericity was statistically significant ($p <$ .001), suggesting that correlations between the four subtests of the LLAMA test were not attributable to chance. The Kaiser-Meyer-Olkin measure of sampling adequacy reported 0.851, indicating that the data is well suited for PCA (Kaiser, 1974). The scree plot and percentage of variance explained between factors suggested a two-component extraction as the most parsimonious model. The rotated component matrix using varimax rotation with Kaiser normalization further supported a two-component solution. Eigenvalues for the LLAMA subtest loadings are displayed in Table 4. LLAMA B (vocabulary learning), E (sound-symbol correspondence), and F (grammatical inference) loaded into the first component based on the strength of correlations reported within the component. This component was labeled as aptitude_explicit on the basis of previous research findings on the LLAMA language aptitude tests (see Methods for more detailed explanation). The second component was labeled as aptitude_implicit based on the subtests that loaded into it (LLAMA D, sound recognition). This finding is in line with previous research examining the role of cognitive aptitude in L2 learning (Granena, 2013; Yilmaz & Granena, 2016).

Table 4 Eigenvalues for LLAMA Subtest Loadings

	Component 1	Component 2
LLAMA subtests	Aptitude_Explicit	Aptitude_Implicit
B	.555	
E	.850	
F	.790	
D		.949

For the scores of the aptitude_explicit and aptitude_implicit component, the eigenvalues for each included subtest were used to create a weighted component score for each individual participant. Specifically, each individual participant's scores on the four subtests was multiplied by its respective subtest's eigenvalue. The results were then summed, resulting in a single weighted component score for the aptitude_explicit and aptitude_implicit component. These weighted scores were used as independent variables in the statistical analyses.

As to the PCA results of the perception questionnaire, all three subcomponents were found to load into one large component, which was labeled as perceived proficiency. Eigenvalues for subcomponent loadings are displayed in Table 5. A weighted component score for the sole component was created for each participant using the eigenvalues. Using each component's eigenvalue, a weighted score was calculated for each participant for the perceived proficiency component. The weighted score was entered into the following statistical analyses as an independent variable.

Table 5 Eigenvalues for Perception Subcomponent Loadings

Perception questionnaire subcomponent	Component 1 Perceived proficiency
Fluency	.859
Vocabulary	.760
Grammar	.849

4.2 Reliability analysis results

The current study examined the participants' cognitive style using their responses to the items included in the cognitive style questionnaire (REI). In order to check for internal consistency (reliability) among the items included in REI, a Cronbach's alpha was run using SPSS. Since the questionnaire was devised to measure two different constructs for cognitive style – the rational-analytical and experiential-intuitive cognitive style, reliability was checked

for questionnaire items that were developed to measure the same construct. Eighteen questions measuring the rational-analytical cognitive style had good reliability as demonstrated by a Cronbach's alpha of 0.833. The remaining 17 questions measuring the experiential-intuitive cognitive style had a Cronbach's alpha of 0.715, indicating an acceptable level of reliability. As a rule of thumb, the standard of acceptable reliability is typically set at .70 and the value of higher than .08 is considered to indicate good reliability (Allen & Yen, 1979). Since reliability was found to be acceptable for both sets of questions, each individual participant's responses for the questions relevant to each construct (cognitive style) were averaged to obtain one single score for each of the rational-analytical and experiential-intuitive cognitive style. The two scores were entered into the statistical models as independent variables.

In addition, participants' perceptions of task experience with their particular interlocutor were measured using a questionnaire, which consisted of 22 question items. Reliability analysis was conducted with the 22 questions in the questionnaire in order to determine if the questionnaire is reliable, and if so, to obtain a single score for the perception score of each participant. The internal consistency of the 22 questions was 0.948, demonstrating a high level of reliability (Allen & Yen, 1979). Thus, each participant's responses for the questions were averaged to obtain a score to be included as an independent variable in the statistical models.

4.3 Linguistic alignment and moderating factors

Prior to describing the results of the current study, descriptive statistics of the following tests and questionnaires administered to participants are presented in Table 6: language proficiency (cloze test) scores (possible total: 50), language analysis scores (possible total: 14), weighted component score for LLAMA B, E, and F (aptitude_explicit; possible total: 219.5), weighted component scores for LLAMA D (aptitude_implicit; possible total: 94. 9), experiential

cognitive style (possible total: 5), rational cognitive style (possible total: 5), weighted component score for fluency, vocabulary, and grammar (perceived proficiency; possible total: 12.34), overall perceived proficiency (possible total: 5), perceived comprehensibility (possible total: 7), and perception of task experience (possible total: 6). In addition, it should be noted that each research question is to be answered with respect to two different constructs – structural alignment and lexical alignment.

Table 6 Descriptive Statistics of Scores for Proficiency Test, Language Aptitude Tests, Cognitive Style Questionnaires, and Perception Questionnaires

Group		Experimental				Control			
Modality		FTF (n=19)		SMMC (n=18)		FTF (n=10)		SMMC (n=14)	
		M	SD	M	SD	M	SD	M	SD
Cloze test	Proficiency test	25.553	5.835	29.471	10.000	70.625	17.258	29.250	6.952
Aptitude tests	Language analysis test	9.789	2.016	10.688	2.330	24.500	5.253	9.786	2.392
	Aptitude_ Explicit	142.206	38.951	151.693	36.252	143.933	52.901	159.31	39.926
	Aptitude_ Implicit	35.715	10.416	39.148	14.129	30.371	15.529	27.116	14.940
Cognitive style questionnaire	Experiential style	3.780	0.516	3.716	0.360	3.750	0.345	3.610	0.410
	Rational style	3.700	0.338	3.902	0.346	3.440	0.483	3.560	0.628
Perception questionnaire	Perceived proficiency	8.540	0.940	9.224	1.539	7.910	1.330	9.150	1.137
	Overall proficiency	3.470	0.595	3.611	0.756	3.130	1.053	3.290	0.958
	Perceived Comprehen-sibility	5.370	0.809	5.722	0.730	5.630	0.484	6.210	0.674
	Perception of task experience	4.460	0.706	4.578	0.687	4.700	0.310	4.820	0.778

4.3.1 Structural alignment effects

The magnitude of the structural alignment effect was operationalized by comparing the occurrence of aligned production and misaligned production of the target grammatical structure (i.e., stranded prepositions in RCs). Table 7 displays the total frequency of aligned and misaligned production of the target structure during the two treatment sessions for both FTF and SMMC groups. Because the control group did not perform any alignment activities, alignment data is not available for the control group. Since a total of 16 primes and 16 non-prime filler trials were provided to each participant in each session, the total possible production tokens for the FTF group was 1216 (608 tokens after primes and 608 tokens after non-primes), and the total for the SMMC group was 1152 (576 tokens after primes and 576 tokens after non-primes). As shown in Table 7, participants in FTF group produced a total of 62 (20.39%) and 11 (3.62%) stranded preposition RCs (score of 1) in the first treatment session and a total of 50 (16.45%) and 5 (1.64%) stranded preposition RCs in the second treatment session after primes and non-primes, respectively. On the other hand, the SMMC participants produced a total of 110 (38.19%) and 17 (5.90%) stranded preposition RCs in the first session and a total of 142 (49.31%) and 14 (4.86%) stranded preposition RCs in the second session following primes and non-primes, respectively. These frequency counts indicate that structural alignment occurred to a greater extent in SMMC mode, compared to FTF mode, in both the first and second alignment sessions. Furthermore, the frequency counts for both modalities demonstrate that the target structure was produced (score of 1) more frequently after hearing a prime than a non-prime.

Table 7 Total Frequency of the Occurrence of Structural Alignment during Treatment Sessions

Alignment Session 1				
Score	**0**		**1**	
Prime type	Prime	Non-prime	Prime	Non-prime
FTF (n=19)	242 (79.61%)	293 (96.38%)	62 (20.39%)	11 (3.62%)
SMMC (n=18)	178 (61.81%)	271 (94.10%)	110 (38.19%)	17 (5.90%)
Alignment Session 2				
Score	**0**		**1**	
Prime type	Prime	Non-prime	Prime	Non-prime
FTF (n=19)	254 (83.55%)	299 (98.36%)	50 (16.45%)	5 (1.64%)
SMMC (n=18)	146 (50.69%)	274 (95.14%)	142 (49.31%)	14 (4.86%)

Note. Numbers indicate the total frequency count of codes assigned for each category based on group and prime type. FTF sessions had a total of 1256 trials (608 prime, 608 non-prime), whereas SMMC sessions had a total of 1152 trials (576 prime, 576 non-prime). Percentages indicate rounded, overall percentage of each code (0, 1) for each prime type (prime or non-prime) during each session by each group.

In order to test if these differences were statistically significant, participants' production data in the alignment activities were analyzed using a logit mixed model. The mean production scores for participants in FTF and SMMC groups are presented in Table 8. As 1 point was assigned for the suppliance of a stranded preposition in the alignment activities, each mean score represents the average score across the 1256 trials for the FTF participants and the 1152 trials across the SMMC participants.

Table 8 Descriptive Statistics of the Target Structure Production Scores during Treatment Sessions

FTF (n=19)					
Primes	*M*	*SD*	*Non-Primes*	*M*	*SD*
Session 1	0.204	0.403	Session 1	0.036	0.187
Session 2	0.164	0.371	Session 2	0.016	0.127
All Sessions	0.184	0.387	All Sessions	0.026	0.157
SMMC (n=18)					
Primes	*M*	*SD*	*Non-Primes*	*M*	*SD*
Session 1	0.382	0.486	Session 1	0.059	0.236

Session 2	0.493	0.500	Session 2	0.048	0.215
All Sessions	0.438	0.493	All Sessions	0.054	0.226

Participants' production of stranded prepositions RCs was modeled as a function of modality. The logit mixed model reported that the main effects of modality and prime type (prime vs. non-prime) were significant (Table 9 and 10): $F(1, 18.55) = 17.54$, $p < .001$ and $F(1, 35.57) = 67.14$, $p < .001$, respectively. The results indicate that SMMC participants were 3.781 times more likely to produce stranded preposition RCs in the alignment sessions than their FTF counterparts. In terms of prime type, prime sentences (e.g., *A mug is something you sip coffee from*.) resulted in a 16.412 times higher likelihood of producing stranded preposition RCs when compared to non-prime sentences (e.g., *A ball is something you kick in the ground*.). No other variables were found to have a significant effect on the occurrence and degree of structural alignment. The estimate, standard error, *t* value, and *p* value associated with the fixed effects in this model are presented in Table 9. In the table, the intercept represents the baseline score if all numerical predictor variables were held at zero and using the baseline level for each categorical level. For each fixed effect, the estimate reports the change based on each variable, while the *t* and *p* values report whether that change is significant.

Table 9 Solution for Fixed Effects in Structural Alignment Model

Fixed Effect	**Estimate**	**Std. Error**	***t***	***P***	***Odds Ratio***
(Intercept)	-6.855	4.944	-1.39	0.182	0.001
Modality (SMMC vs. FTF)	1.330	0.317	4.19	< .001*	3.781
Prime type (Non-prime vs. Prime)	2.798	0.341	8.19	< .001*	16.412
Sex (Female vs. Male)	0.568	0.550	1.03	0.316	1.765
Age	0.180	0.122	1.47	0.157	1.197
Length of English study	-0.000	0.006	-0.15	0.885	0.000
Cognitive factors					
Language proficiency	-0.028	0.029	-0.96	0.384	0.972
Language analysis	0.042	0.098	0.43	0.669	1.043
Aptitude_Explicit	0.003	0.005	0.71	0.484	1.003
Aptitude_Implicit	0.027	0.017	1.62	0.121	1.027

Rationality	0.183	0.390	0.47	0.645	1.201
Experientiality	-0.855	0.543	-1.57	0.131	0.425
Social factors					
Perceived proficiency (weighted score)	-0.198	0.194	-1.02	0.320	0.820
Overall proficiency	-0.386	0.413	-0.93	0.362	0.680
Comprehensibility	0.412	0.246	1.67	0.111	1.510
Task experience	0.071	0.272	0.26	0.796	1.074

Note. Baseline for Type = Non-prime, Modality = FTF, Sex = Male. All numerical predictor variables were centered before being input into the model.
* = significant effect (absolute $t > 2$, $p < .05$; Baayen, 2008)

Additionally, the type III tests of fixed effects represent overall (or omnibus) tests of significance for the predictor variables included in the model, taking the other predictors in the model into account. (Table 10).

Table 10 Type III Tests of Fixed Effects in the Structural Alignment Model

Effect	**Num DF**	**Den DF**	***F***	***p***
Modality	1	18.55	17.54	< .001*
Prime type	1	35.57	67.14	< .001*
Sex	1	18.56	1.06	0.316
Age	1	18.16	2.17	0.157
Length of English study	1	19.11	0.02	0.885
Cognitive factors				
Language proficiency	1	18.72	0.93	0.348
Language analysis	1	19.84	0.19	0.669
Aptitude_Explicit	1	18.05	0.51	0.484
Aptitude_Implicit	1	19.87	2.63	0.121
Rationality	1	18.52	0.22	0.645
Experientiality	1	20.31	2.48	0.131
Social factors				
Perceived proficiency (weighted score)	1	17.64	1.05	0.320
Overall proficiency	1	18.67	0.87	0.362
Comprehensibility	1	18.31	2.80	0.111
Task experience	1	17.75	0.07	0.796

Note. Comparisons were made between least square means.
Num DF = Numerator degrees of freedom, Den DF = Denominator degrees of freedom
* = significant at $p < .05$

4.3.2 Structural alignment and L2 grammar development

In order to examine if the alignment treatment sessions affected subsequent development of the target grammatical structure (stranded preposition RCs), two logit mixed models were constructed for the participant data collected from sentence production task and GJT. The models also tested whether the modality of the treatment sessions, social factors, and individual differences in cognitive abilities impacted the alignment effects on the learning of stranded preposition RCs. For each of the two models, participants' scores on the respective test were entered as the dependent variable.

4.3.2.1 Sentence production test

Table 11 displays the mean scores for participants in the four different conditions for all three of the sentence production tests. As can be seen, FTF and SCMC participants who participated in the alignment sessions produced more stranded preposition constructions on the immediate and delayed posttests when compared to their respective pretest scores. Both of these groups also scored higher on the immediate and delayed posttests when compared to their respective control conditions.

Table 11 Descriptive Statistics for Scores on Sentence Production Tests

	Pretest		Immediate Posttest		Delayed Posttest	
Group	*M*	*SD*	*M*	*SD*	*M*	*SD*
SMMC Alignment (n=18)	0.210	0.408	0.546	0.498	0.463	0.499
FTF Alignment (n=19)	0.184	0.388	0.346	0.476	0.281	0.449
SMMC Control (n=14)	0.208	0.406	0.244	0.430	0.262	0.440
FTF Control (n=10)	0.167	0.373	0.158	0.365	0.225	0.418

In order to test if these differences were significant, a logit mixed model was fit using the variables described above. The model parameters are reported in Table 12 along with the type III

tests of fixed effects presented in Table 13. As shown in Table 13, the type III tests of fixed effects for the model showed that the main effect of time was significant, $F(2, 38.95) = 5.67$, $p < .001$ and modality almost approached significance (p=.051). The model also reported a significant interaction between group (experimental vs. control) and time (pretest, immediate posttest, delayed posttest): $F(2, 2061) = 9.53$, $p < .001$. The nonparallel slopes shown in Figure 2 are also indicative of the interaction between group and time. The y-axis displays the log odds of sentence production test score and the x-axis represents time (pretest, immediate posttest, delayed posttest).

Table 12 Solution for Fixed Effects in Sentence Production Test Model

Fixed Effect	**Estimate**	**Std. Error**	***t***	***P***	***Odds Ratio***
(Intercept)	-3.129	4.740	-0.66	0.514	0.044
Modality (SMMC vs. FTF)	0.856	0.689	1.24	0.219	2.354
Group (Experimental vs. Control)	0.551	0.676	0.82	0.418	1.735
Time (Pre vs. Immediate)	-0.184	0.458	-0.40	0.688	0.832
Time (Pre vs. Delayed)	0.517	0.433	1.19	0.173	1.677
Sex (Female vs. Male)	0.161	0.564	0.29	0.778	1.175
Age	0.126	0.137	0.92	0.363	1.134
Length of English study	0.002	0.005	0.47	0.639	1.002
Cognitive factors					
Language proficiency	0.000	0.027	-0.02	0.987	1.000
Language analysis	0.039	0.092	0.43	0.672	1.040
Aptitude_Explicit	-0.003	0.005	-0.71	0.485	1.003
Aptitude_Implicit	0.010	0.015	0.71	0.485	1.010
Rationality	-0.233	0.421	-0.55	0.583	0.792
Experientiality	0.019	0.448	0.04	0.966	1.019
Social factors					
Perceived proficiency (weighted score)	-0.173	0.209	-0.83	0.413	0.841
Overall proficiency	-0.319	0.344	-0.93	0.361	0.727
Comprehensibility	0.133	0.271	0.49	0.627	1.142
Task experience	0.000	0.292	-0.00	0.997	1.000
Significant interaction					
Immediate: Experimental vs. Control	1.178	0.488	2.42	0.016*	3.248

Note. Baseline for Test = Pretest, Modality = FTF, Group = Control, Sex = Male. All numerical predictor variables were centered before being input into the model.

