The Effect of Language Aptitude on Recast-Driven L2 Morphosyntax Acquisition: An Overview

Ruirui Jia[1]
Teachers College, Columbia University

ABSTRACT

The purpose of this paper is to review several studies on the effects of language aptitude on the recast-driven acquisition of L2 morphosyntax. Recasts are one of the most commonly used forms of corrective feedback in second language (L2) classrooms. It is clear from research that there are a variety of internal and external factors that affect the ability of L2 learners to benefit from recasting. Among those internal factors, working memory and language analytic ability, as two critical components of language aptitude, have gained increasing attention in recast studies. Given L2 learners' variability in their ability to notice the gap and extrapolate grammatical rules, working memory and language analytic ability may be responsible for learners' ability to attend to the recasts provided. By reviewing and synthesizing relevant research, the current literature review demonstrates that despite the inconsistent results and the need for further verification, working memory and language analytic ability, in general, tend to mediate recasts-driven L2 morphosyntax acquisition. Also, L2 learners have demonstrated a disposition to draw upon different components of language aptitude at different second language developmental stages and response to different types of corrective feedback.

Keywords: language analytic ability, language aptitude, L2 morphosyntax acquisition, recasts, working memory

INTRODUCTION

Recasts, as one of the most frequently used techniques for corrective feedback (Panova & Lyster, 2002), have received enormous attention in investigating its efficacy in promoting second language development. They require L2 learners to notice the gap between what they know of the target linguistic structures and what remains to be acquired. However, studies have shown that recasts often result in the least L2 uptake (Panova & Lyster, 2002) and several external factors were proposed to explain the result such as the salience of target

---

[1] Ruirui Jia received her MA in Applied Linguistics from Teachers College, Columbia University in May 2021. She is interested in L2 individual differences research, instructed second language acquisition and second language processing. Correspondence should be sent to E-mail: rj2568@tc.columbia.edu

language structures, task complexity, contexts of learning, and outcome measures (Li, 2010b). Given the cognitive-interactionist focus of this research domain, internal factors such as individual differences in cognitive abilities are also popular areas of research inquiry. Among them, language aptitude as "an extensively studied individual difference variable" (Li, 2013, p.634) has regained its research popularity for its expanded research scope as it extended from being predictive in nature to being explanatory in how the interaction between aptitude and different learning conditions and stages impose cognitive demands to L2 learners (Li, 2013). Therefore, the exploration of the interaction between aptitude and the effect of recasts could result in a more accurate and comprehensive understanding of the mechanism of L2 learning.

Since language aptitude is a multi-componential concept, incorporating a series of cognitive abilities such as phonetic coding ability, language analytic ability, and working memory (Skehan, 1998), the current paper will only focus on two widely investigated subcomponents of language aptitude---working memory and language analytic ability as working memory plays an important role in regulating attention during complex cognitive tasks, allowing both the storage and manipulation of the information gained from input. Language analytic ability, on the other hand, governs the ability to identify and generalize linguistic patterns, both of which are of critical importance in processing recasts. As L2 learners vary in their ability to notice the gap and extrapolate grammatical rules, working memory and language analytic ability may be responsible for learners' ability to attend to the recasts provided. Thus, by reviewing the literature with regard to language aptitude and recasts, the current paper aims to demonstrate how working memory and language analytic ability as two components of language aptitude mediate the effect of recasts on L2 morphosyntax acquisition.

To begin, the paper will first address the definition of recasts, followed by a detailed introduction of language aptitude and its critical components. Given the prominent role that working memory and language analytic ability play in second language acquisition research, two separate sections will explain the two constructs. After that, several empirical studies on the relationship between language aptitude (working memory and language analytic ability) and the effects of recasts will be reviewed, which is followed by a detailed discussion about the interaction between these two constructs and recast-driven second language morphosyntax acquisition. Finally, a summary of the findings and suggestions for future research will be provided.

RECASTS

Recasts, as one of the subcategories of corrective feedback (Ellis, 2015), are defined as "the reformulation of all or part of a learners' immediately preceding utterance and where, throughout the exchange, the focus of the interlocutors is on meaning, not language as object" (Long, 2007, p. 77). Unlike Long's interpretation of recasts which emphasized meaning negotiation, Sheen (2006) maintained that recasts can be used not only for the negotiation of meaning but also for the correction of forms even if there is no communication breakdown. Thus, they defined recasts as "the teacher's reformulation of all or part of a student's utterance that contains at least one error within the context of a communicative activity in the classroom" (p.365).

As the most frequently and widely used technique for error treatment in instructional settings (Panova & Lyster, 2002), "recasts are unlikely to disrupt the flow of communication between the teacher and a learner" (Revesz, 2012, p. 95), allowing smooth, contingent, nonintrusive, and meaning-oriented pedagogical processes (Li, 2013). Moreover, by providing both positive and negative evidence, recasts enable L2 learners to pay more attention to the form and form-meaning associations (Revesz, 2012) as recasts also function as content confirmation, setting L2 learners free to comprehend the meaning of the utterance (Long, 2007). Thus, their spared attention allows them to notice the gap (Schmidt, 1990, as cited in Ellis, 2015) between what they just said and what was reformed, enabling them to make cognitive comparison (Ellis, 2015) which could push learners to produce modified output that may facilitate their L2 development.