Pre = Pretest, Immediate = Immediate posttest, Delayed = Delayed posttest, Experimental = Experimental group, Control = Control group
* = significant effect (absolute $t > 2$, $p < .05$; Baayen, 2008)

Table 13 Type III Tests of Fixed Effects in Sentence Production Test Model

Effect	Num DF	Den DF	*F*	*p*
Modality	1	36.46	4.09	0.051
Group	1	35.58	3.64	0.064
Time	2	38.95	5.67	< .001*
Sex	1	35.05	0.08	0.778
Age	1	36.37	0.85	0.363
Length of English study	1	34.28	0.22	0.639
Cognitive factors				
Language proficiency	1	33.78	0.00	0.987
Language analysis	1	35.03	0.18	0.672
Aptitude_Explicit	1	32.96	0.50	0.485
Aptitude_Implicit	1	37.48	0.50	0.485
Rationality	1	36.20	0.31	0.583
Experientiality	1	34.38	0.00	0.966
Social factors				
Perceived proficiency (weighted score)	1	33.81	0.69	0.413
Overall proficiency	1	34.79	0.86	0.361
Comprehensibility	1	34.85	0.24	0.627
Task experience	1	35.41	0.00	0.997
Significant Interaction				
Group * Time	2	2061	9.53	< .001*

Note. Comparisons were made between least-square means.
Num DF = Numerator degrees of freedom, Den DF = Denominator degrees of freedom
* = significant at $p < .05$

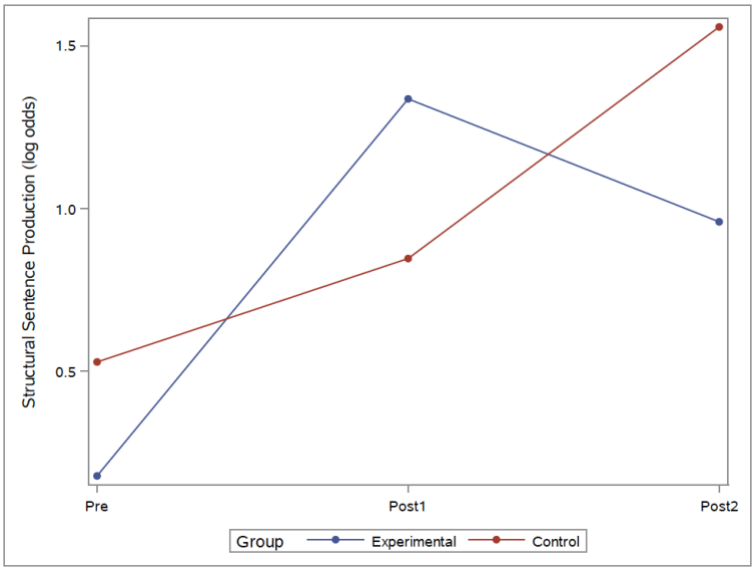

Figure 2 Interaction between Group and Time in the Sentence Production Test Model

Post hoc pairwise comparisons were conducted to further examine the significant interaction effects. Results of pairwise comparisons showed differences between the experimental and control group only on the immediate posttest ($p < .001$). The odds ratio suggests that the experimental group was 4.687 times more likely to produce stranded preposition RCs than the control group on the immediate posttest. However, there was no significant difference between the experimental and control group on the pretest and delayed posttest. Overall these results indicate that the alignment activities were helpful in developing productive knowledge of the stranded preposition RC in terms of short-term learning outcomes.

4.3.2.2 Grammaticality judgment test (GJT)

To determine whether the alignment treatment sessions helped L2 learners improve their receptive grammatical knowledge, a logit mixed model was conducted on participants' scores on GJT. The mean scores and standard deviations for GJT scores of participants in the four different conditions are shown in Table 15. As can be seen, FTF and SMMC participants who participated in the alignment sessions had higher scores on the immediate and delayed posttests when

compared to their respective pretest scores. Both of these groups also scored higher on the immediate and delayed posttests when compared to their respective control conditions.

Table 14 Descriptive Statistics for Scores on GJTs

	Pretest		Immediate Posttest		Delayed Posttest	
Group	*M*	*SD*	*M*	*SD*	*M*	*SD*
SMMC Alignment (n=18)	0.472	0.499	0.747	0.435	0.667	0.471
FTF Alignment (n=19)	0.485	0.500	0.661	0.473	0.602	0.489
SMMC Control (n=14)	0.571	0.495	0.638	0.440	0.683	0.465
FTF Control (n=10)	0.678	0.467	0.633	0.482	0.833	0.373

In order to test if these differences were significant, a logit mixed model was fit. As shown in Table 15 and 16, the model reported a significant main effect of time: $F(2, 23.24) = 2.56$, $p < .001$, and that the participants were 4.158 times more likely to correctly answer the GJT items on the delayed posttest than on the pretest. The model also reported that length of English study and explicit language aptitude (aptitude_explicit) were both significant, positive predictors of the GJT scores: $F(1, 37.27) = 4.72$, $p = .036$ and $F(1, 37.85) = 8.42$, $p < .001$, respectively. The odds ratio suggests that each increase in length of English study for both experimental and control participants resulted in a 1.01 times higher likelihood of producing correct answers on any of the GJT tests. Moreover, the participants were 1.013 times more likely to correctly answer the GJT items with each increase in explicit language aptitude test.

Table 15 Solution for Fixed Effects in GJT Model

Fixed Effect	**Estimate**	**Std. Error**	***t***	***p***	***Odds Ratio***
(Intercept)	-3.028	3.828	-0.79	0.434	0.048
Modality (SMMC vs. FTF)	-0.502	0.645	-0.78	0.440	0.605
Group (Experimental vs. Control)	-0.499	0.623	-0.80	0.426	0.607
Time (Pre vs. Immediate)	-0.283	0.562	-0.50	0.616	0.754
Time (Pre vs. Delayed)	1.425	0.615	2.32	0.022*	4.158
Sex (Female vs. Male)	-0.199	0.523	-0.38	0.706	0.820
Age	0.004	0.122	0.03	0.975	1.004

Length of English study	0.010	0.005	2.17	0.036*	1.010
Cognitive factors					
Language proficiency	0.046	0.024	1.90	0.066	1.047
Language analysis	-0.056	0.085	-0.66	0.517	0.946
Aptitude_Explicit	0.013	0.004	2.90	0.006*	1.013
Aptitude_Implicit	-0.013	0.013	-0.99	0.328	0.987
Rationality	-0.539	0.372	-1.45	0.156	0.583
Experientiality	0.676	0.412	1.64	0.109	1.966
Social factors					
Perceived proficiency (weighted score)	-0.000	0.164	-0.01	0.996	1.000
Overall proficiency	0.144	0.217	0.66	0.510	1.155
Comprehensibility	-0.267	0.226	-1.18	0.245	0.766
Task experience	0.117	0.165	0.71	0.483	1.124
Significant interaction					
Immediate: Experimental vs. Control	1.178	0.501	2.50	0.013*	3.248

Note. Baseline for Test = Pretest, Modality = FTF, Group = Control, Sex = Male. All numerical predictor variables were centered before being input into the model.
Pre = Pretest, Immediate = Immediate posttest, Delayed = Delayed posttest, Experimental = Experimental group, Control = Control group
* = significant effect (absolute $t > 2$, $p < .05$; Baayen, 2008)

Table 16 Type III Tests of Fixed Effects in GJT Model

Effect	**Num DF**	**Den DF**	***F***	***p***
Modality	1	39.52	0.15	0.701
Group	1	40.87	0.14	0.713
Time	2	23.24	2.56	< .001*
Sex	1	41.14	0.14	0.706
Age	1	38.45	0.00	0.975
Length of English study	1	37.27	4.72	0.036*
Cognitive factors				
Language proficiency	1	37.68	3.59	0.066
Language analysis	1	36.64	0.43	0.517
Aptitude_Explicit	1	37.85	8.42	0.006*
Aptitude_Implicit	1	36.95	0.98	0.328
Rationality	1	38.29	2.10	0.156
Experientiality	1	38.85	2.69	0.109
Social factors				
Perceived proficiency (weighted score)	1	46.31	0.00	0.996
Overall proficiency	1	47.15	0.44	0.510
Comprehensibility	1	38.00	1.39	0.245
Task experience	1	37.90	0.50	0.483

Significant Interactions				
Group * Time	2	1595	6.15	0.002*
Group * Modality * Time	2	1595	3.64	0.026*

Note. Comparisons were made between least-square means.
Num DF = Numerator degrees of freedom, Den DF = Denominator degrees of freedom
* = significant at $p < .05$

The model also revealed a significant three-way interaction between group, time, and modality: $F(2, 1595) = 3.64$, $p = .03$. This indicates that the interaction between group and time was different in FTF and SMMC modalities. Figure 3 shows the interaction between group and time for FTF and SMMC modality separately.

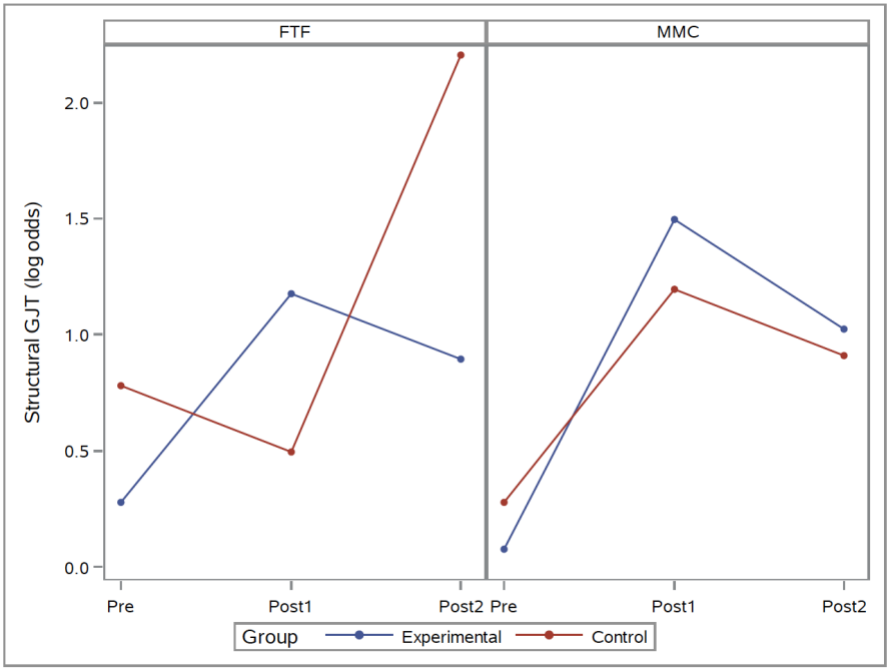

Figure 3 Interaction between Group, Time, and Modality in the GJT Model

To further examine the significant interaction effect, follow-up pairwise comparisons were conducted. First, a comparison was made between the FTF and SMMC modality when comparing the pretest scores to those of the immediate posttest when the experimental group was compared to the control group. This comparison was not significant. Specifically, there was no significant difference in GJT scores on the pretest regardless of whether the participants completed the alignment activities (i.e., experimental group) or not (i.e., control group).

Similarly, for the immediate posttest, there was no significant difference between the experimental and control group in terms of their GJT scores. This pattern of results was the same in the FTF and SMMC modality, and this is reflected in the non-significance of this comparison. These results suggest that for both FTF and SMMC modalities, when comparing the experimental and control group, there was no significant change in GJT scores regardless of whether the participants took GJT before (pretest) or after completing the two activity sessions (immediate posttest). The absence of significant interaction allowed further investigation of the significant main effect for time. Results demonstrated that when comparing the pretest and immediate posttest scores within each group and within each modality, significant differences existed only within the SMMC experimental group ($p < .001$). Specifically, the SMMC experimental group was 4.137 times more likely to correctly answer the GJT items on the immediate than on the pretest.

The second comparison investigated the differences between scores of the delayed and those of the immediate posttest, when the experimental group was compared to the control group, in the FTF modality compared to the SMMC modality. Results of this comparison revealed that there was no significant difference in the GJT scores between the experimental and control group in both the FTF and SMMC modalities. These results indicate that for both the FTF and SMMC modalities, when comparing the scores of the immediate and delayed posttest, there was no significant difference regardless of whether the participants carried out the two alignment activities (experimental group) or not (control group). As a follow-up to these findings, further investigations were made for the significant main effect of time. Results demonstrated that for the FTF modality, when comparing the delayed posttest scores to the immediate posttest scores, there was a significant score change for the control group ($p = .01$),

with FTF control participants being 82% less likely to correctly answer the GJT items on the immediate posttest than on the delayed posttest. For the SMMC modality, when the immediate posttest scores were compared to those of the delayed posttest, there was no significant change for both the experimental and control groups.

4.3.3 Lexical alignment effects

The magnitude of the lexical alignment effect was operationalized by comparing the occurrence of aligned production and misaligned production of the target words. Table 19 displays the total frequency of aligned and misaligned production of the target words during the two alignment sessions for both FTF and SMMC groups. Because the control group did not carry out the alignment activities, alignment data is not available for the control group. Since a total of 16 primes were provided to each participant in each session, the total possible production tokens for the FTF group was 608 (304 tokens in session 1 and another 304 in session 2), and the total for the SMMC group was 576 (288 tokens in session 1 and in session 2). As shown in Table 19, participants in FTF group produced a total of 104 (33.77%) target words (score of 1) in the first treatment session and a total of 144 (50.00%) target words in the second treatment session after hearing the primes. The SMMC group produced a total of 137 (44.48%) target words in the first session and a total of 154 (53.47%) target words in the second session following the prime words. These frequency counts show that lexical alignment occurred to a greater extent when two L2 peers carried out the alignment activities in SMMC mode, compared to FTF mode, in both the first and second alignment sessions.

Table 17 Total Frequency of the Occurrence of Lexical Alignment during Treatment Sessions

Session	**Session 1**		**Session 2**	
Score	0	1	0	1
FTF (n=19)	200 (64.94%)	104 (33.77%)	160 (55.56%)	144 (50.00%)

SMMC (n=18)	151 (49.03%)	137 (44.48%)	134 (46.53%)	154 (53.47%)

Note. Numbers indicate the total frequency count of codes assigned for each category based on group and prime type. FTF sessions had a total of 608 trials, whereas SMMC sessions had a total of 576 trials. Percentages indicate rounded, overall percentage of each code (0, 1) for each prime type (prime or non-prime) during each session by each group.

A logit mixed model was constructed on the participants' production of the target words in the alignment sessions in order to examine the effect of modality as well as social and individual differences factors on lexical alignment effects. The fixed effects included modality (FTF vs. SMMC), social factors (i.e., participants' perceptions of their interlocutor with respect to proficiency, comprehensibility, and task experience), and cognitive factors (i.e., individual differences in cognitive style, language aptitude, and English proficiency) as well as participants' demographic information (i.e., sex, age, length of English study). The outcome variable was the instances of lexical alignment during the alignment sessions. The random effects included random intercepts for item and participant. Table 18 displays the mean production scores for participants in FTF and SMMC groups:

Table 18 Descriptive Statistics of the Target Words Production Scores during Treatment Sessions

	FTF (n=19)		**SMMC (n=18)**	
	M	*SD*	*M*	*SD*
Session 1	0.342	0.474	0.476	0.499
Session 2	0.474	0.499	0.535	0.499
All Sessions	0.408	0.491	0.505	0.500

The model reported that there was no significant main effect or interaction effect associated with the degree of lexical alignment. The solution for fixed effects in this model is reported in Table 19 and type III tests of fixed effects in Table 20:

Table 19 Solution for Fixed Effects in Lexical Alignment Model

Fixed Effect	Estimate	Std. Error	*t*	*p*	*Odds Ratio*
(Intercept)	-2.266	5.778	-0.39	0.699	0.103
Modality (SMMC vs. FTF)	0.479	0.374	1.28	0.216	1.614
Sex (Female vs. Male)	-0.545	0.647	-0.84	0.410	0.580
Age	-0.039	0.144	-0.26	0.801	0.962
Length of English study	-0.002	0.007	-0.24	0.815	0.998
Cognitive factors					
Language proficiency	-0.045	0.033	-1.33	0.197	0.956
Language analysis	0.054	0.113	0.48	0.639	1.055
Aptitude_Explicit	-0.003	0.006	-0.56	0.582	0.997
Aptitude_Implicit	0.007	0.019	0.38	0.710	1.007
Rationality	-0.171	0.462	-0.37	0.715	0.843
Experientiality	0.793	0.625	1.27	0.220	2.210
Social factors					
Perceived proficiency (weighted score)	-0.058	0.230	-0.25	0.805	0.944
Overall proficiency	-0.040	0.482	-0.08	0.936	0.961
Comprehensibility	0.505	0.292	1.73	0.100	1.657
Task experience	-0.062	0.323	-0.19	0.849	0.940

Note. Baseline for Type = Prime, Modality = FTF, Sex = Male. All numerical predictor variables were centered before being input into the model.
* = significant effect (absolute $t > 2$, $p < .05$; Baayen, 2008)

Table 20 Type III Tests of Fixed Effects in Lexical Alignment Model

Effect	Num DF	Den DF	*F*	*p*
Modality	1	19.42	1.64	0.216
Sex	1	19.23	0.71	0.410
Age	1	19.06	0.07	0.801
Length of English study	1	19.06	0.06	0.815
Cognitive factors				
Language proficiency	1	19.30	1.78	0.197
Language analysis	1	19.35	0.23	0.639
Aptitude_Explicit	1	19.10	0.31	0.582
Aptitude_Implicit	1	19.33	0.14	0.710
Rationality	1	19.77	0.14	0.715
Experientiality	1	19.41	1.61	0.220
Social factors				
Perceived proficiency (weighted score)	1	19.11	0.06	0.805
Overall proficiency	1	19.12	0.01	0.936
Comprehensibility	1	19.70	2.99	0.100
Task experience	1	19.04	0.04	0.849

Note. Comparisons were made between least square means.

Num DF = Numerator degrees of freedom, Den DF = Denominator degrees of freedom
* = significant at $p < .05$

4.3.4 Lexical alignment and L2 vocabulary development

4.3.4.1 Word production test

Table 21 displays the mean scores for participants in the four different conditions for all three of the sentence production tests. Scores for the two experimental groups were higher on the immediate and delayed posttests when compared to those on the pretest. In addition, when comparing immediate and delayed posttest scores, the experimental conditions had higher scores than the control conditions, and the SMMC experimental participants had higher scores than the FTF experimental participants.

Table 21 Descriptive Statistics for Scores on Word Production Tests

	Pretest		Immediate Posttest		Delayed Posttest	
Group	*M*	*SD*	*M*	*SD*	*M*	*SD*
SMMC Alignment (n=18)	0.111	0.314	0.352	0.478	0.280	0.449
FTF Alignment (n=19)	0.077	0.267	0.294	0.456	0.240	0.427
SMMC Control (n=14)	0.105	0.306	0.172	0.377	0.172	0.377
FTF Control (n=10)	0.091	0.287	0.134	0.341	0.125	0.331

In order to test if these differences were significant, a logit mixed model was fit. The type III tests of fixed effects reported a significant main effect of time and group: $F(2, 87.12) = 6.63$, $p < .001$ and $F(1, 43.63) = 16.97$, $p < .001$, respectively (see Table 23), as well as a significant interaction effect between group and time: $F(2, 5543) = 16.44$, $p < .001$, as shown in Figure 4.

Table 22 Solution for Fixed Effects in Word Production Test Model

Fixed Effect	**Estimate**	**Std. Error**	***t***	***p***	***Odds Ratio***
(Intercept)	-6.666	2.340	-2.85	0.007*	0.001
Modality (SMMC vs. FTF)	0.302	0.406	0.74	0.458	1.352
Group (Experimental vs. Control)	0.071	0.401	0.18	0.861	1.074

Time (Pre vs. Immediate)	0.780	0.556	1.40	0.162	2.181
Time (Pre vs. Delayed)	0.730	0.558	1.31	0.192	2.075
Sex (Female vs. Male)	0.188	0.275	0.68	0.499	1.207
Age	0.066	0.066	1.00	0.324	1.068
Length of English study	0.003	0.002	1.14	0.262	1.043
Cognitive factors					
Language proficiency	0.008	0.013	0.62	0.538	1.008
Language analysis	0.042	0.045	0.95	0.349	1.043
Aptitude_Explicit	-0.000	0.002	-0.21	0.831	1.000
Aptitude_Implicit	-0.002	0.007	-0.34	0.733	0.998
Rationality	0.185	0.202	0.92	0.364	1.203
Experientiality	-0.153	0.218	-0.70	0.487	0.858
Social factors					
Perceived proficiency (weighted score)	-0.015	0.101	-0.15	0.883	0.985
Overall proficiency	-0.097	0.169	-0.58	0.567	0.908
Comprehensibility	0.104	0.131	0.79	0.433	1.110
Task experience	0.080	0.141	0.57	0.572	1.083
Significant interactions					
Experimental: Pre vs. Immediate	1.578	0.390	4.04	< 0.01*	4.845
Experimental: Pre vs. Delayed	1.239	0.393	3.15	< 0.01*	3.452

Note. Baseline for Test = Pretest, Modality = FTF, Group = Control, Sex = Male. All numerical predictor variables were centered before being input into the model.
Pre = Pretest, Immediate = Immediate posttest, Delayed = Delayed posttest, Experimental = Experimental group, Control = Control group
* = significant effect (absolute $t > 2$, $p < .05$; Baayen, 2008)

Table 23 Type III Tests of Fixed Effects in Word Production Test Model

Effect	**Num DF**	**Den DF**	***F***	***p***
Modality	1	45.00	2.69	0.108
Group	1	43.63	16.97	< .001*
Time	2	87.12	6.63	< .001*
Sex	1	42.22	0.46	0.499
Age	1	42.24	1.00	0.324
Length of English study	1	42.28	1.29	0.262
Cognitive factors				
Language proficiency	1	41.87	0.39	0.538
Language analysis	1	41.93	0.90	0.349
Aptitude_Explicit	1	42.37	0.05	0.831
Aptitude_Implicit	1	42.53	0.12	0.733
Rationality	1	40.68	0.84	0.364
Experientiality	1	41.05	0.49	0.487

Social factors				
Perceived proficiency (weighted score)	1	39.76	0.02	0.883
Overall proficiency	1	42.91	0.33	0.567
Comprehensibility	1	40.69	0.63	0.431
Task experience	1	41.35	0.32	0.572
Significant Interaction				
Group * Time	2	5543	16.44	< .001*

Note. Comparisons were made between least-square means.
Num DF = Numerator degrees of freedom, Den DF = Denominator degrees of freedom
* = significant at $p < .05$

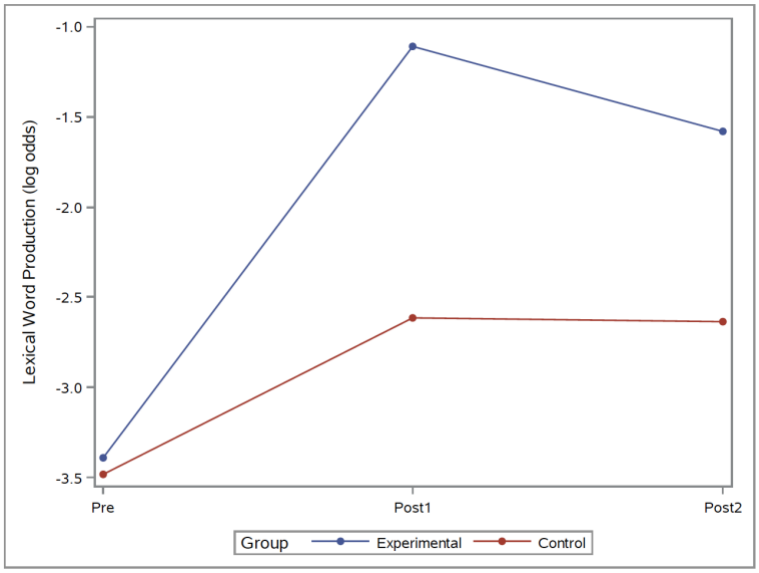

Figure 4 Interaction between Group and Time in the Word Production Test Model

To further examine the interaction between group and time, follow-up pairwise comparisons were carried out. Results of pairwise comparisons revealed that significant differences existed between the experimental and control group on both the immediate and delayed posttests ($p <$ .001). The odds ratio suggests that when compared to the control participants, the experimental participants were 4.513 times more likely to produce the target words on the immediate posttest and 2.877 times more likely to produce the target words on the delayed posttest. However, there was no significant difference between the experimental and control group on the pretest. Overall,

these findings demonstrate that the alignment activities were helpful in developing productive knowledge of the target words in terms of both short-term and long-term learning outcomes.

4.3.4.2 Word translation test

Participants' receptive vocabulary knowledge was assessed using a word translation test. Descriptive statistics show that the two experimental groups earned higher scores than the control groups on both the immediate and delayed posttests and that their performances were better on both posttests than on the pretest. In addition, the SMMC experimental participants had higher scores than their FTF counterparts on all three tests (Table 24).

Table 24 Descriptive Statistics for Scores on Word Translation Tests

	Pretest		Immediate Posttest		Delayed Posttest	
Group	*M*	*SD*	*M*	*SD*	*M*	*SD*
SMMC Alignment (n=18)	0.306	0.461	0.510	0.500	0.497	0.500
FTF Alignment (n=19)	0.281	0.450	0.419	0.493	0.408	0.491
SMMC Control (n=14)	0.290	0.454	0.297	0.457	0.355	0.477
FTF Control (n=10)	0.306	0.461	0.313	0.464	0.303	0.460

A logit mixed model was constructed to test if the observed mean differences were significant. The type III fixed effects for the model (Table 26) and the solution for fixed effects (Table 25) showed that participants' language proficiency was positively correlated with test scores: $F(1, 39.15) = 7.35$, $p < .001$, indicating that high proficient learners were more likely to achieve high scores on the word translation test. The odds ratio suggests that each increase in proficiency test scores for both experimental and control participants resulted in a 1.045 times higher likelihood of producing correct answers on any of the word translation tests. In addition, the type III fixed effects for the model revealed a significant main effect of time ($F(2, 5543) = 32.88$, $p < .001$) and group ($F(1, 38.94) = 11.51$, $p < .001$) on participants' test scores (Table 26).

Table 25 Solution for Fixed Effects in Word Translation Test Model

Fixed Effect	Estimate	Std. Error	*t*	*p*	*Odds Ratio*
(Intercept)	-2.208	2.970	-0.74	0.008*	0.110
Modality (SMMC vs. FTF)	0.079	0.429	0.18	0.854	1.406
Group (Experimental vs. Control)	0.119	0.421	0.28	0.778	2.542
Time (Pre vs. Immediate)	0.075	0.275	0.27	0.784	2.075
Time (Pre vs. Delayed)	-0.077	0.277	-0.28	0.782	2.169
Sex (Female vs. Male)	-0.098	0.366	-0.27	0.790	0.906
Age	0.018	0.084	0.22	0.830	1.018
Length of English study	0.001	0.003	0.42	0.675	1.001
Cognitive factors					
Language proficiency	0.044	0.016	2.71	0.010*	1.045
Language analysis	-0.013	0.057	-0.23	0.816	0.987
Aptitude_Explicit	0.003	0.003	0.95	0.347	1.003
Aptitude_Implicit	0.005	0.009	0.53	0.601	1.005
Rationality	-0.081	0.259	-0.31	0.755	0.922
Experientiality	0.171	0.281	0.61	0.548	1.186
Social factors					
Perceived proficiency (weighted score)	0.018	0.130	0.14	0.892	1.018
Overall proficiency	-0.245	0.216	-1.14	0.260	0.783
Comprehensibility	0.006	0.168	0.03	0.973	1.006
Task experience	-0.287	0.180	-1.59	0.120	0.751
Significant interactions					
Experimental: Pre vs. Immediate	1.120	0.324	3.46	< 0.01*	3.065
Experimental: Pre vs. Delayed	1.181	0.326	3.62	< 0.01*	3.258

Note. Baseline for Test = Pretest, Modality = FTF, Group = Control, Sex = Male. All numerical predictor variables were centered before being input into the model.
Pre = Pretest, Immediate = Immediate posttest, Delayed = Delayed posttest, Experimental = Experimental group, Control = Control group
* = significant effect (absolute $t > 2$, $p < .05$; Baayen, 2008)

Table 26 Type III Tests of Fixed Effects in Word Translation Test Model

Effect	Num DF	Den DF	*F*	*p*
Modality	1	39.57	2.01	0.164
Group	1	38.94	11.51	< .001*
Time	2	5543	32.88	< .001*
Sex	1	38.60	0.07	0.790
Age	1	39.00	0.05	0.830
Length of English study	1	39.21	0.18	0.675
Cognitive factors				

Language proficiency	1	39.15	7.35	< .001*
Language analysis	1	38.69	0.06	0.816
Aptitude_Explicit	1	39.04	0.91	0.347
Aptitude_Implicit	1	38.93	0.28	0.601
Rationality	1	38.60	0.10	0.755
Experientiality	1	38.92	0.37	0.548
Social factors				
Perceived proficiency (weighted score)	1	37.98	0.02	0.892
Overall proficiency	1	39.22	1.30	0.260
Comprehensibility	1	38.50	0.00	0.973
Task experience	1	38.81	2.53	0.120
Significant Interaction				
Group * Time	2	5543	21.36	< .001*

Note. Comparisons were made between least-square means.
Num DF = Numerator degrees of freedom, Den DF = Denominator degrees of freedom
* = significant at $p < .05$

Interaction between group and time was also significance ($F(2, 5543) = 21.36$, $p < .001$) (see Figure 5).

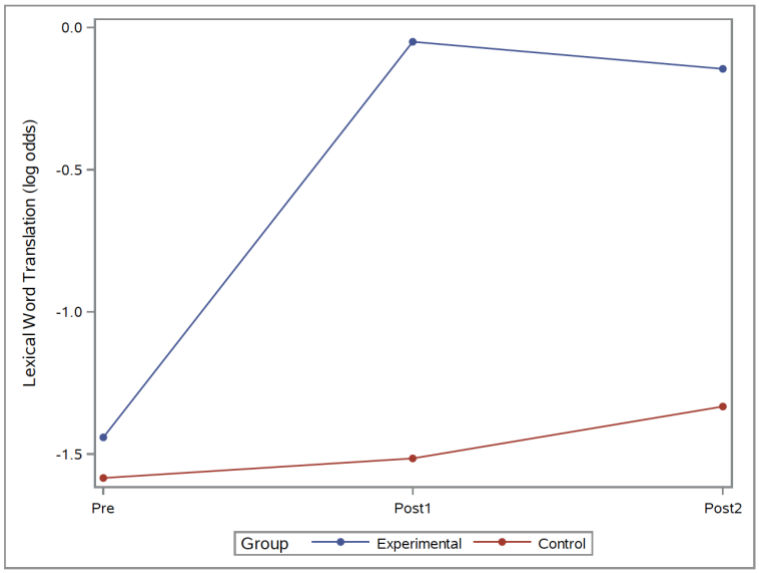

Figure 5 Interaction between Group and Time in the Word Translation Test Model

Follow-up pairwise comparisons showed differences to exist between the experimental and control group on both the immediate ($p < .001$) and delayed posttests ($p < .001$). The odds ratio suggests that the experimental group had a 4.331 times greater likelihood to correctly translate

the target words on the immediate posttest than the control group. On the delayed posttest, the experimental participants were 3.248 times more likely to produce correct translations for the target words than the control group. These results indicate that the participants benefitted from the alignment activities for the development of their receptive knowledge of the target words in terms of both short-term and long-term learning outcomes.

4.4 Summary of the results

In sum, the results suggest that linguistic alignment occurred regardless of modality; however, learners in the SMMC context demonstrated a greater degree of structural alignment when compared to the FTF participants while there was no significant difference between the SMMC and FTF modes with respect to the degree of lexical alignment. None of the social and cognitive factors had a significant effect on the extent to which participants aligned with their peer interlocutor in terms of their production of target words and the stranded preposition RC structure during the alignment activity sessions.

With regard to learning effects, results found a significant main effect for time (pretest, immediate posttest, delayed posttest) and a significant interaction effect between group (experimental vs. control) and time in the following three learning models: sentence production test, word production test, and word translation test. Specifically, the experimental participants outperformed the control participants on the immediate posttest of the four tests. In addition, for the word production and word translation tests, the experimental participants had significantly higher scores on the delayed posttest as well as on the immediate posttest when compared to the control participants. On the other hand, performances of the experimental and control participants did not significantly differ in the GJT on either of the immediate or delayed posttest. Further investigations of the significant main effect for time indicated that there was significant

improvement between the pretest and immediate posttest for the SMMC experimental group. Additionally, the FTF control group had significantly higher scores on the delayed posttest than on the immediate posttest.

Furthermore, none of the social factors had a significant effect on the learning of target linguistic features. In terms of the impact of cognitive factors (i.e., individual differences in cognitive abilities), explicit language aptitude was positively correlated with participants' scores on the GJT, indicating that participants with higher explicit language aptitude scores tended to achieved better scores on the GJT than those with lower explicit language aptitude scores. Furthermore, participants' language proficiency mediated the effect of lexical alignment in the development of receptive knowledge of the target words measured using the word translation test such that participants with high proficiency were more likely to get better scores on the word translation test. Table 27 presents the overall summary of the results.