Unlike other types of corrective feedback, recasts cannot be simply categorized as either implicit or explicit, despite a general trend to treat it as an implicit input-providing technique because of its uninterrupted nature (Long & Robinson, 1998). The dichotomous classification could disguise the characteristics that may place recasts on the implicit and explicit continuum (Mackey & Goo, 2007). Features such as the mode of delivery, the length of recasts, the emphasis of prosodic features, and the number of changes could transfer recasts from implicit to explicit to various degrees (Sheen, 2006). Thus, corrective recasts characterized as interrogative intonation, shortened utterances, and a limited number of changes to the original sentence are believed to be more salient for learners to notice (Sheen, 2006). Such a claim was supported by Egi's (2007) study which revealed that learners tend to notice more and benefit more from the recasts that are short and similar to the original sentence because the semantic contingency may reduce L2 learners' attention to the content and thus reduce their processing load, allowing more attention to be spared to form. Moreover, Asari's (2017) research further highlighted the positive effect of salience-enhanced recasts on L2 learners' uptake, indicating that "shorter, segmented, and interrupting recasts were much better predictors of learners' modified output" (p.65) and their subsequent development than normal recasts.

However, the studies exploring the effect of recasts often lead to divergent results and several external factors such as the salience of recasts and the outcome measures are commonly proposed to account for the inconsistency (Goo, 2012; Revesz, 2012; Zhao, 2013). Apart from that, Mackey and Philp's (1998) study also revealed that learners who are more developmentally advanced may benefit more from recasts than those who are developmentally unready, indicating that developmental readiness could be a mediating factor influencing the effect of recasts. Moreover, Lyster and Ranta (1997) accredited the unsettled result to treatment contexts. They claimed that the meaning-focused contexts of instruction such as immersion classrooms which place meaning prior to form may lead to less noticing to form. They also found that learners may fail to distinguish recasts from noncorrective repetition as teachers tend to repeat learners' nonproblematic oral production for communicative purposes, which may veil the corrective nature of recasts. Although counterevidence exists (Yilmaz & Yuksel, 2011), the salience of target language structures can also be a factor contributing to the divergent results as Ono and Witzel's (2002) exploration of two salient language structures (progressive -ing and 3rd person possessive pronouns) and two less salient structures (past tense -ed and plural -s) reported possessive pronouns benefiting more from recasts than plural -s and in Kim's (2019) study; the same result was also found for two Korean structures which differ in salience.

Aside from external factors, learner internal factors are also believed to be critical in explaining the effectiveness of recasts. Unlike those factors external to learner themselves, learner internal factors are mainly those cognitive, conative, affective, and personality-related factors that learners bring with them to a specific learning situation, including aptitude, attitude, motivation, anxiety, etc. Among them, language aptitude as one of the most important cognitive individual variables, has attracted a great deal of attention in L2 acquisition research and is believed to be important in mediating the effects of recasts. Working memory and language analytic ability as two components of language aptitude are essential for noticing and processing recasts. Thus, it is worthwhile to explain in detail the language aptitude construct and how it tends to impact the effectiveness of recasts in the following sections.

LANGUAGE APTITUDE

Language aptitude is regarded as the "specific talent for learning foreign languages that exhibits considerable variation between learners" (Dörnyei & Skehan, 2003, p. 613). As a multi-componential construct, language aptitude is composed of a series of domain-general and domain-specific cognitive abilities. The early and most influential model of language aptitude was proposed by Carroll (1981) who conceptualized language aptitude based on his analysis of the Modern Language Aptitude Test (MLAT) battery (Carroll & Sapon, 1959, 2002) as a combination of four distinct abilities: phonetic coding ability (the ability to code sounds from input so that it can be maintained), grammar sensitivity (the ability to figure out the functions that words fulfill in a sentence), inductive language learning ability (the ability to infer, extrapolate, and generalize grammatical rules from language data), and rote learning ability (the ability to conduct form-meaning mappings and to maintain and recall form-meaning associations). Later on, Skehan (1998) proposed language analytic ability to be the umbrella term for grammar sensitivity and inductive language learning ability in his information processing model, thus narrowing down the conceptualization of the construct into three dimensions: phonetic coding ability, language analytic ability, and rote memory. However, as working memory received more and more research attention in SLA, it has been proposed to replace rote memory as a new component of language aptitude (Robinson, 2005, as cited in Li, 2015) because the traditional rote learning ability was proposed and verified in the heyday of the audiolingual method. Such a method representing decontextualized and discrete learning could not accommodate the recent instructional context where communicative competence, authentic language use, and incidental learning are highlighted (Li, 2015). Given the fact that working memory featuring attention, storage, processing, and internalizing new linguistic input (Li, 2015) was reported to have a close and positive correlation with L2 lexicon, formulaic sequence, collocation, and grammar acquisition (Wen et al., 2016), it has the potential to become one of the most important components of language aptitude. In fact, working memory has been regarded as a cognitive converging space where the three dimensions of language aptitude---phonetic coding ability, language analytic ability, and memory are integrated (Sawyer & Ranta, 2001, as cited in Li, 2013).

After Carroll's classic portrayal of language aptitude, a number of language aptitude models and test batteries were proposed based on different theoretical perspectives for different testing purposes. Among them, Skehan's (2016) Macro-SLA aptitude model which was developed based on the information processing theory linked various aptitude components to different second language developmental stages and the cognitive processes involved. Within the model, phonetic coding ability, which refers to the ability to code and store incoming phonological information, was believed to be responsible for noticing and pattern recognition. Language analytic ability which was defined as the capability to extrapolate and generalize grammatical rules of language (Li, 2015; Skehan, 1998) was believed to be highly correlated with processes such as "pattern recognition, complexification, restructuring, and feedback handling" (Wen et al., 2016, p.9). It is usually measured by the Words in Sentences subtest of MLAT (Carroll & Sapon, 2002) and the inductive language learning ability subset of the LLAMA aptitude test (LLAMA F) (Meara, 2005). However, working memory as a relatively new component as opposed to Carroll's classic model played a significant role in knowledge acquisition processing stages and was also prominent in avoiding errors for production (Wen et al., 2016). Moreover, grounded in cognitive science, the High-Level Language Aptitude Battery (Hi-LAB) developed by the

University of Maryland has offered a richer interpretation and more fine-grained measures of the cognitive constructs that could help predict and explain advanced L2 proficiency. Within the model, along with other constructs such as "long-term memory retrieval, implicit learning processing speed as well as auditory perceptual acuity", an in-depth exploration of working memory was displayed as three subfunctions of the central executive. Updating, inhibitory control, and task switching were identified and measured via three corresponding tests and two span tests; "the letter span and the non-word span test" (Linck et al., 2013, p.535) were proposed to measure phonological short-term memory.

Working memory being considered as a part of language aptitude is relatively recent and previous studies have treated working memory as a separate cognitive variable for investigation. Given its prominence in second language acquisition research, a detailed introduction of working memory will be given in the next section.

Working Memory

Unlike short-term memory (STM) proposed by Atkinson and Shiffrin (1968) who assumed STM to be a simple warehouse for short-term information storage, working memory developed from STM refers to both storage and processing of information. It is defined as "the ability to maintain information in an active and readily accessible state, while concurrently and selectively processing new information" (Conway et al., 2007, p. 3) "necessary for a wide range of complex cognitive activities" (Baddeley, 2003, p.189) such as reasoning, planning, and foreign language learning. There are two general views on the construction of working memory, one of which is a unitary domain-general approach and the other is a multi-componential approach. Based on Baddeley and Hitch's (1974) view, the multi-componential approach divided working memory into the central executive that controls selective attention and suppresses task-irrelevant information and two "slave systems" that are responsible for storing different types of stimuli---the phonological loop that stores and manipulates oral information and the visual-spatial sketchpad that stores and processes visuospatial information. Later, Baddeley (2000) added the fourth component, the episodic buffer, into the model, functioning as a storage system to integrate the visual, spatial, and phonological information obtained from the two storage systems into a single unit. Based on this view, working memory has been operationalized as phonological short-term memory (PSTM) and complex working memory. PSTM which is usually measured through non-word recall and digit span tests is important for the storage of phonological information (Baddeley, 2003), but it is limited in capacity. It means that if abundant information is received, the earlier heard items maintained in the temporal storage system will suffer from decaying before they can be rehearsed in the subvocal rehearsal system where the memory gets strengthened. On the other hand, complex working memory which is usually measured by complex span tests such as reading, listening, and operation span tests is believed to be crucial in attentional control (Baddeley, 2003). It helps to switch and monitor learners' attention to specific stimuli and to activate the information stored in the long-term memory. However, Cowan (1999) believed that Baddeley and Hitch's (1974) model failed to comprehensively include other modalities that are activated during language learning. Thus, to depict a more exhaustive picture of working memory, Cowan (2005) proposed the embedded-processes model which was influential for its process-based interpretation of the architecture of working memory. Such a model treated working memory as a unitary construct and perceived long-term memory as the only existing memory system. Under this model, working memory is just an activated part of long-term memory within the focus of attention which is limited in capacity and is controlled by the central executive for attending, monitoring, and searching the information needed for the ongoing tasks. Since it was believed that the information going through the focus of attention would experience a deeper and more extensive processing and analysis, new information that is expected to be learned must enter the focus of attention to be stored and encoded in the long-term memory (Robinson, 2003).

Despite the theoretical differences, both models agree on the interaction between working memory and long-term memory. There has been no doubt in cognitive neuroscience that the central executive mechanism of working memory coordinates the interaction between long-term memory and working memory, providing “an interface between perception, long-term memory, and action” (Gazzaniga et al., 2014, p.512). Moreover, many neuroimaging studies have confirmed that the functioning of working memory can activate the areas associated with long-term memory (Baddeley, 2010). Thus, it is not surprising that the storage and processing of incoming language data would activate long-term memory for information retrieval, which allows prestored knowledge to be maintained in an accessible state for further manipulation and processing (Baddeley, 2010).

Language Analytic Ability

Apart from working memory, language analytic ability, as another component of language aptitude, is also a cognitive construct of inquiry in this review. Skehan (1998) conceptualized language analytic ability as the combination of Carroll’s (1981) grammar sensitivity and inductive language learning ability and defined it as learners’ capacity to extrapolate and generalize grammatical rules and patterns. It is usually measured by the Words in Sentences subtest of the Modern Language Aptitude Test (MLAT) (Carroll & Sapon 2002) and the inductive language learning section of the LLAMA test, LLAMA_F (Meara, 2005). Moreover, Skehan (2016) associated language aptitude components to different L2 developmental stages and various cognitive processes in his Macro-SLA aptitude model where language analytic ability was proposed to be linked to pattern recognition, restructuring, and extending. Such an association helps to explain the essential roles that language analytic ability plays in generalizing grammatical patterns from the input and handling the feedback received and places the construct in a larger picture of L2 development. Furthermore, language analytic ability, as one of the most important explicit language aptitude components, is found to be highly associated with L2 general proficiency (Li, 2013) and mediates the learning of explicit knowledge (DeKeyser, 2000). Given its’ role in explicit learning and rules extrapolation, a burgeoning number of studies examining the relationship between language analytic ability and the effectiveness of different corrective feedback type were published. Some critical research pertaining to the current theme will be reviewed in the next sections.

EMPIRICAL STUDIES ON LANGUAGE APTITUDE AND RECASTS

Since processing recasts requires L2 learners to not only notice the gap in their language system but also identify the correct language form in the input, individual differences in working memory capacity and language analytic ability could affect how much linguistic evidence learners are able to capture and manipulate and how well learners are able to generalize patterns from the input. It is predicted that learners with higher working memory capacity and higher language analytic ability could gain more L2 form knowledge through recast-driven interaction as they tend to notice more and extrapolate more target-like linguistic forms than their counterparts. However, the studies on the relationship between language aptitude components and recast-driven L2 morphosyntax development fail to reach a clear conclusion and the results vary.