Table 27 Overall Summary of the Results

		Relevant RQ		Finding
Structural alignment	Alignment effects	RQ1-1	Occurrence of alignment	Yes
		RQ1-2	Effects of social factors	No
		RQ1-3	Effects of cognitive factors	No
	Learning effects	RQ2-1	Subsequent production of the target grammatical structure	Yes
		RQ2-2	Effects of social factors	No
		RQ2-3	Effects of cognitive factors	Explicit language aptitude on the GJT
Lexical alignment	Alignment effects	RQ1-1	Occurrence of alignment	Yes
		RQ1-2	Effects of social factors	No
		RQ1-3	Effects of cognitive factors	No
	Learning effects	RQ2-1	Subsequent production of the target words	Yes
		RQ2-2	Effects of social factors	No
		RQ2-3	Effects of cognitive factors	Learners' language proficiency on the word translation test

5 DISCUSSION

The purpose of the study was to examine whether linguistic alignment occurs at the level of lexical and grammatical choice when L2 peers carry out collaborative alignment activities in two modalities of interactions (i.e., FTF and SMMC). In particular, lexical and structural primes were presented in an integrated fashion in order to enhance alignment effects. In addition, this study aimed to investigate the effects of linguistic alignment on the learning of target words and grammatical structure (stranded preposition RCs). Furthermore, the study investigated whether social factors (i.e., L2 learners' perceptions of their peer interlocutor's language proficiency, comprehensibility of the interlocutor's language production, and task experience with the interlocutor) and cognitive factors (i.e., individual differences in cognitive language aptitude, cognitive style, and language proficiency) would modulate any alignment effects. Structural alignment was operationalized as the aligned production of a stranded preposition RC that a learner produced after hearing a prime sentence during interactive alignment activities between L2 peers. Lexical alignment was operationalized as instances of accurate production of target words after a prime word is provided. Learning outcomes from the alignment activities were measured using both productive (sentence production test and word production test) and receptive (GJT and word translation test) tests.

5.1 Occurrence of linguistic alignment

5.1.1 Occurrence of structural alignment

In regards to the occurrence and degree of structural alignment, results indicate that the amount of aligned production of the target structure was significantly greater following primes when compared to non-primes (i.e., fillers), and this finding was consistent regardless of interaction modes. These results align with previous L2 alignment research demonstrating a

greater amount of aligned production of target grammatical structures as compared to misaligned production of them (Conroy & Antón-Méndez, 2015; Kim & McDonough, 2008; McDonough & Mackey, 2006). This finding lends support to the notion that structural alignment occurs because prior production or comprehension of a particular grammatical structure raises the activation of the relevant syntactic representations and/or processes, making them a better candidate for subsequent use (Branigan et al., 2000).

In line with previous L2 alignment research showing structural alignment effects in peer interaction (e.g., McDonough & Chaikitmongkol, 2010; McDonough et al., 2015), this study also demonstrated that structural alignment occurred while L2 peers carried out collaborative alignment activities in pairs. The current finding indicated a positive role of peer interaction in eliciting alignment effects as was also pointed out by McDonough and Chaikitmongkol (2010) and McDonough et al. (2015). McDonough et al. confirmed the effectiveness of using collaborative alignment activities in ESL classrooms by showing learners' use of particular grammatical structures targeted in their study when multiple alternative structures are available for expressing the same information. Similarly, McDonough and Chaikitmongkol (2010) demonstrated that collaborative syntactic priming activities could be useful in EFL classroom as such activities help promote learner production of target grammatical structures.

The current study expands the L2 alignment literature by including pre-experiment sessions, which were designed not only to help L2 learners develop perceptions of their peer interlocutors but also to familiarize them with communicative activities. Furthermore, in this study, L2 learners were provided with structural and lexical primes in an integrated fashion (i.e., integrated primes) so that the alignment effects could be enhanced. Previous research has claimed that when two L1 speakers interact, alignment at a non-meaning-based level (e.g.,

structural) enhances alignment of representations at another level that is meaning-based (e.g., lexical) (Pickering & Garrod, 2004). In that regard, it may be plausible that structural alignment that occurred during L2 peer interaction promoted lexical alignment effect. However, this speculation can only be tested by including a comparison group, to which only structural primes were provided.

With regard to the modality effect, the current findings were in line with the results of Kim et al. (under review), which investigated the structural alignment phenomenon in an L2 learning context by comparing the FTF and SCMC mode, such that structural alignment occurred in text-based online chat as in FTF spoken interactions. In addition, the present study found that modality had a significant effect on the magnitude of structural alignment that occurred during the communicative alignment activities in SMMC mode. More specifically, SMMC interactions elicited significantly more aligned production of the target structure than FTF interactions. For example, a prime sentence containing a target word and stranded preposition RC "*A kettle is something you heat water in*" elicited the following aligned production from an SMMC participant and misaligned production from an FTF participant:

Example 4: Structurally aligned production of an SMMC participant (pseudonym: Jihye)

A kettle is something you heat water in.

Example 5: Structurally misaligned production of an FTF participant (pseudonym: Yena)

A kettle is something that you can boil the water.

Across the two treatment sessions, the SMMC participant Jihye produced 30 instances of structurally aligned production (93.75%) out of a possible total of 32 instances whereas the FTF participant Yena demonstrated structural alignment on 10 task items (31.25%).

While this particular observation accords with findings of previous L2 alignment research (e.g., Kim et al., under review), it contrasts with those from L1 alignment research (e.g., Cleland & Pickering, 2006; Hartsuiker et al., 2008). Previous L1 research investigating alignment effects in oral and written (i.e., synchronous text-chat) modes have suggested that despite the unavailability of visual and prosodic feedback in text-only environments (e.g., SCMC, SMMC), structural alignment effects were not markedly different between the written and spoken modes, indicating that speaking and writing involve the same syntactic processing in task-based interactions between L1 adult speakers (Hartsuiker et al., 2008). However, the differing degree of structural alignment in the two modalities of interaction found in this study seems to indicate that text-based and spoken interactions may not necessarily have a commonality and that L2 speakers may process written and spoken language input, particularly syntactic structures of the input, in a similar fashion.

The greater magnitude of structural alignment in the SMMC context may be attributable to the availability of explicit memory (i.e., awareness) and the occurrence of noticing during task-based interactions in the two interactional contexts. Previous research has suggested that text-based interaction enhances the opportunity to draw L2 learners' attention (noticing) to linguistic forms, as they have more time to process the written input compared to the oral input during FTF interaction (Ziegler, 2016). Specifically, due to a slower pace of conversation and slower turn-taking in text-based communication, compared to FTF conversation, L2 learners are allowed to have extended time for monitoring and processing the language input and their own production. This may obviate the social need to have to respond immediately and give learners extra online planning time to construct their output (Kitade, 2000). Additionally, previous studies have indicated that text-based online chat may have afforded L2 learners opportunities for

noticing linguistic features because they could easily access previous chat messages that remain on the screen by scrolling up and down in order to reference and review the message exchanges (Yuksel & Inan, 2014). In order to preserve the authenticity of the modality, the SMMC participants were not instructed as to whether or not they would be allowed to refer back to the prime sentences. Then, it is possible that the SMMC participants made use of scroll up and down function of their smartphones during the alignment activities. This may have helped them notice and analyze the target grammatical structure, construct their own sentences by either aligning or misaligning with their interlocutors. If the use of scroll up and down function was restricted during the activities, different results could have obtained from the SMMC group. However, without relevant data examining such explicit strategies that learners may have employed during the chat interaction, this study could not provide evidence for the role of noticing in the alignment effects in the SMMC context. Future study is warranted to use screen capture programs or eye-tracking techniques to address this issue.

Another possible explanation for SMMC being a more facilitative context may be related to Korean EFL learners' tendency to utilize explicit grammatical knowledge when carrying out a language activity in an educational context. Although the participants were engaged in a communicative activity, which had its primary focus on meaning with the target structure being hidden (i.e., learners were not told explicitly what the grammatical structure the task targeted), they might have employed typical strategies pertaining to analyzing the grammatical structure of input that they encounter and using metalinguistic knowledge to construct sentences during the alignment activities. This explicit focus on form may have been more possible in the SMMC condition due to less time pressure and the availability of text-based interaction, as learners were able to spend more time to express their intended meaning as accurately and as coherently as

they could (Swain & Lapkin, 1995). In turn, the SMMC condition appears to have helped strengthen the learners' mental representations associated with the target structure that they encountered in the prime sentence, thereby increasing the likelihood that the structure is used again (i.e., a greater magnitude of structural alignment) in their own turns during the alignment sessions. This suggests that alignment in text-chat contexts might tap into different cognitive processes and strategies than those used in the FTF mode. This question should be further examined in future studies using different data sources such as stimulated recall, interviews, or knowledge source judgment questionnaire (Marsden, Williams, & Liu, 2013), which can provide further insights on how learners process primes in different modes of communication.

5.1.2 Occurrence of lexical alignment

As for the occurrence and degree of lexical alignment, results demonstrated lexical alignment in both FTF and SMMC contexts. Participants showed a tendency to use their interlocutor's choice of object names (i.e., target words) even though the target words were generally disfavored terms for the particular objects that they rarely produced in the pretest (on approximately 11.11% of trials for the SMMC group and 7.73% for the FTF group). Hence it appears that the participants' tendency to align lexical choice with their interlocutor was powerful enough to overcome a strong default preference between two available choices for a name of an object. Furthermore, the extent to which the participants aligned was not influenced by the modality of interaction, indicating that L2 learners lexically aligned with their peer partner, irrespective of the context where interactions occurred. For example, when a prime sentence containing a target word and stranded preposition RC "*A recliner is something you lie on*" was presented, the same SMMC participant of example 4 and FTF participant of example 5 produced following sentences:

Example 6: Lexically aligned production of an SMMC participant Jihye

A recliner is something you can relax on.

Example 7: Lexically aligned production of an FTF participant Yena

A recliner is something where you relax.

While the SMMC participant Jihye produced 22 instances (68.75%) of lexically aligned production out of a possible total of 32 instances across the two task sessions, the FTF participant Yena lexically aligned with her confederate partner on 19 items (59.38%).

These findings are consistent with those of L1 research which showed that L1 speakers aligned with their interlocutor to the same extent in the spoken and written modalities (Branigan et al., 2011). The non-significant role of modality on lexical alignment effects found in this study supports the notion that lexical alignment processes in typed or spoken dialog involving L2 learners are broadly similar to alignment processes in dialog between co-present interlocutors who use speech to communicate (Branigan et al., 2010, 2011). L2 alignment research has also demonstrated lexical alignment effects in FTF oral interactions (Ni Eochaidh, 2010) and in text-based interactions (Michel & Smith, 2017). The current findings may indicate that lexical alignment is not affected by particular characteristics of typed text such as longer time allowed for processing, availability of strategic processes associated with inspection or self-monitoring, and typed text remaining on the screen to be referenced and reviewed.

Furthermore, findings of the current study may support IAM's claim that lexical representations receive activation from priming at multiple sub-lexical levels such as conceptual, orthographical, and phonological levels (Ni Eochaidh, 2010). According to IAM, interlocutors align on an activation pattern across different levels of sub-lexical representations (e.g., phonological, orthographical, conceptual), and percolation between these levels increases the

likelihood of lexical alignment. Specifically, lexical alignment is primarily driven by shared conceptualizations between interlocutors (conceptual alignment) and enhanced by the repetition of word-form. For example, if a speaker names an object as a "couch", the conceptual representation COUCH, and the phonological word-form [kaʊtʃ] spread activation to the lexical level and increases the likelihood that the interlocutor will use "couch" to refer to that same object. In this regard, lexical alignment observed in the current study may reflect the priming of sub-lexical representations such as conceptual, phonological, and orthographical representations. For the FTF mode, conceptual and phonological representations of the target words spread activation to their associated lexical representations, leading to lexical alignment. On the other hand, when L2 learners carried out the alignment activities in the SMMC mode, lexical alignment may have been driven by the flow of activation from conceptual and orthographical representations. In sum, present findings may indicate that lexical alignment is not due to modality-specific mechanisms and that similar underlying mechanisms operate in the FTF and SMMC contexts.

5.2 Linguistic alignment effects on learning outcomes

The current study examined whether the alignment activities were beneficial for the development of L2 grammar and vocabulary. Target linguistic features included the stranded preposition RC and 32 words unfamiliar to the participants. Improvement in productive and receptive language knowledge was measured using multiple measurement tests. Overall, the findings suggested the pedagogical benefits of the alignment activities for the learning of the stranded preposition RC and target words in both FTF and SMMC modalities.

5.2.1 Structural alignment effects on the learning of L2 grammar

To determine whether L2 learners benefitted from the alignment activities in terms of developing productive and receptive grammatical knowledge of the stranded preposition RC, the sentence production test and grammaticality judgement test were used, respectively. First, findings of the sentence production test showed that the experimental participants outperformed the control participants on the immediate posttest in terms of the amount of target structure production. In addition, while modality was found to be a significant predictor for the magnitude of structural alignment, modality did not have a significant impact on the sentence production test scores across the pretest, immediate posttest, and delayed posttest. This particular finding is consistent with that of Kim et al. (under review), which reported a null effect of modality on immediate and delayed learning effects measured by the sentence production test. According to Kim et al., a lack of significant difference in the subsequent learning between the FTF and SCMC group may indicate that the amount of aligned production might not be a significant factor in immediate and delayed learning effects. They suggested that although alignment was elicited to a greater extent in the SCMC group due to the availability of explicit memory in text-based interaction, the explicit strategy that the SCMC participants might have employed during the interactive alignment activity might not have contributed to the delayed learning effects. As was also indicated by Kim et al., further empirical evidence which explains learners' use of explicit memory during text-based alignment is required to test this speculation.

With regard to the role of alignment activities in the development of receptive grammatical knowledge of the stranded preposition RC, findings of the GJT demonstrated that there was no significant difference in the GJT scores between the experimental and control group on any of the three tests (pretest, immediate posttest, delayed posttest). Further investigations of

the significant main effect for time revealed that within the SMMC modality, while there was a significant increase between the pretest and immediate posttest for the experimental group, there was no significant change in the GJT scores for the control group. Interestingly, the FTF control group had significantly higher scores on the delayed posttest than on the immediate posttest whereas there was no significant change between the two posttests for the FTF experimental group.

No significant difference between the experimental and control group as well as the significant score change of the FTF control group was unexpected because the control participants did not participate in the treatment sessions. These findings may be attributable to a practice effect, that is, a mean gain score influenced by familiarity and/or practice in taking the posttest rather than as a result of the experimental treatment (Odlin, 1994). Although the control participants did not carry out the alignment activities, they would have been familiar with and possibly learned the stranded preposition RC structure as they were repeatedly exposed to the same structure while taking three different versions of the GJT at three different time points (i.e., the pretest, immediate posttest, and delayed posttest). Each version of the GJT had 9 target items, through which the participants could possibly develop the receptive knowledge of the target construction. As shown in Table 14, the control group had the highest score on the delayed posttest when compared to that on the pretest and immediate posttest. Another possible explanation may be that the small sample size (37 participants in the experimental group and 24 in the control group) reduced the chances of detecting an effect that actually existed, which in turn resulted in the absence of a statistically significant difference between the experimental and control group.

In addition, the type of knowledge representations on which L2 learners draw when completing an untimed GJT might have also affected the results. Unlike the sentence production test, an untimed GJT has been identified a valid measure of explicit grammatical knowledge because L2 learners are likely to resort to explicit knowledge of the L2 when judging grammaticality of L2 sentences (Bowles, 2011; Han & Ellis, 1998). Given the relatively high mean scores that the control participants had on the pretest when compared to the experimental participants (see Table 14), they appear to have had some prior knowledge of the stranded preposition RC. Then, it is plausible that the control participants employed explicit knowledge of the target structure to analyze the sentences contained in the GJTs, and that as they got more familiar with the target structure through repeated exposure to it on the GJTs across the three time points, they became better able to judge grammaticality of the target sentences over time. This issue should be further investigated in future research using different data sources such as stimulated recall, interviews, or knowledge source judgment questionnaire (Marsden et al., 2012), which can provide further insights on what strategies that the control participants utilized when taking the GJTs.

Taken together, findings of the sentence production test and GJT demonstrated that the alignment activities were helpful in developing productive knowledge of the stranded preposition RC, irrespective of the modality in which the alignment activities were performed. However, it was only the SMMC experimental participants who benefitted from the alignment activities for the development of receptive knowledge of the stranded preposition RC. Additionally, it is interesting to note that while modality had a significant effect on the degree of structural alignment, the learning effects were not significantly affected by the modality. In the current

dataset, structural alignment occurred to a lesser degree in the FTF (i.e., spoken) mode when compared to the SMMC (i.e., written) mode.

Previous research has shown that alignment effects were not necessarily greater when speakers reported that they noticed the target form in the interlocutor's utterances, suggesting that noticing of the target form may not always lead to linguistic alignment during alignment activities (Branigan et al., 2011). This, in turn, may indicate that the number of alignment instances does not always correspond to how much learners were explicitly aware of the form (Michel, 2018). Given this, it may be plausible that the significantly smaller number of alignment instances in the FTF mode was not necessarily due to lack of explicit attention to the target form but a matter of choice on the part of the learners. Mina, one of the FTF participants pointed out this issue in the interview:

> I noticed that my partner repeatedly used the same structure during the activities. I was not familiar with the structure, so I learned the structure from my partner during the activities. For example, my partner said "A kettle is something you boil water in." I would have said "A kettle is something you use to boil water." I wanted to practice the structure during the activities but because I felt like I had to respond fast to my partner, I often chose to use a different structure to describe the target object. It took me much more time to construct a sentence with the structure.

Based on this interview excerpt, it seems that for the FTF participants, explicit awareness of the form did not always lead to the production of the form during the alignment activities but helped them improve their productive and receptive grammatical knowledge. A possible explanation for the smaller amount of alignment in the FTF mode despite explicit awareness of the target structure may be due to the pressure for a fast turn-taking in the oral interaction as Mina

indicated in the interview. During the alignment activities, the FTF participants might have chosen not to use the less familiar structure (the stranded preposition RC) that could take longer time to construct but to use structures that they were able to construct faster. This finding may be supported by previous research demonstrating that L2 learners resort to an avoidance strategy when they perceive certain words or grammatical structures are difficult to produce. Previous studies showed that frequency of use of particular linguistic features and affective states could be predictors of such avoidance behaviors (e.g., Kleinmann, 1978; Liao & Fukuya, 2004). For example, L2 learners tend to avoid less familiar linguistic features because they are not confident or anxious about their ability to accurately produce such linguistic features.

On the other hand, the written modality allowed the SMMC participants to review their partners utterances containing the target structure, take more time to process the primes, and produce the target structure during the alignment activities, which in turn led to a greater amount of alignment. In this regard, the current findings suggest that irrespective of the extent to which the learners aligned in their use of the target structure, the alignment activities were beneficial for learning the stranded preposition RC, possibly if the learners were aware of the target form during the interaction. Using stimulated recalls or eye-tracking techniques, further research might provide more robust evidence for the role of explicit awareness of the target structure during the alignment activities in the learning effects.

The current set of findings also speaks to the relative importance of the input component of structural alignment. The FTF participants produced an average of 18.42 percent of stranded preposition RCs after hearing a prime sentence across the two treatment sessions whereas the SMMC participants produced an average of 43.75 percent of stranded preposition RCs (see Table 7). Despite the significant difference in the amount of alignment production between the

FTF and SMMC group, the alignment activities were useful for improving the learners' productive and receptive grammatical knowledge for both groups. Contrary to previous findings highlighting the potential value of structural alignment as output activities (e.g., McDonough & Chaikitmongkol, 2010; McDonough & Trofimovich, 2016), the current findings seem to demonstrate that the input component of structural alignment is associated with subsequent production. Put differently, the input component of structural alignment might not only drive detection of the target grammatical structure within the alignment activities but also extend and consolidate existing structural knowledge through processing and comprehending the input received during the alignment activities.

The current study adds to the L2 alignment literature that focused on alteration between developmentally more advanced (target-like) and less advanced forms by studying stranded preposition RCs (i.e., also known as oblique RCs). Previous research has proposed that the stranded preposition RC is developmentally more advanced and pose greater challenges in processing and acquisition of its target-like form when compared to other types of RCs such as subject RCs and direct object RC (Bardovi-Harlig, 1987; Conroy & Antón-Méndez, 2015; Keenan & Comrie, 1977). The processing difficulty of the stranded preposition RC lies in the complex and abstract nature of the structure, which requires L2 speakers to simultaneously account for the processing of RC as well as verb argument construction (Kim et al., under review). Previous research has suggested that the processing difficulty of the stranded preposition RC is primarily attributable to the linear distance between the head and the gap in RCs (the distance factor; O'Grady, 2011). Specifically, Kim and O'Grady (2016) claimed that as the difficulty of processing RC increases with the length of the filler-gap dependency, the stranded preposition RC draws on more integration resources than the direct object RC (the non-

target-like interlanguage form in this study) because they have more intervening lexical items to process between the filler and the gap. This may in turn require more time to connect the filler with the empty gap, thus creating a burden on syntactic processing before the dependency can be resolved.

Furthermore, the use of the stranded preposition RC requires not only the processing of RC, but also the correct co-indexation of verb, noun, and preposition (e.g., Students *learn words from* dictionaries.), which makes the structure difficult to process and acquire. With this in mind, and consistent to findings of previous research (Conroy & Antón-Méndez, 2015; Kim et al., under review), the current findings may demonstrate that the alignment activities, whether carried out in the spoken (FTF) or written (SMMC) modality, were helpful in easing the difficulties in processing a developmentally advanced structure such as the stranded preposition RC and eventually acquiring it as evidenced by the improved performances on the immediate and delayed posttests when compared to those on the pretest.

5.2.2 Lexical alignment effects on the learning of L2 vocabulary

The current study expands the L2 alignment literature by investigating whether alignment occurred at the lexical level in task-based interaction between L2 peers and if so, whether the alignment effects led to the learning of L2 vocabulary. This study made the first attempt to empirically examine the role of lexical alignment in L2 vocabulary development. Findings of the current study provide evidence for the learning value of interaction-based alignment in word choice. As to the benefits of the alignment activities for the development of productive vocabulary knowledge, results of the word production test showed that for the experimental groups, scores improved significantly on the immediate and delayed posttests than on the pretest. Although there was a significant drop in the scores between the immediate and delayed posttest,

the participants' scores were still significantly better on the delayed posttest than on the pretest. In addition, comparisons of the experimental and control groups' test scores demonstrated the beneficial role of the alignment activities, showing that the experimental participants outperformed their counterparts in the control group on both the immediate and delayed posttests. The participant's performances, however, did not significantly differ between the SMMC and FTF modality on any of the three tests.

Similar results were found when examining if the alignment activities were helpful in developing receptive vocabulary knowledge using a word translation test. Results showed that the experimental participants had significantly higher scores on both immediate and delayed posttests than on the pretest. Furthermore, there was no significant change in the scores of the experimental participants between the immediate and delayed posttest. Moreover, the experimental group outperformed the control group on both the immediate and delayed posttests. Finally, modality did not have a significant impact on the participants' scores on the three tests.

To summarize the findings, learners who carried out the collaborative alignment activities either in the FTF or SMMC context produced a significantly greater number of target words than did learners in the control group on both immediate and delayed posttests. Moreover, for the word translation test, both the FTF and SMMC experimental participants achieved higher scores on the immediate and delayed posttests than on the pretest. These findings demonstrate the positive impact of lexical alignment on L2 vocabulary development. Researchers have suggested that vocabulary learning occurs when learners try to communicate messages with others by producing target words (e.g. Ellis, 2003: Van den Branden, 2006). In addition, previous L2 vocabulary research has demonstrated that language activities designed to force learners to engage with target words may help learners develop vocabulary knowledge and greater

engagement leads to greater learning (e.g., Lee & Muncie, 2006; Schmitt, 2008). Given that the participants of this study not only had receptive exposure to the target words but also opportunities to produce those words during the alignment activities, they might have engaged with the target words to a great extent. And the engagement with the target words through receptive exposure and productive practice might have led to the learning of the target words as demonstrated by the improved scores on the word production and word translation tests. Although it may be premature to suggest that the findings of this lab-based study could be extended to L2 classrooms or naturalistic settings of even more authentic L2 use, it is highly plausible that collaborative, communicative activities eliciting lexical alignment (e.g., collaborative alignment activities) may hold considerable promise as an important component of vocabulary instruction as was the case with the learning of L2 grammar through structural alignment activities.

Previous research has suggested that L2 speakers, particularly those with low proficiency, may often fail to align with their high proficient interlocutors (e.g., L1 speakers) on the use of an infrequent, less familiar word because the representation of the word is less available due to their infrequent use of the word (Costa et al., 2008). However, when L2 learners have a clear goal to achieve during communicative interaction such as learning or successful completion of a task, they take non-automatic routes to alignment (i.e., strategic alignment) by deliberately choosing to use the same word with their interlocutors. Strategic alignment refers to alignment effects that come about due to the consciously and purposefully controlled nature of production and perception processes, although not necessarily intentional and deliberatively planned (Kopp & Bergmann, 2013). Research has proposed that alignment involves both automatic and strategic components, which are not mutually exclusive, in particular contexts, and that the balance

between the two distinct components may differ between interactive contexts (Branigan et al., 2010; Michel & Smith, 2017). Such research has suggested that although alignment occurs largely due to an automatic psycholinguistic priming mechanism, which operates with little or no conscious awareness (e.g., Pickering & Garrod, 2004; McDonough et al., 2016), it can be mediated by conscious strategic behavior of speakers (Michel & Smith, 2017). Strategic components may play a greater role in contexts where speakers aspire to achieve the goal of successfully completing a communicative task or where there are reasons to believe that it may not be successful (Costa et al., 2008; Ni Eochaidh, 2010). It may be plausible that the occurrence of lexical alignment in this study is related to strategic component of alignment as the participants had a goal of completing the alignment activities successfully with their partners. However, the current study did not focus particularly on the strategic component and therefore, future research is called for to examine this issue.

Furthermore, the current findings support the notion that disfavored, infrequently used words are susceptible to priming effects (Ni Edchaidh, 2010). Researchers have proposed that highly disfavored, less frequently used words may benefit more from repetition or priming than high-frequency words due to their lower resting level of activation (Griffin & Bock, 1998). According to usage-based accounts of language use, frequency of a word (or construction) may impact its representation in the language system (Croft & Cruse, 2004; Theakston, 2004). From this account, it is suggested that lexical preferences in L2 are less well established, or less entrenched due to the less frequent use of L2. In other words, due to the less frequent practice of referring to objects in their L2, L2 learners are not likely to display the same linguistic tendencies demonstrated by L1 speakers (e.g., preference of referring to a picture of an axe as an "axe" rather than a "hatchet"). In L2 learners' mental lexicon, the preference between "hatchet"

and “axe” is less entrenched, and so is less resistant to being replaced by the disfavored term, “hatchet”. Therefore, the activation of the disfavored, low-frequency word is raised by prior production or comprehension of the word and accordingly, L2 learners’ preference for the high-frequency word can be overcome. This leads to greater susceptibility to alignment effects on the disfavored word.

5.3 Effects of social factors on linguistic alignment

A unique contribution of the current study to the existing L2 alignment research is the investigation of the effects of social factors on the magnitude of linguistic alignment and the development of the target linguistic features. Of a range of social factors that have been found to affect alignment effects in L1 dialogue, this study included L2 learners’ perceptions of the interlocutor in terms of the interlocutor’s English proficiency, comprehensibility of the interlocutor’s language production, and task experience with the interlocutor. None of these social factors had a statistically significant impact on the extent to which the participants aligned with their confederate interlocutors in terms of their choice of grammatical structure and words. In addition, the social factors did not moderate the effect of linguistic alignment on the learning of the target words and grammatical structure assessed using productive and receptive tests. One possible explanation for the non-significant impact of the social factors may be that as shown in Table 6, the participants’ perception ratings were consistently high with a low standard deviation. The high average ratings and low standard deviations may indicate that most of the participants in this study tended to issue high rating scores to their peer partners, regardless of their actual perceptions of their interlocutors. This, in turn, may have led to statistically non-significant relationship of the participants’ perceptions to the degree of alignment and the learning outcomes from the alignment activities.

Specifically, participants showed a significant overall tendency to reuse the target linguistic features (i.e., stranded preposition RCs and disfavored words) after hearing their interlocutor's prime sentences, irrespective of their perceptions of the interlocutor in both FTF and SMMC modalities. Likewise, the amount of aligned production of the target structure had no significant relationship to the participants' perceptions of their interlocutors. These results do not conform to previous findings of L1 alignment research which demonstrated a significant role of speakers' perceptions in linguistic alignment effects (e.g., Branigan et al., 2010; Branigan et al., 2011). Moreover, the current findings did not confirm the predictions concerning the relationship between L2 speakers' perceptions of their interlocutor's language abilities and the degree of linguistic alignment. Researchers have put forward the notion that in dialogues involving L2 speakers, beliefs about the interlocutor's linguistic competence and performance would affect their choices of words and sentence structures (Beebe, 1980; Costa et al., 2008). For instance, Costa et al. (2008) predicted a positive relationship between the magnitude of linguistic alignment and perception of the interlocutor's language ability.

In the current study, the non-significant effect of L2 learners' perceptions on the degree of structural and lexical alignment in this study indicates that there was not a clear linear relationship between the participants' perceptions of their peer interlocutors and the extent to which they aligned in their choice of words and sentence structure during the alignment sessions. As shown in Table 28, for both structural and lexical alignment, the priming amount (number of instances of alignment) had a weak correlation with the participants' perceived proficiency of the interlocutor, overall proficiency of the interlocutor, comprehensibility of the interlocutor's language production, and task experience with the interlocutor. The same held true for both FTF

and SMMC participants. This finding may suggest that the participants' alignment behaviors could not be predicted based on their perceptions of their interlocutors.

Table 28 Correlations between Alignment Amount and Perception Scores

	FTF		SMMC	
Perception	Structural alignment	Lexical alignment	Structural alignment	Lexical alignment
Perceived proficiency	0.111	0.079	-0.257	-0.224
Overall proficiency	0.098	0.009	0.044	0.006
Comprehensibility	0.291	0.240	0.247	0.066
Task experience	-0.004	0.134	-0.048	-0.083

Note. As a rule of thumb, $0 < |r| < .3$ = weak correlation, $.3 < |r| < .7$ = moderate correlation, $.7 < |r|$ = strong correlation

The non-linear, weak relationship between the priming amount and the participants' perceptions was also demonstrated in the interview excerpts. One of the participants, Jung-min, remarked as below when asked if she noticed the target structure and what made her align or diverge or why not she aligned with her interlocutor:

> I noticed that my partner used the same structure over and over during the alignment tasks. I thought he sounded quite proficient in English and I actually learned that the picture could be described using such sentences (i.e., stranded preposition RCs). But I didn't repeat the same sentence structure in my turns. Rather, I tried to use as many possible alternative structures as possible wanted to show him that he could use different structures than the stranded preposition RCs to describe the pictures.

In a similar vein, Hyo-jin explained why she did not choose to use the same words with her partner despite her positive perception of the interlocutor's language ability:

> During the activities, I realized my partner was more fluent t than I had thought in class.. He used lots of words that I was not familiar with and I learned those words during

> the activities. But when describing the same objects presented in the activities, I chose not to copy my partner's words because some of them sounded a bit awkward to me. That may have been because of my study abroad experience in the US for about a year. For example, I learned that an alternative term for a "stroller" is "buggy" but stuck to "stroller" because "stroller" is more prevalently used in the US, I believe.

As can be seen from Jung-min and Hyo-jin's interview excerpts, positive perception of the interlocutor's language ability did not necessarily lead to a greater degree of linguistic alignment. This finding is consistent with previous research demonstrating that perceived proficiency of the interlocutor may not be the decisive factor in affecting the way L2 peer interacts in a collaborative activity (Watanabe, 2008; Watanabe & Swain, 2008).

Importantly, the learners' perceptions towards their interlocutors may have been affected if they found it odd that their interlocutors sounded more proficient during the alignment activities than they had thought in class. As can be seen from Jung-min and Hyo-jin's comments, it is possible that the participants noticed that their partners were being (unusually) proficient in English, being faster and more accurate in their language production. This could have confused the participants' perceptions of their interlocutors' language abilities, resulting in misalignment despite their positive perception during the activities. Moreover, it is also plausible that the participants' alignment behaviors were influenced by their awareness that they were carrying out pedagogic activities for an experimental purpose. In the interview excerpt, Jung-min pointed out that despite her positive perception of her interlocutor's language proficiency, she chose not to use the same grammatical structure with her interlocutor in order to show her abilities to construct different structures to convey the same message. The reason for this intentional misalignment may be that the participants were aware that they were being observed

by the researcher when performing the alignment activities and their performances would be assessed to be used for research. If the learners carried out natural conversations rather than communicative activities in a more natural context, their alignment behaviors might have changed. This question should be further examined in future research by comparing L2 learners' alignment behaviors in a natural conversation and in a pedagogic activity. In addition, Gile (2001) suggested that degree of linguistic alignment may depend on how much a speaker engages in the conversation with his/her particular interlocutor and that degree of engagement is determined by how collaborative the speakers are in a conversation. In addition, according to CAT, the participants' reluctance to repeat their interlocutors' choice of words and sentence structures may be an indication of their desire to maintain distance or accentuate distinctiveness from their interlocutor. Taken these together, a possible explanation for the non-significant relationship between the amount of aligned production and perceptions of the interlocutor may be related to the scripted input provided by the confederate-learners, use of pedagogic activities for an experimental purpose, level of engagement, and the participants' desire to assimilate with or dissimilate from their interlocutors.

5.4 Effects of cognitive factors on linguistic alignment

In addition to the social factors, the effects of cognitive factors were also investigated in this study. The cognitive factors included in this study are language proficiency, explicit language aptitude, implicit language aptitude, rational cognitive style, experiential cognitive style, and language analysis ability. The current study found that none of the cognitive factors had a significant impact on the magnitude of alignment at the lexical and structural levels. However, two of the cognitive factors were found to be significant predictors of the learners' performances on receptive language tests. Specifically, GJT scores were affected by explicit

language aptitude, with participants with higher explicit language aptitude having higher scores on GJT. Similarly, learners with high proficiency were more likely to achieve high scores on the word translation test.

First, explicit language aptitude, which was measured using LLAMA B, D, and F, has been found to tap into cognitive abilities in the domain of explicit and attention-driven cognitive processes including explicit inductive learning ability, explicit associative learning ability, and rote memory ability. These cognitive abilities have been suggested to be particularly relevant to learn a language intentionally through reasoning, deliberate hypothesis testing, and memorization (Granena, 2016). Previous SLA research has shown that abilities in this domain of explicit cognition, such as grammatical sensitivity or language analytical ability, have a significant relationship with outcomes (Skehan, 1989). Additionally, explicit language aptitude had an effect on L2 outcome measures that were untimed and that focused on language forms and language correctness such as untimed GJT used in this study (Granena, 2013). Given this, the significant effect of explicit language aptitude on the learners' GJT scores may indicate that the participants of this study drew on their explicit cognitive abilities during the alignment activities. By doing so, they could infer the grammatical rule by generalizing from the model (prime) sentences, which in turn may have led to the development of receptive grammatical knowledge. This finding conforms to those of previous L2 alignment research in that orienting attention to form during alignment activities may facilitate the development of the target form (Marsden et al., 2013). Taken together, the findings suggest that structural alignment may not be driven solely by implicit priming mechanisms but involves both implicit and explicit components that may work in tandem (McDonough et al., 2016).