Studies on Working Memory and the Effect of Recasts

Mackey et al.'s (2002) study investigated how (N=30) Japanese ESL learners' working memory capacity affected their noticing and recast-driven development of English question formation. In their study, the participants were required to complete a picture drawing and a story completion pretest before participating in three treatment sessions where they received recasts from native English speakers. After an immediate posttest, the participants were randomly divided into two groups: a delayed posttest group taking the delayed test two weeks later and an L1 stimulated recall group. The participants' complex working memory was measured through a listening span test (LS) in both their first language Japanese and second language English. Their phonological short-term memory (PSTM) was measured through a nonword span (NWS) test. In line with the hypothesis, the study revealed that learners with higher working memory capacity (WMC) tended to report more noticing and demonstrated more significant long-term development than their low WMC counterparts who only showed more immediate and less-sustained development.

Similar to Mackey et al. (2002), Revesz's (2012) study also confirmed the hypothesis, but it further demonstrated the influence of different outcome measures on the effectiveness of recasts. Ninety (N=90) EFL learners in three Hungarian high schools were recruited to examine their improvement in English past progressive construction. The study followed a pretest–posttest–delayed posttest design and the participants were randomly assigned to two experimental groups (the recast group and the non-recast group) and a control group with the former two groups receiving three rounds of oral description treatment before the immediate posttest. In each testing section, learning was measured by three types of task: a grammatical judgment task, a written production task, and two oral production tasks. A subset of the participants in both the recast (N=22) and non-recast group (N=23) were administered both the PSTM and the complex working memory testing six months after the delayed posttest with their PSTM being measured by a digit span (DS) and an NWS test and their complex WM by a reading span (RS) test. The study revealed that recasts led to the greatest improvement in the oral production test but the least in the written grammatical judgment test. Moreover, learners with higher RS scores performed better on the written test whereas those with higher DS and NWS scores performed better on the oral test. This further indicated that L2 learners are highly likely to draw on PSTM and complex working memory for different learning processes to various extents (Revesz, 2012). The finding inspired Zhao (2013) to examine whether different components of working memory could predict recast-driven L2 learning. Sixty-five (N=65) first-year English major students from three classes in a Chinese university participated in the study and were randomly divided into three groups: the corrective recast, task control, and test control group with only the first group receiving recasts while performing the following three tasks during the classroom treatment sessions: the description of the person in a photo, the description of partners' lifestyle and the description of a Chinese city. The participants' PSTM was measured by both DS and NWS tests and their complex working memory was measured by an LS test. The results highlighted the significant role of PSTM in moderating noticing as both the NWS and DS scores were positively correlated with their oral posttest performance, though only the NWS scores had a predictive effect on their posttests. However, despite a moderately positive correlation between their LS scores and their delayed posttest performance, LS scores were negatively correlated with learners' immediate posttest. Zhao attributed the result to the longer time that learners with higher WMC needed to consolidate the information because they were able to capture and store an overwhelming amount of information from recasts whereas their low WMC counterparts could only hold a limited amount due to their limited storage and processing capacity.

Given the fact that studies reviewed above only involved orally-delivered recasts, Sagarra and Abdul (2013) further examined how working memory mediated the effect of computer-delivered feedback realized through different modalities on the development of Spanish noun-adjective gender and number agreement. Two hundred eighteen (N=218) native English speakers of L2 Spanish were involved in the study, and they were randomly divided into seven groups characterized by a combination of different feedback modalities (oral and written) and feedback types (no feedback, utterance rejection, recasts, and enhanced recasts). All learners were required to attend a vocabulary presentation before taking the vocabulary and grammar pretest. Seven types of feedback were given for the sentence-gap filling task during the treatment session, after which the participants were required to complete one immediate written posttest, two delayed written tests, two oral delayed posttests, and a working memory test measured by an RS test. The study revealed that working memory was positively associated with the performance of the oral recast group but not the written recast group, indicating that "processing oral recasts may consume more attentional resources than written ones" (p.211).

However, conflicting results were not uncommon. Trofimovich and his colleagues (2007) examined how different aptitude components (working memory, language analytic ability, and attentional control) were associated with L2 learners' noticing of recasts and their subsequent development of English possessive determiners, transitive and intransitive verbs. Thirty-two (N=32) French-speaking participants were required to complete a picture description task where they received recasts in the form of morphosyntactic recasts, lexical recasts, or both, and they were asked whether any differences between their own production and the recasts were perceived after each recast episode to capture their noticing. The same type of task they received during the treatment was used for not only the pre-test but also for the immediate and delayed posttest to assess their development. Their working memory was measured through both an L1 letter-number sequencing test and an L2 non-word recognition test. The study demonstrated that working memory did not mediate learners' noticing nor their subsequent development and the researchers proposed that the salience of the recasts could be a potential factor leading to more noticing with less consumption of working memory.

However, even when recasts were delivered in an implicit way, the same result was found. Yilmaz (2013) investigated how working memory, measured by an operational span test, interacted with native English speakers' acquisition of two Turkish structures: locative case morpheme and plural morpheme through recasts and explicit correction. Forty-eight (N=48) participants were divided into three groups: a recast group, an explicit correction group, and a control group. In the treatment sessions, they received corresponding feedback for a one-way information gap activity. To measure their knowledge concerning the two target language structures, a comprehension test, an oral production test, and a recognition test were adopted for both the immediate and the delayed posttest. Similar to Trofimovich et al.'s (2007) study, no significant correlation was found between working memory and the effect of recasts. The researcher speculated that the communicative context where learners need to answer a series of meaning-oriented questions might veil the corrective nature of the recasts, inhibiting them from noticing the gap, thus leading to the low involvement of working memory.

Similarly, Kim and Cho's (2017) study also emphasized the influence of learning context on the consumption of working memory but it was explained from a different perspective. They explored how individual differences in working memory influenced

Korean EFL learners' acquisition of regular and irregular English past tense during one-on-one conversational interaction. Forty-two (N=42) participants were randomly divided into a control and a corrective recast group. The treatment session contained two story sequence tasks and one information gap task with only the corrective recast group receiving explicit recasts whenever there was an error in their past tense usage. The participants' complex working memory capacity was measured through an LS test and their PSTM was measured by an NWS test. The study illustrated that neither the participants' PSTM nor their complex working memory had a significant correlation with their L2 improvement, which again rejected the prediction that learners with higher WM capacity could gain more L2 knowledge from recast-driven interaction. Apart from the saliency of recasts and the nature of the target language structure, the result can also be explained by the more intensive interactional context adopted in this study as the one-on-one coaching-based learning context can make the recasts more salient to be noticed. The interactive task which was conducted in a laboratory setting without time limits can help the learners notice and focus on the corrective nature of the recasts and render the high involvement of their working memory unnecessary.

Studies on Language Analytic Ability and the Effect of Recasts

Studies exploring the interaction between language analytic ability (LAA) and the effect of recasts are also subject to inconsistent results and according to Li (2015), the mediating roles that language analytic ability plays are often associated with the implicit and explicit nature of the corrective feedback provided. Sheen (2007a) compared the correlation between language analytic ability and the effect of recasts and metalinguistic correction on ESL learners' acquisition of English indefinite article *a* and the definite article *the*. One hundred and eleven (N=111) participants were divided into recast, metalinguistic correction, and control group for two-story narration treatment tasks. Their LAA was measured through a language analysis test previously adopted by Schmitt et al. (2003) and their linguistic knowledge was measured through a speeded dictation, a writing task, and an error correction test for the pre-test, post-test, and delayed posttest. The study revealed that LAA was only significantly correlated with the effect of metalinguistic correction but not with recasts, which went against Trofimovich et al.'s (2007) finding where language analytic ability measured by the Words in Sentences subtest of MLAT (Carroll & Sapon, 2002), demonstrated a significant and positive correlation with the effect of recasts on the learning of English possessive *his/her*.

Compared with the two studies detailed above, Li (2015) maintained that the complexity of the target language structures could be a plausible reason for the divergent results obtained by Sheen (2007a) and Trofimovich et al. (2007) as possessives are much simpler and more transparent than articles to process. Such an explanation was also supported by Yilmaz's (2013) study where he investigated how forty-eight (N=48) native English speakers' language analytic ability, measured by the LLAMA aptitude test, mediated their learning of two Turkish target language structures---locative case morpheme /-DA/ (with four allomorphic variations: [-de], [-da], [-te], and [-ta]) and plural morpheme /-lAr/ (with two allomorphic variations: [-ler] or [-lar]) through recasts and explicit correction. The study revealed that LAA was only correlated with the effect of recasts for the learning of the plural structure as the locative structure imposed more processing demands on L2 learners for its more complex allomorphic variations.

Moreover, the salience of recasts was proposed to be another reason for the different results found in Sheen's (2007a) and Trofimovich et al.'s (2007) study as the recasts in Sheen's (2007a) study were employed in classrooms. These tended to be more implicit and difficult to be noticed whereas the recasts employed in Trofimovich et al.'s (2007) study were delivered by computers, so the recasts were more explicit and easier to be noticed (Li, 2015). However, another Sheen's (2007b) study revealed that as long as recasts were made more explicit for noticing, learners with higher LAA could benefit from both recasts and metalinguistic correction. In this study, Sheen compared the correlation between language analytic ability, measured through a language analysis test previously used by Schmitt et al. (2003), and the effect of focused written recasts and written metalinguistic correction on one hundred and eleven (N=111) intermediate ESL learners' acquisition of English indefinite article *a* and the definite article *the*. It was found that learners with higher LAA can benefit from both types of written corrective feedback but the improvement was more evident when metalinguistic information was given, which suggested that the explicit type of corrective feedback could arouse more awareness for learners with higher LAA to conduct language analysis (Sheen, 2007b) but the focused written recasts were also salient enough for learners with higher LAA to gain benefit.

To arouse learners' awareness of the corrective nature of recasts, the learning context could also be made conducive for learners to attend to the recasts provided even for those structures that are less salient to process. Kim's (2019) study explored language analytic ability and the relative effect of recasts on L2 Korean learners' acquisition of Korean honorific subject-verb agreement and the object relative clauses with the former structure having lower perceptual salience than the latter. Forty-five (N=45) participants with different nationalities were divided into a recast and a control group for four communicative tasks realized through picture description activities. Their language analytic ability was measured through an artificial language test previously used by Schmitt et al. (2003) and their L2 development was assessed via a similar type of task used during the treatment. The study demonstrated that learners with higher LAA showed more development than those with lower LAA for both target structures, indicating that learners with stronger LAA experienced deeper processing of recasts, allowing them to find and generalize more rules from the feedback, but such development was evident for both language targets regardless of the level of salience. Kim (2019) explained that the dyadic interaction adopted in the study where the activities were more form-focused made the corrective intention of the feedback more likely to be noticed, leading to L2 learners allocating more attention to form even for less salient language targets.