Another cognitive factor, learners' overall proficiency, was correlated with scores on the word translation test, indicating that language proficiency moderated the effects of lexical alignment on the development of receptive vocabulary knowledge. This finding concurs with that of a previous study demonstrating a significant role of L2 proficiency in the learning outcomes of alignment activities (Kim et al., under review). Kim et al., showed that high proficient learners were more likely to profit from structural alignment activities for the development of L2 grammar than learners with low proficiency due to their ability to retain the information for both short-term and longer-term learning. Adding to previous evidence for the relationship between language proficiency and L2 grammar development, the current study found that in the domain of lexical alignment, language proficiency was a significant cognitive factor that modulated the alignment effects on the development of receptive knowledge of the target words. Previous SLA research has demonstrated that L2 learners with high proficiency are often able to apply more diverse and complex vocabulary strategies, whereas L2 learners with a lower level of target language skills are usually constrained within fewer and more basic learning strategies (Riazi & Alvari, 2004) and that the use of various vocabulary learning strategies contributes to vocabulary acquisition (Tılfarlıoğlu & Bozgeyik, 2012).

Moreover, language proficiency was also found to be an essential variable in determining the orientation and effectiveness of vocabulary strategies (Bialystok, 1979; O'Malley, Chamot, Stewner-Manzanares, Kupper, & Russo,1985). For example, Schmitt (1997) indicated that L2 learners' strategy patterns changed over time as they progressed in proficiency. That is, their vocabulary learning strategies shifted from cognitively less demanding strategies (e.g., form-based memorization) toward cognitively more taxing strategies (e.g., meaning-based processing) as their proficiency increases. Schmitt's finding suggested that the transition to greater "depth of

processing" and "greater degrees of semantic involvement" (Craik & Tulving, 1975, p. 267) may promote acquisition and long-term retention of new words (Craik & Lockhart, 1972). In this regard, it may be plausible that high proficient participants in this study employed cognitively more demanding strategies when encountering the target words during the alignment activities, which led to the learning of the words. Furthermore, the high proficient learners' use of the cognitively demanding strategies may have assisted in both the short-term and long-term retention of the vocabulary knowledge acquired through the alignment activities. However, the investigation of the relationship between vocabulary learning strategies and the learning outcomes of the alignment activities was beyond the scope of this study. Therefore, future research is called for to examine the types of vocabulary learning strategies used by high proficient and low proficient learners during the alignment activities, and to discover the extent to which different vocabulary learning strategies are beneficial for learning new words through lexical alignment activities.

5.5 Implications for research

The current study adds to a body of L2 research showing that alignment occurs in L2 interactions and the alignment effects assist in L2 development. This study demonstrated that linguistic alignment occurred at both lexical and structural levels when L2 peers interacted in collaborative alignment activities, in which they heard (FTF group) or read (SMMC group) integrated lexical and structural primes. With that being said, this study expands on previous L2 alignment research by investigating whether lexical alignment occurs in L2 interactions. Despite abundant evidence for the occurrence of lexical alignment in L1 dialogues, lexical alignment effects in L2 interactions has received scarce attention, particularly in L2 alignment research adopting the cognitive-interactionist perspective. Results of this study demonstrated not only the

lexical alignment effects in task-based interaction between L2 peers but also the effectiveness of lexical alignment in the learning of L2 vocabulary. More importantly, the present study aimed at empirically testing the notion that alignment at a non-meaning-based level (e.g., structural) enhances alignment of representations at another level that is meaning-based (e.g., lexical). To do so, the experiment was set up to investigate the effects of integrated primes on eliciting target language forms by incorporating the target words into prime sentences in which the target grammatical structure (the stranded preposition RC) was embedded. However, further investigations should include a comparison group to which only lexical primes are presented in order to determine whether structural primes promoted lexical alignment effects.

In addition, findings of this study provide some insights into the mechanisms that drive linguistic alignment in dialogues involving L2 learners. Hypotheses have been put forward in L1 alignment research as to the strategic component of alignment that may work in tandem with automatic component. Researchers have proposed that although linguistic alignment is largely due to its automatic processes of priming (Pickering & Garrod, 2004), the automatic mechanism alone cannot address the full range of the complexities involved in the alignment phenomenon (Wachsmuth et al., 2013). In other words, different mechanisms of alignment, such as automatic and strategic components, are placed on a continuum of automaticity and may work in tandem (Branigan et al., 2010). Researchers speculated that strategic component may be relatively more important in task-based interactions between two L2 learners than the automatic priming-based component because L2 learners may extensively focus on language forms to successfully complete a communicative task, believing that their incomplete linguistic knowledge can lead to unsuccessful completion of a task (Branigan et al., 2010; Costa et al., 2008). Findings from the supplementary interview data supported this hypothesis regarding the role of strategic

component in linguistic alignment between L2 interlocutors by showing that some participants intentionally chose to or not to use the same words with their peer interlocutors. More systematic investigations are called for to shed light on the strategic component of linguistic alignment between L2 learners, particularly in task-based instructional contexts.

Drawing on the notion that alignment is a phenomenon of adaptive behaviors at both social and cognitive levels (Pickering & Garrod, 2013), the current study sought to address both social and cognitive dimensions of alignment by exploring the role of social factors and cognitive factors in alignment effects and the learning outcomes of the alignment activities. By doing so, the current study expands the scope of L2 alignment studies, particularly those with the cognitive-interactionist perspective, by adopting socio-cognitive approach to alignment. The socio-cognitive approach incorporates social factors into the cognitive mental states involved in the alignment process. The social factors investigated in this study included learners' perceptions of their interlocutor in terms of the interlocutor's proficiency, comprehensibility of the interlocutor's language production, and task experience with the interlocutor. Findings showed that none of the social factors had a significant impact on the degree of alignment at the lexical and structural levels and subsequent production of the target words and grammatical structure. The cognitive factors were individual differences in cognitive abilities including explicit and implicit language aptitude, language analysis ability, experiential and rational cognitive style, and language proficiency. Explicit language aptitude was found to modulate the role of structural alignment in the development of receptive knowledge of the stranded preposition RC. Additionally, language proficiency had a significant effect on the development of receptive vocabulary knowledge measured by the word translation test. These findings adds to the L2 literature that documents what cognitive factors are associated with linguistic alignment effects

and learning outcomes from linguistic alignment. Further investigations may include other cognitive (e.g., level of attention, linguistic and metalinguistic awareness) and social factors (e.g., liking of the interlocutor, solidarity) than those investigated in the current study in order to provide further insights into what cognitive and social factors affect the magnitude of linguistic alignment and the learning outcomes from alignment.

With regard to measuring the effect of social factors, one unique feature of this study is the inclusion of pre-experiment sessions. All the experimental participants completed two pre-experiment sessions in class, primarily in order to develop general perceptions of their interlocutors' language abilities. By having them carry out different types of communicative activities during the pre-experiment sessions, any effect of task type on their perceptions could be minimized.

5.6 Pedagogical implications

This study aimed to seek ways to apply the alignment (priming) paradigm to L2 pedagogical concerns. In particular, the current study focused on learner-learner interaction (i.e., peer interaction) during the alignment activities. SLA researchers have suggested peer interaction as an essential principle for optimal L2 practice because collaboration creates opportunities to promote L2 learning (Ortega, 2007; Philp, Adams, & Iwashita. 2013). Findings of this study confirmed the facilitative role of peer interaction in L2 development when two L2 peers carried out an alignment activity. Specifically, results of this study demonstrated that L2 learners had a tendency to align with their peer interlocutors in terms of their choice of words and grammatical structure during the alignment activities. Such strong tendencies have been repeatedly reported in L2 alignment research which examined the occurrence of linguistic alignment between a researcher and a learner. Moreover, this study showed that structural and lexical alignment

occurring between L2 peers led to the learning of L2 grammar and vocabulary, respectively. Overall, these findings suggest that the alignment activity can serve as a tool for learning and teaching L2 grammar and vocabulary when used by L2 peers.

An additional contribution of this study to the existing body of SLA research is the finding that mobile devices like smartphones can be used to implement alignment activities using text-chat applications available on smartphones. The current results concurred with those of previous L2 alignment studies in terms of the occurrence of linguistic alignment in different modalities. Specifically, structural and lexical alignment occurred in both text-based and spoken interactions and the alignment effects facilitated the learning of L2 grammar and vocabulary, respectively. This finding lends support to the view that task-based practice in the written modality supports L2 development (Michel, 2017), indicating that benefits of SCMC can be extended to SMMC due to their shared characteristics for text-based interaction. The shared characteristics include increased salience for both input and output processing, decreased (time) pressure, message exchanges remaining visible, and possibilities for sheltered practice, which can facilitate noticing and form-focused behavior. Furthermore, findings of this study corroborate those of previous MALL research that MALL allows L2 learning to take place outside the regular curriculum, and serves to engage L2 learners, and improves learning outcomes (see Chwo et al., 2018, for a meta-analysis of MALL research). Since, among different personal electronic devices, smartphones are most widely used as teaching and learning tool in diverse educational contexts, researchers have sought ways to integrate smartphones into L2 instructions (Chee et al., 2017). The current study showed that communicative activities can successfully be implemented using smartphones and L2 learners can benefit from such activities for developing L2 grammar and vocabulary. With the helpful functions of smartphone such as

easy access to language resources without time and spatial constraints and availability of mobile messaging apps for real-time communication, SMMC can provide an even more helpful environment for communicative language practice.

Finally, the current study was carried out with Korean EFL learners. Whereas these learners had numerous years of previous English instruction involving explicit metalinguistic instruction, they had had limited opportunities to use English for communicative purposes. As evidenced by the learners' improved performances on the posttests of the measurement tests, it appears that the communicative orientation of the collaborative alignment activities not only provided the learners with opportunities to practice English communicative skills but also promoted the development of both productive and receptive knowledge of the stranded preposition RC and target words during communicative interactions. Given this finding, it may be plausible that collaborative, communicative activities designed to elicit linguistic alignment help EFL learners develop L2 knowledge in the same way that their previous instructional experiences had emphasized the acquisition of explicit knowledge (McDonough & Chaikitmongkol, 2010).

6 CONCLUSIONS

6.1 Limitations and directions for future research

There are several limitations that need to be acknowledged. First, notable limitations of this study include the small sample size of participants (n=61) and a single grammatical structure targeted by the alignment activities, which may limit the generalization of the current findings to different grammatical structures and L2 learner groups in various contexts. Moreover, the participants of this study were relatively homogenous in terms of English learning experiences and educational background. Therefore, the readers should be cautious about extending the results of this study to different L2 learner groups studying English in different contexts (e.g., young learners, learners studying in ESL settings). For example, alignment behaviors during task-based interaction may differ between second language and foreign language learners due to the way they have been exposed to the language and/or the interactional strategy they have developed in their respective educational settings. Future research would benefit from replicating the current study with various other target linguistic features and with a larger number of diverse learner populations. In addition, with particular regard to the effect of lexical alignment on vocabulary learning, more exposure to each target word might have resulted in greater learning outcomes. In this study, the participants were exposed to each target word only once since different target words were used across the two alignment activities. Future research is warranted to design alignment activity sessions, during which L2 learners are exposed to and produce the same target words more than once. Greater vocabulary learning could occur if learners encounter the same words repeatedly in prime sentences during the activity sessions.

In the current study, none of the social factors (perceptions of the interlocutor in terms of the interlocutor's language proficiency, comprehensibility of the interlocutor's language

production, and task experience with the interlocutor) had a significant effect on the aligned production or on the learning of the target words and grammatical structure. The non-significant effect of the learner perception may be attributable to the potential unreliability of peer evaluation. In order to collect learner perception data, the participants were asked to evaluate their peer interlocutors' language abilities in terms of their overall proficiency, fluency, grammatical knowledge, and vocabulary knowledge. Previous research has suggested that when making judgements of peers, learners are often guided by the considerations of social desirability, which can lead to inflated peer evaluations. The fear of being deprecated, and the expectation of reciprocation from others may also lead to inflated evaluations (Omelicheva, 2005). Also possible is that a friendship and familiarity bias of the learners towards their confederate partners might have influenced their perception ratings. Most of the experimental participants were English majors and had taken the same major courses for at least 1 to 2 years at the time of data collection. Then, many of them might have been friends or at least familiar with one another. Previous studies have demonstrated that L2 learners expressed discomfort and uneasiness of evaluating their classmates and tended to evaluate them leniently (Azarnoosh, 2013; Saito & Fujita, 2005). Therefore, it is plausible that the learners' peer evaluation in the questionnaire did not correctly capture their perceptions and therefore affected the results of the study to a certain extent.

Additionally, the research design of this study may be responsible for the non-significant effect of learner perception of the interlocutor. It is possible that the two pre-experiment sessions did not provide sufficient opportunities to the participants for developing reliable perceptions of their interlocutor. It may have also been the case that irrespective of their actual perceptions, the participants chose to either align or misalign with their interlocutors during the alignment

activities if they noticed that their partners were following a script provided by the researcher or if they found their partners more proficient during the treatment sessions than they had thought previously. Moreover, implementation of the alignment activities in a controlled laboratory setting might have affected the participants' perceptions of their interlocutors. Future research may consider conducting a classroom-based study, in which students can complete more pre-experiment sessions prior to experiment sessions and the participants' perceptions may not be influenced by different activity settings.

Furthermore, given that social factors other than perceptions regarding the interlocutor's language ability and task performance have been found to have a significant association with alignment effects (e.g., social status, self-esteem, liking, relative role in conversation) in L1 alignment research, it is premature to conclude that social factors do not moderate the effect of linguistic alignment. Therefore, future research should investigate the extent to which other social factors affect L2 learners' alignment behaviors during alignment activities and the learning outcomes from the alignment activities. In addition, any of the demographic information factors included in the analysis (i.e., sex, age, length of English study) was not found to have a significant relationship with the degree of linguistic alignment or the learning outcomes from the alignment activities. However, other demographic information factors such as the participants' majors might have influenced their alignment behaviors and learning outcomes. For example, participants majoring in English are likely to have had more access and exposure to English as well as more opportunities for communicative language practice, which, in turn, may have helped them develop different language learning strategies from those with non-English majors. Therefore, the role of participants' majors in alignment effects and learning outcomes should be further investigated in future research.

With regard to the learning effects demonstrated in the word translation test, it is possible that the participants' performances on the immediate and delayed posttests of the word translation test were affected by a practice effect as a result of the same words (target words) being included in all three versions of the test. Efforts were made to minimize the practice effect by counter-balancing the order of the tests and including different distractors. Nevertheless, the increased scores on the immediate and delayed posttests may be at least partly attributable to the repeated exposure to the same words in the three versions of the word translation test. Future research may consider using different tests to measure the improvement in the learners' receptive vocabulary knowledge in order to avoid any potential practice effect and provide a more accurate picture of the pedagogical benefits of lexical alignment activities.

In the current study, only interviews with selected participants were used to explore how the participants drew on their interlocutors' output (i.e., target words and structure embedded in prime sentences). As mentioned previously, data from stimulated recalls or eye-tracking techniques that could account for language processing during alignment activity performance would have contributed to a better understanding of the nature of alignment (i.e., automatic vs. strategic) and whether heightened attention on certain linguistics features in the input facilitated aligned production and subsequent production of the features.

Additionally, the C-test was used to assess general language proficiency of the participants in this study. Due to its advantageous features such as an easy-to-administer test format, fast and objective scoring, and high reliability, the C-test has been claimed to provide an integrative assessment of general language proficiency for a number of different languages (e.g., for English, Dörnyei & Katona, 1992, Eckes & Grotjahn, 2006, Hastings, 2002; for French, Tremblay, 2011; for German, Norris, 2006; for Korean, Lee-Ellis, 2009). Therefore, C-tests have

been prevalently used to measure L2 learners' global proficiency in numerous SLA research. However, use of C-tests as tests of general language proficiency has not been without controversy. For example, some researchers have argued that C-tests were measures of reading comprehension ability but productive skills in the language could not be assessed using C-tests (e.g., Cohen, Segal, & Weiss, 1984; Harsch & Hartig, 2016). C-tests have also been claimed to be primarily measures of micro-level skills such as spelling, punctuation, word choice and, for this reason, not suited to measuring general language proficiency (e.g., Cohen et al., 1984; Stemmer, 1991). Future studies may include a more reliable and valid measure of global language proficiency, which does not generate controversy over its use in SLA research.

In this study, learners' production of the stranded preposition RC was analyzed in terms of suppliance of a stranded preposition in an RC, regardless of whether the learners chose the appropriate preposition or not. Because the stranded preposition RC was treated as a construction, the focus of the study was on the learning effects on the development of relevant mental representation for the stranded preposition RC rather than learners' abilities to use the correct preposition. However, an accuracy-based analysis may have presented different results for the alignment effects and the learning outcomes from the alignment activities. A previous study suggested potential benefits of structural alignment in the accurate production of complex grammatical structures (Kim et al., under review). Future research may consider using an accuracy-based analysis in order to provide further insight into the effects of structural alignment on accurate production of a complex syntactic structure such as the stranded preposition RC.

A final note for future research concerns the pedagogical benefits of the alignment activities to the confederate-learners. In the current study, the focus of the current study was on whether the participant-learners improved their grammatical and vocabulary knowledge as a

result of carrying out alignment activities, in which they received primes read or written by the confederate-learners. Therefore, this study did not examine if learning occurred to the confederate-learners and the relevant data were not included in the analysis. However, it is plausible that the confederate-learners also acquired the target words and grammatical structure to a certain extent as they were exposed to the written input containing primes while reading or texting the prime sentences to the participant-learners. As a follow-up to this study, the confederate-learners' data from the measurement tests should be analyzed in order to determine whether exposure to the target words and grammatical structure while providing primes to the participant-learners was beneficial for their development of L2 vocabulary and grammar.

6.2 Concluding remarks

Linguistic alignment, particularly structural alignment, is a topic that has recently received considerable attention from SLA researchers due to its potential as a tool for L2 learning and teaching. Drawing on previous L2 alignment research, the current study aimed to explore L2 learners' alignment behaviors while carrying out communicative activities in pairs as well as the role of linguistic alignment in L2 development. Furthermore, the purpose of the study was to advance the study of linguistic alignment by investigating the extent to which a range of cognitive and social factors influence structural and lexical alignment while L2 learners carry out a communicative activity in two different interactional contexts: FTF and SMMC. By doing so, this study expands the existing literature on linguistic alignment in L2 interaction by providing additional evidence that two cognitive factors – explicit language aptitude and language proficiency - moderated the effect of linguistic alignment on developing receptive knowledge of the stranded preposition RC structure and receptive vocabulary knowledge of the target words, respectively. However, none of the social factors included in this study had a significant

relationship with the extent to which L2 learners aligned with their peer interlocutors or the learning outcomes from the alignment activities.

The findings of the current dissertation suggest that lexical alignment as well as structural alignment occurred in L2 peer interaction, irrespective of the modalities of interaction (FTF and SMMC), in which alignment activities were carried out. The findings also indicate that productive and receptive knowledge of the stranded preposition RC and target words were promoted as a result of completing alignment activities in either of the two modalities. Finally, although none of the social factors were found to have a significant impact on the degree of linguistic alignment or the learning outcomes from the alignment activities, the current study offers directions for future research by suggesting other social factors that may impact the way L2 peers linguistically align with each other and the development of L2 grammar and vocabulary.

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APPENDICES

Appendix A: Target Words Used in the Alignment Activities

		Alternative	Target noun	Verb	Preposition
Task 1	prime	axe	hatchet	split	with
	prompt			chop	
	prime	basket	hamper	throw	in
	prompt			put	
	prime	soda	pop	get	from
	prompt			gain	
	prime	bench	seat	rest	on
	prompt			sit	
	prime	lamp	light	illuminate	with
	prompt			brighten	
	prime	gun	pistol	fire	from
	prompt			shoot	
	prime	plane	aircraft	transport	in
	prompt			fly	
	prime	bus	coach	ride	on
	prompt			leave	
	prime	pan	skillet	sauté	with
	prompt			fry	
	prime	closet	wardrobe	select	from
	prompt			choose	
	prime	stroller	buggy	push	in
	prompt			carry	
	prime	notebook	laptop	type	on
	prompt			play	
	prime	glasses	spectacles	see	with
	prompt			read	
	prime	cup	mug	sip	from
	prompt			drink	
	prime	handbag	purse	keep	in
	prompt			have	
	prime	highway	freeway	travel	on
	prompt			drive	
Task 2	prime	ladle	dipper	scoop	with
	prompt			stir	
	prime	box	crate	store	in

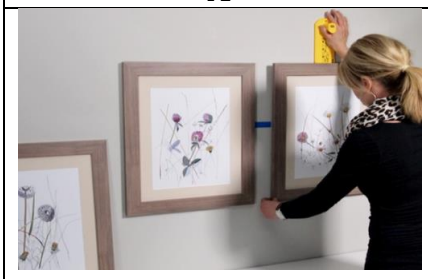
prompt			stack	
prime prompt	internet	web	receive gather	from
prime prompt	chair	recliner	lie relax	on
prime prompt	blind	shade	block cover	with
prime prompt	pamphlet	booklet	collect learn	from
prime prompt	theater	cinema	enjoy watch	in
prime prompt	subway	metro	commute hop	on
prime prompt	eraser	rubber	erase remove	with
prime prompt	cupboard	cabinet	retrieve grab	from
prime prompt	teapot	kettle	heat boil	in
prime prompt	range	stove	prepare cook	on
prime prompt	shears	scissors	trim cut	with
prime prompt	plate	dish	serve eat	from
prime prompt	suitcase	luggage	pack bring	in
prime prompt	carpet	rug	set place	on

Appendix B: Sample Items from the Alignment Activity

Direction: You (B: prompt) and your partner (A: prime) will describe a picture including the same/a similar object in different contexts. B will listen to (read) A's description first and choose the right picture between the two presented to you. And then, B will describe his/her picture by using the verb in the parenthesis. Describe your picture as accurately as possible in one sentence.

Target item 1.
1. Confederate-Learner: A *hatchet* is something you split timber with.

2. Participant-Learner:
(looking at a picture containing a hatchet and another picture of an unrelated object)
"B is a picture of a hatchet."

A	B
	

3. Confederate-Learner: "Correct, you're right. Now it's your turn."

4. Participant-Learner:
(looking at a picture containing a hatchet in a different context; verb *chop* is presented in the prompt) "(if alignment occurs) A *hatchet* is something you chop wood with?

5. Confederate-Learner: (looking at a picture containing a hatchet in a different context and a distractor picture) "It's B. B shows a hatchet."

A	B
	

Filler item 1.

1. Confederate-Learner: A *flower* is something you arrange in a vase.

2. Participant-Learner:
(looking at a picture containing a rose and another picture of an unrelated object)
"B is a picture of a flower."

A	B
	

3. Confederate-Learner: "Okay, good. Your turn."

4. Participant-Learner:
(looking at a picture containing a rose in a different context; verb *smell* is presented in the prompt) "(if alignment occurs) A *flower* is something you smell?

5. Confederate-Learner:
(looking at a picture containing a rose in a different context and a distractor picture)
"It's A. A shows a flower."

A	B
	

Target item 2.

1. Confederate-Learner: A *light* is something you illuminate your desk with.

2. Participant-Learner:
(looking at a picture containing a light and another picture of an unrelated object)
"It's A."

A	B
	

3. Confederate-Learner: "Right. Now it's your turn."

4. Participant-Learner:
(looking at a picture containing a light in a different context; verb *brighten* is presented in the prompt) "(if alignment occurs) A *light* is something you brighten your room with?

5. Confederate-Learner: (looking at a picture containing a light in a different context and a distractor picture) "A is a picture of a light."

A	B
	

Appendix C: Prime Sentences and Expected Responses in the Alignment Activities

	Verb	Prime sentence	Verb	Expected response
Task 1	split	A hatcher is something you split timber with.	chop	A hatchet is something you chop wood with.
	throw	A hamper is something you throw laundry in.	put	A hamper is something you put clothes in.
	get	Pop is something you get caffeine from.	gain	Pop is something you gain weight from.
	rest	A seat is something you rest on.	sit	A seat is something you sit on.
	illuminate	A light is something you illuminate your desk with.	brighten	A light is something you brighten your room with.
	fire	A pistol is something you fire bullets from.	shoot	A pistol is something you shoot bullets from.
	transport	An aircraft is something you transport passengers in.	fly	An aircraft is something you fly people in.
	ride	A coach is something you ride on.	leave	A coach is something you leave on.
	sauté	A skillet is something you sauté food with.	fry	A skillet is something you fry food with.
	select	A wardrobe is something you select clothes from.	choose	A wardrobe is something you choose clothes from.
	push	A buggy is something you push a baby in.	carry	A buggy is something you carry a baby in.
	type	A laptop is something you type a letter on.	play	A laptop is something you play a game on.
	see	Spectacles are something you see things with.	read	Spectacles are something you read books with.
	sip	A mug is something you sip coffee from.	drink	A mug is something you drink tea from.
	keep	A purse is something you keep essentials in.	have	A purse is something you have a wallet in.
	travel	A freeway is something you travel on.	drive	A freeway is something you drive on.
Task 2	scoop	A dipper is something you scoop soup with.	stir	A dipper is something you stir soup with.
	store	A crate is something you store things in.	stack	A crate is something you stack things in.
	receive	The web is something you receive information from.	gather	The web is something you gather information from.

lie	A recliner is something you lie on.	relax	A recliner is something you relax on.
block	A shade is something you block the sun with.	cover	A shade is something you cover the window with.
collect	A booklet is something you collect information from.	learn	A booklet is something you learn information from.
enjoy	A cinema is something you enjoy a movie in.	watch	A cinema is something watch a movie in.
commute	A metro is something you commute on.	hop	A metro is something you hop on.
erase	A rubber is something you erase stains with.	remove	A rubber is something you remove pencil marks with.
retrieve	A cabinet is something you retrieve plates from.	grab	A cabinet is something you grab plates from.
heat	A kettle is something you heat water in.	boil	A kettle is something you boil water in.
prepare	A stove is something you prepare food on.	cook	A stove is something you cook food on.
trim	Shears are something you trim hair with.	cut	Shears are something you cut hair with.
serve	A dish is something you serve food from.	eat	A dish is something you eat food from.
pack	Luggage is something you pack clothes in.	bring	Luggage is something you bring clothes in.
set	A rug is something you set furniture on.	place	A rug is something you place furniture on.

Appendix D: Expected Responses in the Sentence Production Tests

	Verb	Target noun	Expected response
Version 1	fire	bow	A bow is something you fire an arrow from.
	cover	tarp	A tarp is something you cover your car with.
	leave	bulletin board	A bulletin board is something you leave messages on.
	split	saw	A saw is something you split wood with.
	transport	road	A road is something you transport freight on.
	put	kimchi refrigerator	A kimchi refrigerator is something you put kimchi in.
	sip	tumbler	A tumbler is something you sip coffee from.
	travel	ship	A ship is something you travel in.
	receive	satellite dish	A satellite dish is something you receive TV channels from.
	read	tablet	A tablet is something you read e-books on.
	trim	clippers	Clippers are something you trim har with.
	sauté	frying pan	A frying pan is something you sauté food in.
Version 2	set	CD rack	A CD rack is something you set CDs on.
	select	medicine cabinet	A medicine cabinet is something you select medicine from.
	ride	motorcycle	A motorcycle is something you ride on.
	collect	piggy bank	A piggy bank is something you collect coins in.
	block	barricade	A barricade is something you block the road with.
	sit	armchair	An armchair is something you sit on.
	gain	magazine	A magazine is something you gain information from.
	store	Tupperware	Tupperware is something you store food in.
	boil	electric kettle	An electric kettle is something you boil water in.
	stir	spoon	A spoon is something you stir soup with.
	eat	bowl	A bowl is something you eat soup from.
	drink	glass	A glass is something you drink water from.
Version 3	choose	catalog	A catalog is something you choose products from.
	scoop	ice-cream scoop	An ice-cream scoop is something you scoop ice cream with.
	drive	street	A street is something you drive a car on.
	throw	trash can	A trash can is something you throw trash in.
	fly	helicopter	A helicopter is something you fly in.
	watch	TV channel	A TV channel is something you watch a show from.

carry	briefcase	A briefcase is something you carry documents in.
chop	cutting board	A cutting board is something you cut vegetables on.
shoot	camera	A camera is something you shoot photos with.
grab	vending machine	A vending machine is something you grab a drink from.
have	dining table	A dining table is something you have your meal on.
see	telescope	A telescope is something you see stars with.

Appendix E: Grammaticality Judgment Test (Version I)

Name: _____

Please read each sentence below and then determine whether it is a grammatical or ungrammatical sentence. If you think the sentence ungrammatical: (1) Explain the error and (2) Correct the error to make a grammatical sentence. (Note: There is no punctuation or spelling errors). If you are not sure about the grammaticality of the sentence, please circle "I don't know" rather than guessing.

Example:
Tom got a cold. He couldn't went to school yesterday.
Correct **Incorrect** **I don't know**

Explanation: Need a base form of the verb after the modal verb

1. A tray is something you serve food from. **Correct** **Incorrect** **I don't know**

Explanation:_____

2. Why Mary came to see you this morning? **Correct** **Incorrect** **I don't know**

Explanation:_____

3. A playground is something you play soccer. **Correct** **Incorrect** **I don't know**

Explanation:_____

4. That tall building built in 1857. **Correct** **Incorrect** **I don't know**

Explanation:_____

5. A loveseat is something you rest on. **Correct** **Incorrect** **I don't know**

Explanation:_____

6. There is a flower shop on the first level. **Correct** **Incorrect** **I don't know**

Explanation:_____

7. A desk lamp is something you illuminate your desk with.
Correct **Incorrect** **I don't know**

Explanation:_____

8. Mary is biking to school everyday. **Correct** **Incorrect** **I don't know**

Explanation:_____

9. Ice is something you prepare iced coffee. **Correct** **Incorrect** **I don't know**

Explanation:_____

10. John was really shocked when he saw the accident.
Correct **Incorrect** **I don't know**

Explanation:_____

11. A history book is something you learn history. **Correct** **Incorrect** **I don't know**

Explanation:_____

12. What can we do to help you? **Correct** **Incorrect** **I don't know**

Explanation:_____

13. A drawer is something you keep your clothes in. **Correct** **Incorrect** **I don't know**

Explanation:_____

14. My father gave me some advice. **Correct** **Incorrect** **I don't know**

Explanation:_____

15. A hammock is something you relax in. **Correct** **Incorrect** **I don't know**

Explanation:_____

16. Paul changed his phone number last week. **Correct** **Incorrect** **I don't know**

Explanation:_____

17. Paper is something you type letters. **Correct** **Incorrect** **I don't know**

Explanation:_____

18. Coffee beans can be buyed at a supermarket. **Correct** **Incorrect** **I don't know**

Explanation:_____

Grammaticality Judgement Test (Version II)

Name: _____

Please read each sentence below and then determine whether it is a grammatical or ungrammatical sentence. If you think the sentence ungrammatical: (1) Explain the error and (2) Correct the error to make a grammatical sentence. (Note: There is no punctuation or spelling errors). If you are not sure about the grammaticality of the sentence, please circle "I don't know" rather than guessing.

Example:
Tom got a cold. He couldn't went to school yesterday.

Correct **Incorrect** **I don't know**

Explanation: Need a base form of the verb after the modal verb

1. A train is something you commute in. Correct Incorrect I don't know

Explanation:_____

2. Where you will stay during your visit in Rome? Correct Incorrect I don't know

Explanation:_____

3. A pound is something you retrieve a pet from. Correct Incorrect I don't know

Explanation:_____

4. Look! It was raining outside now. Correct Incorrect I don't know

Explanation:_____

5. A shelf is something you stack things. Correct Incorrect I don't know

Explanation:_____

6. Can you lend me few money? Correct Incorrect I don't know

Explanation:_____

7. A knife is something you cut food with. Correct Incorrect I don't know

Explanation:_____

8. Which house did Tim and Jane decide to buy? Correct Incorrect I don't know

Explanation:_____

9. A well is something you get water. Correct Incorrect I don't know

Explanation:_____

10. The cave paintings were drawn about 2000 years ago.
Correct Incorrect I don't know

Explanation:_____

11. A backpack is something you pack your books. Correct Incorrect I don't know

Explanation:_____

12. My family had a good time at the party last weekend.
Correct Incorrect I don't know

Explanation:_____

13. A griddle is something you cook food on. Correct Incorrect I don't know

Explanation:_____

14. Ken always studies at the library. Correct Incorrect I don't know

Explanation:_____

15. A chalk eraser is something you erase chalk markings.
Correct Incorrect I don't know

Explanation:_____

16. Many students thought the lecture was bored. Correct Incorrect I don't know

Explanation:_____

17. A trolley is something you hop on. Correct Incorrect I don't know

Explanation:_____

18. Where can I borrow books in this town? Correct Incorrect I don't know

Explanation:_____

Grammaticality Judgement Test (Version III)

Name: _____

Please read each sentence below and then determine whether it is a grammatical or ungrammatical sentence. If you think the sentence ungrammatical: (1) Explain the error and (2) Correct the error to make a grammatical sentence. (Note: There is no punctuation or spelling errors). If you are not sure about the grammaticality of the sentence, please circle "I don't know" rather than guessing.

Example:
Tom got a cold. He couldn't went to school yesterday.