Studies on Working Memory, Language Analytic Ability, and Recasts

Although Trofimovich et al.'s (2007) and Yilmaz's (2013) study where the roles of working memory and language analytic ability were explored in relation to the effect of corrective feedback found only language analytic ability to be significantly correlated with recast-driven L2 learning, two studies by Li (2013, 2015) revealed that both working memory and language analytic ability were predictors of learners' performance under the condition of recasts. In 2013, Li explored how individual differences in language aptitude in terms of working memory and language analytic ability mediated learners' acquisition of Chinese classifiers differently under the condition of recasts and metalinguistic correction. Seventy-eight (N=78) learners of Chinese were assigned to recast, metalinguistic correction, and control groups. The Chinese proficiency test, grammatical judgment test (GJT), and elicited imitation test (EI) were administered along with a working memory test which was a listening span test, and language analytic ability was measured through the Words in Sentences subtest of MLAT (Carroll & Sapon, 2002). The principal component analysis and the SEM analysis confirmed that working memory and language analytic ability tapped into the same construct which was aptitude were both predictive of L2 competence. The study revealed that both components were significant predictors of the learning of Chinese classifiers but they were sensitive to different types of corrective feedback. LAA was reported to be more sensitive to the effects of recasts given learners with higher LAA tended to notice more about the linguistic problems and were better at extrapolating and generalizing rules and patterns from the negative and positive evidence provided by the recasts. Li (2013) explained that the salience and transparency of the language structure, the experimental context which was in a laboratory setting, and the partial and didactic corrective recasts could make the corrective nature of recasts more salient to be noticed and push the learners to notice, process, and identify the rules behind the target language structure. Moreover, the relatively simple and transparent target structure adopted in this study did not require complex form and meaning mappings, so the learning was within the learners' processing capacity, making it possible for them to figure out the language patterns. However, working memory was a better predictor of the effect of metalinguistic correction because explicit feedback requires learners to consciously memorize linguistic facts, which puts a heavy burden on the learners' working memory to selectively attend to the linguistic information contained in the feedback and at the same time inhibit the competing or irrelevant information to perform the task.

The follow-up study conducted by Li (2015) also demonstrated the same pattern but it was the first time that proficiency was introduced as a variable in aptitude-recast research. Unlike the study published in 2013, this study only considered working memory and language analytic ability in relation to the effect of recasts, and there were only twenty-eight (N=28) learners of Chinese recruited with 17 of them being beginner Chinese learners and the rest being advanced Chinese learners. With target structure, treatment tasks, the operationalization of recasts, and the testing of proficiency, treatment effects and aptitude constructs being equal, the study again demonstrated that working memory and language analytic ability were significantly correlated as both tapped into the same construct. Moreover, based on the regression analysis, the study found that LAA was a stronger predictor of beginner learners' acquisition of Chinese classifiers whereas WM was primarily responsible for predicting advanced-level learners. Li (2015) accredited the results to the nature of the target language structure, arguing that for beginner learners, they have to first figure out and extrapolate the form of Chinese classifiers and then conduct semantic mappings between classifiers and their corresponding nouns. Such syntactic permutation at the first stage could place a heavy burden on beginning learners' language analytic ability, eclipsing the role of working memory. However, for advanced learners, they might have been exposed to the target structure, so they may draw more on their working memory at this stage to store new linguistic input from the aural input and retrieve the knowledge previously learned and stored in their long-term memory. Despite the influence of the target language structure, the findings indicated how L2 learners with different proficiency levels may draw upon working memory and language analytic ability differently throughout their learning process.

DISCUSSION

To investigate the mediating role that working memory plays in recast-driven L2 learning, a number of studies have been reviewed. Although most studies confirmed the hypothesis that learners with higher working memory capacity tend to gain more from recasts (Li, 2013, 2015; Mackey, et al., 2002; Revesz, 2012; Sagarra & Abbuhl, 2013; Zhao, 2013), counterevidence was not unusual and differences in the modality of recasts (Sagarra & Abbuhl, 2013), the salience of recasts (Trofimovich et al., 2007; Yilmaz, 2013; Zhao, 2013) and the nature of learning context (Kim & Cho, 2017; Yilmaz, 2013) across studies could account for the divergent results. The dyadic communicative task adopted in Kim and Cho's

(2017) study can increase the learners' noticing of the corrective nature of the recasts because the untimed one-on-one focused interaction carried out in the laboratory setting can help the learners concentrate on the ongoing task, reduce the level of distraction that they might have in real English classes and make the recasts more salient for them to notice. Thus, a high involvement of working memory becomes unnecessary in such an interactive communicative task. The nonsignificant relationship found in Yilmaz's (2013) study could also be the result of the communicative nature of the activities where learners had to answer a series of questions, which to some extent distracted learners' attention to form. Thus, the relatively more output required in such a context could inhibit the learners from noticing the corrective nature of recasts, hence leading to less consumption of working memory. Moreover, when recasts were made more explicit, it could reduce the burden of noticing and the consumption of working memory because the adoption of a raising intonation for repetition made the negative evidence more salient and shifted the learners' focus from meaning to form. Moreover, when recasts were made short, it increased the possibility for L2 learners to make a cognitive comparison (Ellis, 2015) which could encourage them to restructure their L2 knowledge represented in their long-term memory through pushed output, guaranteeing better effect on learners' uptake compared with ordinary recasts (Revesz, 2012). Moreover, when comparing oral and written recasts, Sagarra and Abbuhl's (2013) research only found a positive correlation between working memory and the performance of the oral recast group, which indicated that working memory imposed a different influence on L2 learners' performance when recasts were adopted in different modalities, suggesting that more attentional resources were needed for processing oral instead of written recasts. In sum, the above discussion presents several external factors that could impact the effect of working memory on recast-driven L2 morphosyntax learning. However, various factors are intertwined in real research settings, so individual factors cannot give us fixed results all the time. Thus, more studies are needed to find out whether there is an interaction between different factors and whether such an interaction could open a new window to the relationship between working memory and the effect of recasts.

Despite the general confirmation of the hypothesis that learners with higher working memory capacity could gain more L2 form through recast-driven interaction, the contribution of different working memory components is complex in nature. PSTM and complex WM were reported to be responsible for different learning processes to various extent (Revesz, 2012; Zhao, 2013) and the time of development also demonstrated differences between the two components. Learners with higher PSTM capacity were reported to perform better on oral tasks (Revesz, 2012) as higher PSTM enabled them to store the phonological information in their short-term memory long enough to be able to go through rehearsal before decaying and allowing long-term memory trace to be created to facilitate the proceduralization of the L2 knowledge (N. Ellis, 2005, as cited in Revesz, 2012). Since producing oral output bears time pressure, learners were more likely to draw on the procedural knowledge stored in their long-term memory for automatic processing (Ellis, 2015). However, learners with higher complex WM were found to perform better in GJT and written description tasks (Revesz, 2012) as their ability to switch, control, and focus their attention among various ongoing tasks allowed them to consciously allocate more attentional resources to recasts, leading to the creation of declarative knowledge. Since the tasks do not require spontaneous production, learners with higher complex WM were more likely to draw on their metalinguistic knowledge to conduct explicit linguistic processing for checking and rewriting answers (Revesz, 2012). However, unlike the facilitating effect of PSTM on both the immediate and delayed oral tests, complex WM was found to be negatively correlated with the immediate oral test but positively correlated with the delayed oral test in a moderate way (Zhao, 2013). This finding highlighted the likelihood that learners with lower WMC might tap into other cognitive abilities such as language analytic ability to compensate for their limited WM capacity (Zhao, 2013) whereas learners with higher WM capacity would need more time to proceduralize the information gleaned from the input.

Another word of caution for interpreting the results is that studies differ in how complex working memory was measured. As indicated below, the validity of the results could be undermined to various degrees if learners' working memory capacity cannot be fully captured under certain conditions or measured by certain tests. Compared with other studies using working memory span tests such as reading, listening, and operation span tests to measure both the storage and processing capacity of working memory, the letter-number sequencing test used in Trofimovich et al.'s (2007) study failed to capture how well learners can retain relevant information accessible in their phonological short-term memory (Goo, 2012). Such a measure tended to allow more time for learners to rehearse the incoming information than those complex working memory tests, hence making the test less cognitively demanding, resulting in lower involvement of working memory (Goo, 2012). Revesz's (2012) and Sagarra and Abbuhl's (2013) studies which adopted the reading span task did not limit the time for the participants to read the sentences. This could jeopardize the validity of the result because the involvement of working memory could be low when learners were not under pressure to complete the test. This could justify the use of the listening span test adopted by half of the studies reviewed because the short intervals between each test stimulus pre-recorded in the audio form can impose more pressure on the participants' working memory to store sentence-final words and process the plausibility of each sentence at the same time. Thus, the high involvement of working memory could result in more reliable data. Furthermore, among all the studies reviewed, only Mackey et al. (2002) administered the complex working memory test in the participants' second language. Though Trofimovich et al.'s (2007) study also adopted the L2 non-word recognition test, the simple working memory test only intended to measure storage instead of storage and processing as a whole. Despite no uniform correlation found between L1 and L2 working memory capacity, most studies favor the stance that L1 working memory capacity is larger than L2 working memory capacity even in simple working memory tests such as DS and NWS test (Van de Noort et al., 2006). Thus, if there was indeed a significant difference between L1 and L2 working memory capacity, only testing L2 learners' L1 working memory might not truly reflect their L2 linguistic behavior when engaging in recast-driven interaction. When it comes to listening span tests where the recall of the sentence-final word and the accuracy of grammaticality and plausibility judgment are usually measured, only Li (2013, 2015) and Zhao (2013) took reaction time into consideration. If the processing time was ignored from the rating, the potential trade-off effect between time and accuracy might not be controlled, which could undermine the validity of the measure of working memory in terms of both storage and processing.

Overall, the effect of working memory on recast-driven L2 development is complex in nature. Despite most studies confirming the hypothesis that learners with higher working memory could gain more benefit from the recasts provided, the limited amount of evidence is not reliable to draw an early conclusion. Differences in the measures of working memory, the saliency of recasts, the time of development, and the intensity of the conversational context could lead to divergent results and make studies difficult for comparison.

As for language analytic ability, despite the inconsistent results, most studies confirmed a positive correlation between LAA and recasts (Li, 2013; Li, 2015; Kim, 2019; Trofimovich et al., 2007). However, such a trend should be interpreted with caution as salience in terms of recast characteristics, experimental contexts, as well as target language structures, play an important role in promoting learners' awareness of the corrective nature of recasts. The English possessive *his/her* in Trofimovich et al.'s (2007) study and the Chinese classifier in

Li's (2013) study were more salient, transparent, and simple for learners to notice and process compared with the English article *a/the* in Sheen's (2007a) study and the Turkish locative allomorphic variations in Yilmaz's (2013) research. Moreover, Kim's (2019) study where LAA was related to both salient and non-salient structures provided new insights into how the explicitness of the learning contexts could also affect learners' noticing and the interpretation of the recasts provided. When learning activities focused more on eliciting learners' form-oriented production, learners were more likely to allocate their attention to form, and those with higher LAA could interpret more about the recasts and go through deeper processing (Kim, 2019). Thus, salience seems vital to increasing learners' awareness. In the same token, compared with explicit and implicit feedback, if by any means the implicit feedback could be made more salient such as the focused written recasts adopted in Sheen's (2007b) study, LAA would also be a potential predictor for the effects of recasts. Therefore, just as Yilmaz (2013) and Kim (2019) mentioned, as long as learners are aware of the corrective intention of recasts, a stronger correlation between learners' cognitive abilities and the effect of recasts could be expected.