Correct **Incorrect** **I don't know**

Explanation: Need a base form of the verb after the modal verb

1. A laundry basket is something you gather laundry.
Correct Incorrect I don't know

Explanation:_____

2. Mike was given a warning. Correct Incorrect I don't know

Explanation:_____

3. A microwave is something you heat your food with.
Correct Incorrect I don't know

Explanation:_____

4. When will your parents move to Canada? Correct Incorrect I don't know

Explanation:_____

5. A bookshelf is something you place books. Correct Incorrect I don't know

Explanation:_____

6. Linda bought two present for her children. Correct Incorrect I don't know

Explanation:_____

7. A fryer is something you fry fish in. Correct Incorrect I don't know

Explanation:_____

8. Teresa wants a new computer for last Christmas.
Correct Incorrect I don't know

Explanation:_____

9. A staple remover is something you remove staples.
Correct Incorrect I don't know

Explanation:_____

10. How you spell your name? Correct Incorrect I don't know

Explanation:_____

11. A smartphone is something you enjoy games from.
Correct Incorrect I don't know

Explanation:_____

12. Jennifer was exciting to hear the news. Correct Incorrect I don't know

Explanation:_____

13. A bed is something you lie on. Correct Incorrect I don't know

Explanation:_____

14. My brother broke my vase yesterday morning. Correct Incorrect I don't know

Explanation:_____

15. A dog carrier is something you bring your dog. Correct Incorrect I don't know

Explanation:_____

16. I will wash my clothes tomorrow. Correct Incorrect I don't know

Explanation:_____

17. A street lamp is something you brighten a street with.

Correct Incorrect I don't know

Explanation:_____

18. I have been to Paris twice. Correct Incorrect I don't know

Explanation:_____

Appendix F: C-Test

Direction: On the following pages, some words in the texts have been partially taken out. Read the texts and work out the missing parts. Write each missing part in the blank space.

Passage 1: Test passage "Public Alert"

(Based on the reading material "Police Description" in *Meanings into Words* by Dough, Jones & Mitchell. Cambridge University Press, 1984, p. 16)

Police are looking for a man in connection with this morning's bank robbery in Hong Kong. It is known that the sus___[1] is a man in his ea___[2] thirties, is lightly built, and i___[3] about five feet eight inches ta___[4]. He has small eyes a___[5] a pale complexion with shoulder len___[6] brown hair. He is well dre___[7], wears a gold ring on h___[8] left hand, and speaks wi___[9] a British accent. Police believe h___[10] is still carrying the gun us___[11] in the robbery, and members o [12] the public are warned not t___[13] approach him but instead to not___[14] the police immediately if he is sig___[15]. Extreme caution is urged in approaching the suspect.

Passage 2: Test passage "Advertisement"

(Based on the reading material "The Ultimate Advertising Medium" in *Academically Speaking* by Kayfetz & Spice, Hineley & Hineley, 1987, p. 109)

Radio remains a vital force in advertising, but television dominates the media world today. It is only natural that television has bec___[16] the dominant advertising medium as we___[17]. An important lesson that was fi___[18] learned about advertising on radio w___[19] applicable to television also; in a mar___[20] flooded with numerous products, the fo___[21] of the ad was a [22] least as important as the con___[23]. When advertising on television began, i___[24] was a challenge since adver___[25] could now picture the product a___[26] well as describe it in wo [27]. Cigarette commercials in the m___[28]-1950s showed scene after scene o___[29] spring fields. Clearly the mes___[30] was that smoking is a healthy, fresh and clean experience. How times have changed!

Passage 3: Test passage "Space Shuttle"

(Based on the reading material "The Shuttle and Beyond" in *Meanings into Words* by Dough, Jones & Mitchell, Cambridge University Press, 1984, p. 140)

The development of the space shuttle has dramatically reduced the cost of sending loads into space. The shu____[31] is a reusable type o____[32] space craft which takes o____[33] from the earth like a roc____[34], and lands like an air___[35]. It can transport not on____[36] its own crew, but al [37] passengers, and has a hu____[38] cargo-hold which is cap____[39] of carrying large satellites o__[40] a space laboratory. It i____[41] difficult to imagine the imm____[42] opportunities that have been created by the shu____[43]. One of the great advan__[44] of having a reusable sp____[45] vehicle is that it c____[46] take one load after ano____[47] into orbit. Very large sp____[48] stations cannot be laun___[49] in their complete form dire____[50] from the earth, but they can be built piece by piece in space. The space shuttle has been used as a general workhorse for the past thirty years and it is scheduled to be retired from service in 2011 after 135 launches.

Appendix G: Language Analysis Test

The list in the box below contains words/phrases from an imaginary language along with their English translation. Following this, there will be 14 short English sentences, each with four possible translations into the imaginary language. Based on the examples given in the box, we would like to ask you to try and work out which of the four options is the correct translation of each sentence. Thank you very much.

Name:_____ Student No. _____

kau	dog	**pa**	we, us
meu	cat	**xa**	you
kau meud bo	The dog is chasing the cat.		
pasau meud bo	Our dog is chasing the cat.		
kau meud bi	The dog was chasing the cat.		
pa meud bo	We are chasing the cat.		
so	watch	**paxbo**	We are chasing you.
ciu	mouse	**pa meud bor**	We aren't chasing the cat.

1. **The dog is watching the cat.**
   - **A.** kau meud so
   - **B.** kau meud si
   - **C.** meu kaud so
   - **D.** meu kaud si

2. **The cat was watching the mouse.**
   - **A.** meud ciu so
   - **B.** meu ciud so
   - **C.** meud ciu si
   - **D.** meu ciud si

3. **You are watching us.**
   - **A.** paxbo
   - **B.** paxso
   - **C.** xapbo
   - **D.** xapso

4. **You were chasing the dog.**
   - **A.** xa kaud bo
   - **B.** pa kaud bo
   - **C.** pa kaud bi
   - **D.** xa kaud bi

5. **We were watching you.**
   - **A.** xapsi
   - **B.** paxso
   - **C.** paxsi
   - **D.** paxbi

6. **You are not watching the cat.**
   - **A.** xa meud bor
   - **B.** xa meud sor
   - **C.** xa meud sir
   - **D.** xa meu sor

7. **You are not chasing us.**
   A. paxbor **B.** xapbo
   C. xapabor **D.** xapbor

8. **We were not watching the dog.**
   A. pa kaud sir **B.** pa kau sir
   C. pa kaud sor **D.** pa kaud bir

9. **We were not chasing you.**
   A. xapbir **B.** paxbir
   C. paxbor **D.** xapbor

10. **Your cat is chasing the mouse.**
   A. xacu meud bo **B.** xaseu ciud bo
   C. meuxa ciud bo **D.** ciuxa meud bo

11. **You are not watching our dog.**
   A. xa paseud bor **B.** xa pasaud sor
   C. xa pasaud so **D.** xa pasaud bor

12. **Our mouse was not chasing the dog.**
   A. oasiu kaud bi **B.** xasiu kaud sir
   C. xasiu kaud bi **D.** pasiu kaud bir

13. **Your mouse is chasing us.**
   A. xa ciu pabo **B.** xasiu pbo
   C. xaciu pa bo **D.** xasiu pabo

14. **Our cat was not chasing your dog.**
   A. pseu xasaud bir **B.** pseu xsaud bir
   C. paseu xasaud bir **D.** paseu xsaud bir

Appendix H: Pre-Experiment Survey – Background Questionnaire

Please fill out the following questionnaire as honestly as possible. Your response will not affect your course grade. Your information will be kept confidential and will only be used for research purposes. Your instructor will not have an access to your response. Thank you for your time.

1. Name
2. Birth Year
3. Gender
    1) Female
    2) Male
4. Do you speak any languages other than English?
    1) Yes 2) No

    4-1. If yes, which language(s) do you speak? How long have you studied it (them)? And what level of proficiency do you think you have in the language(s)?

	Length of study (month)	Proficiency level (Beginning=1, Intermediate=2, Advanced=3, Nativelike=4)
Language 1		
Language 2		

5. In what year did you first begin to learn English?
6. How many years have you been studying English in your country?
7. Have you resided in any English-speaking countries? If yes, please indicate where, for how long, and why. Also, if you attended any school or institute for learning English in an English-speaking country, please indicate which school or institute and for how long.
    1) Yes 2) No

    7-1. If yes,

    (1) Where

    (2) For how long

    (3) Why?

7-2. If yes, have you attended any schools/institutes to study English outside your country?

1) Yes 2) No

(1) Which school /institute:

(2) For how long:

8. Currently, how many hours per week and how do you study English outside school? Please specify below.

8-1. How many hours per week outside school?

8-2. How do you study English outside school?

8-3. If you take private lessons or attend classes at hakwons (cram schools), why do you do that?

9. Which skills do you focus on the most when you study English? And how many hours per week do you study for the following skills? Please circle all that apply.

	1-2 hours	3-4 hours	5-6 hours	7-8 hours	More than 8 hours
Listening					
Writing					
Reading					
Communication					
Vocabulary					
Grammar					
Other					

10. Why do you study English? Please write a detailed response.

11. Please rate your current overall proficiency in English by choosing one:

1) Nativelike: Able to converse about the majority of topics in English; Able to understand English lectures, participate in discussions, read academic texts, and write papers without any problem.

2) Advanced: Able to converse about general matters of daily life and topics of one's specialty; Able to grasp the gist of lectures and broadcasts; Able to read high-level materials such as newspapers and write essays about personal ideas.

3) Intermediate: Able to converse about familiar topics; Able to read general matters related to daily life and write several passages about familiar topics.

4) Beginning: Able to hold a simple conversation such as greeting and introducing someone; Able to read simple materials and write a simple passage in simple English.

12. Please circle a response that best describes how you feel about studying English and specify the reason for your response.

Like it very much	
Like it	
Neutral	
Dislike it	
Dislike it very much	

12-1. Reasons

13. On a scale from 1 to 4, identify your English proficiency.

	1=beginning	2=intermediate	3=advanced	4=nativelike
Listening				
Speaking				
Reading				
Writing				
Vocabulary				
Grammar				

Appendix I: Pre-Experiment Survey – Cognitive Style Questionnaire

Please rate your perception of yourself in relation to each of the statements below. 1 represents "Definitely not true of myself" whereas 5 represents "Definitely true of myself." For instance, if you perceive yourself being very honest, then you should circle 5 as shown in the example below. Your response will not affect your course grade. Your information will be kept confidential and will only be used for research purposes. Your instructor will not have an access to your response. Thank you for your time.

Example. I am honest. **Definitely Not true of myself** 1○ 2○ 3○ 4○ 5○ **Definitely true of myself**

1 = Definitely NOT true of myself

2 =Not true of myself

3 = Somewhat true of myself

4 = True of myself

5 = Definitely true of myself

1. I try to avoid situations that require thinking in depth about something.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

2. I'm not that good at figuring out complicated problems.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

3. I enjoy intellectual challenges.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

4. I am not very good at solving problems that require careful logical analysis.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**
5. I don't like to have to do a lot of thinking.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

6. I enjoy solving problems that require hard thinking.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

7. Thinking is not my idea of an enjoyable activity.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

8. I am not a very analytical thinker.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

9. Reasoning things out carefully is not one of my strong points.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

10. I prefer complex problems to simple problems.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

11. Thinking hard and for a long time about something gives me little satisfaction.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

12. I don't reason well under pressure.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

13. I am much better at figuring things out logically than most people.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

14. I have a logical mind.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

15. I enjoy thinking in abstract terms.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

16. I have no problem thinking things through carefully.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**
17. Using logic usually works well for me in figuring out problems in my life.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

18. Knowing the answer without having to understand the reasoning behind it is good enough for me.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

19. I usually have clear, explainable reasons for my decisions. Learning new ways to think would be very appealing to me.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

20. I like to rely on my intuitive impressions.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

21. I don't have a very good sense of intuition.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

22. Using my gut feelings usually works well for me in figuring out problems in my life.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

23. I believe in trusting my hunches.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

24. Intuition can be a very useful way to solve problems.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

25. I often go by my instincts when deciding on a course of action.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

26. I trust my initial feelings about people.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

27. When it comes to trusting people, I can usually rely on my gut feelings.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

28. If I were to rely on my gut feelings, I would often make mistakes.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

29. I don't like situations in which I have to rely on intuition.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

30. I think there are times when one should rely on one's intuition.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

31. I think it is foolish to make important decisions based on feelings.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

32. I don't think it is a good idea to rely on one's intuition for important decisions.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

33. I generally don't depend on my feelings to help me make decisions.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

34. I hardly ever go wrong when I listen to my deepest gut feelings to find an answer.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

35. I would not want to depend on anyone who described himself or herself as intuitive.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

36. My snap judgments are probably not as good as most people's.

Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

37. I tend to use my heart as a guide for my actions.
Definitely NOT true of myself 1 o□2 o □3 o □4 o □5 o **Definitely true of myself**

Appendix J: Interlocutor Perception Survey

Please answer the following questions as honestly as possible. Your response will not affect your course grade. Your information will be kept confidential and will only be used for research purposes. Your instructor will not have an access to your response. Thank you for your time.

Name: _____

1. Please rate your partner's English proficiency based on the descriptions provided in the table. For example, if you think the description for rating 4 best describes how you perceived your partner's proficiency in terms of pronunciation, please circle 4 in the rating column for pronunciation.

Area	Ratings	Description
Fluency	4	Generally natural delivery, only occasional halting when searching for appropriate words/expressions.
	3	The student hesitates and repeats himself at times but can generally maintain a flow of speech, although s/he may need an occasional prompt.
	2	Speech is slow and hesitant. Maintains speech in a passive manner and needs regular prompts.
	1	The student speaks so little that no "fluent" speech can be said to occur.
Pronunciation	4	Occasional errors of pronunciation a few inconsistencies of rhythm, intonation and pronunciation but comprehension is not impeded.
	3	Rhythm, intonation and pronunciation require more careful listening; some errors of pronunciation which may occasionally lead to incomprehension.
	2	Comprehension suffers due to frequent errors in rhythm, intonation and pronunciation.
	1	Words are unintelligible.
Vocabulary	4	Effective use of vocabulary for the task with few inappropriacies.
	3	For the most part, effective use of vocabulary for the task with some examples of inappropriacy.
	2	Limited use of vocabulary with frequent inappropriacies.
	1	Inappropriate and inadequate vocabulary.
Grammar	4	Very few grammatical errors evident.
	3	Some errors in use of sentence structures and grammatical forms but these do not interfere with comprehension.
	2	Speech is broken and distorted by frequent errors.
	1	Unable to construct comprehensible sentences.
Interactional Strategy	4	Interacts effectively and readily participates and follows the conversation.
	3	Use of interactive strategies is generally adequate but at times experiences some difficulty in maintaining interaction consistently.
	2	Interaction ineffective. Can seldom develop an interaction.
	1	Understanding and interaction minimal.

2. How would you rate your partner's overall English proficiency compared to yourself?

Ratings	Description
5	Much better than myself.
4	Better than myself.
3	Approximately the same with myself.
2	Worse than myself.
1	Much worse than myself.

3. Please evaluate overall how easy it was to understand your partner's English during the task.

Rating	Description
4	Speaker is very easy to understand.
	Little (if any) listener effort is required. Errors (if any) are not distracting.
3	Speaker is mostly comprehensible.
	Listeners can understand with some effort. Errors are occasionally distracting.
2	Speaker is sometimes comprehensible.
	Significant listener effort is required. Errors are often distracting. Words and individual sentence meaning are usually comprehensible. Meaning of the overall recording is incomprehensible.
1	Speaker is very difficult to understand.
	Great listener effort is required. Errors are very distracting. Most words are intelligible, but sentence meaning is often unclear.
0	Speaker is basically incomprehensible.
	Only an occasional word is intelligible.

3-1. If you sometimes had difficulties understanding your partner's English, what do you think caused such difficulties? (E.g., difficult words, inappropriate words, difficult grammatical structures, ungrammatical structures, inaccurate pronunciation, strong accent, etc.)

4. Please indicate how you felt while carrying out the task with your partner. 1 represents "strongly disagree" whereas 5 represents "strongly agree." For instance, if you strongly agree with the statement "I am a student," then you should circle 5 as shown in the example below. Your response will not affect your course grade. Your information will be kept confidential and will only be used for research purposes. Your instructor will not have an access to your response until the end of semester. Thank you for your time.

1 = Strongly disagree

2 = Disagree

3 = Undecided

4 = Agree

5 = Strongly agree

Example. I am a student. **Strongly disagree** 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(1) I felt confident while carrying out the task with my partner.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(2) I felt relaxed while carrying out the task with my partner.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(3) I felt calm while carrying out the task with my partner.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(4) A low level of concentration was required while carrying out the task with my partner.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(5) The task with my partner was easy to complete.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(6) I was able to recover easily from mistakes while carrying out the task with my partner.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(7) I learned that collaborative work is beneficial for learning English while working with my partner.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(8) I would do the task with my partner again.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(9) Doing the collaborative task with my partner was uncomfortable for me.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(10) Doing the collaborative task with my partner was uneasy to me.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(11) Doing the collaborative task with my partner was difficult for me.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(12) Doing the collaborative task with my partner was annoying to me.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(13) Doing the collaborative task with my partner was confusing to me.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(14) Doing the collaborative task with my partner was disappointing to me.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(15) Doing the collaborative task with my partner was enjoyable to me.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(16) Doing the collaborative task with my partner was entertaining to me.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(17) Doing the collaborative task with my partner was exciting to me.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(18) Doing the collaborative task with my partner was fun to me.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(19) Doing the collaborative task with my partner was interesting to me.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(20) Doing the collaborative task with my partner was pleasurable to me.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(21) Doing the collaborative task with my partner was happy for me.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**

(22) Doing the collaborative task with my partner was satisfying to me.

Strongly disagree 1○ 2○ 3○ 4○ 5○ **Strongly agree**