Considering working memory (WM) and language analytic ability (LAA) together, it is highly likely that they are interconnected in some way as both of them are subcomponents of the same construct, language aptitude. The central executive of working memory seems to take on a similar job as language analytic ability for linguistic processing, though LAA can process more complex morphosyntax than WM (Li, 2010a). Moreover, the conscious awareness associated with LAA is also an important feature of the central executive which presides over attentional control. Such a claim was supported by Li's (2010a) correlation analysis as a significant but marginal correlation was found between working memory and language analytic ability, revealing that working memory and language analytic ability indeed share something similar but at the same time, they are individual cognitive constructs in nature (Li, 2010a). Li's other two studies (2013, 2015) also verified the result as the SEM and component analysis demonstrated that working memory and language analytic ability captured the same construct but held different coefficients in relation to aptitude with WM being .39 and LAA being .78. Given the statistical evidence, it is crucial to discuss qualitatively in what ways the two constructs are related and also differ from each other under the condition of recasts.

Just as Li (2010a) maintained, working memory and language analytic ability are related to each other in that the state of one construct tends to affect the function of the other. Higher working memory capacity could allow the phonological information captured from recasts to be stored in PSTM long enough for linguistic processing where language analytic ability is at work whereas lower working memory capacity could otherwise lead to insufficient processing and less accurate interpretation as the information suffers from decay before the procedure is accomplished. On the other hand, higher language analytic ability is related to more efficient working of central executive and it helps to reduce the storage burden placed upon PSTM, allowing more incoming information to be captured for further processing. On the other hand, lower language analytic ability could impose heavy memory load as more information is waiting to be analyzed due to its slow and deficit processing speed.

However, the two constructs are also different in many ways. As introduced in the earlier section, working memory and language analytic ability differ in that working memory is believed to be domain-general and contributes not only to language learning but also to other complex cognitive activities such as solving math problems and reading books whereas language analytic ability is believed to be domain-specific and pertains to identifying language patterns and making linguistic generalizations. Moreover, working memory and language analytic ability are sensitive to different types of corrective feedback. Although Li's (2013) study demonstrated that working memory was more sensitive to explicit feedback whereas language analytic ability was more sensitive to implicit feedback for the learning of Chinese classifier, more replication studies are needed to verify the result as the target structure adopted in this study bears its own features. The Chinese classifier requires L2 learners to first acquire the syntactic permutation (numeral + classifier + noun) and then conduct semantic mapping between classifiers and their corresponding nouns (Li, 2013). The uses of recasts could put more processing demands on learners' language analytic ability as recasts (being an implicit type of corrective feedback) entailed learners to put more effort on noticing, identifying, and extrapolating the grammatical rules and patterns. The effect of WM might be eclipsed by that of LAA. However, metalinguistic feedback has already made the target syntactic pattern explicit for noticing, so working memory could play a more dominant role in attentional control, encoding, and storing correct classifiers and at the same time suppress distracting classifiers to accomplish classifier-noun mappings (Li, 2013). Given the limited number of studies investigating aptitude components and the relative efficacy of different types of corrective feedback, whether Li's finding could be generalized into other linguistic structures, learning contexts, and population is a question too early to answer. Thus, Li's (2013) study could only bring us to the point that L2 learners may draw on working memory and language analytic ability differently in response to different types of corrective feedback.

Working memory and language analytic ability may also play a different role at different L2 developmental stages (Cowan, 1999, as cited in Li, 2015). When differences in the level proficiency were factored into the study, Li's (2015) study showed that advanced learners resorted more to working memory than language analytic ability as they might have already been exposed to the syntactic structures at their early stage of learning the target structure. This could result in the storage of new linguistic data obtained from recasts and the retrieval and reactivation of their existing linguistic knowledge stored in their long-term memory to be more important. Thus, working memory responsible for information storage and attentional control could play a more dominant role in storing correct linguistic forms and inhibiting distracting information. On the other hand, beginner learners who have less exposure to the target language tended to draw more upon language analytic ability because the identification of the linguistic regularities required them to extrapolate and generalize the rules from recasts during the initial stage of learning the structure, putting more processing demand on their language analytic ability instead of memory load. However, more replication studies are also needed to verify and generalize the results.

CONCLUSION

The current review examined the correlation between WM and LAA and the effectiveness of recasts in terms of the acquisition of L2 morphosyntax. Although studies revealed inconsistent results, working memory and language analytic ability tend to mediate recast-driven L2 morphosyntax acquisition in a positive way and L2 learners have demonstrated a disposition to draw upon different components of language aptitude (working memory and language analytic ability) at different second language developmental stages and response to different types of corrective feedback.

As discussed earlier, the differences in the operationalization of the cognitive constructs (i.e., LS/RS/OPSAN for WM; MLAT/LLAMA for LAA), the measures of learners' development (oral tasks vs written tasks vs GJT), the salience of recasts, the complexity of linguistic targets, and the nature of learning contexts could render the studies difficult for comparison. Thus, the current review only revealed the factors that could influence the interaction between language aptitude and recasts and more studies are needed to make valid comparisons to either confirm, reject, or provide new perspectives to the findings of the current literature.

Furthermore, to depict a more precise and comprehensive picture of aptitude components, multiple measures are encouraged to be used for capturing the same constructs and more fine-grained abilities are expected to be identified along with the development of their corresponding measures that could tap into the sub-functions of a larger construct for a more in-depth understanding. Based on Skehan's Macro-SLA model which emphasized the link between aptitude components and different second language developmental stages (Skehan, 2016), future studies are also encouraged to take a process-oriented stance (Li, 2015) to discuss the relationship between language aptitude and the effect of recasts as most studies reviewed above adopted a product-oriented approach, ignoring language learning as a process. If we only zoom in to a specific time of learning, a bigger picture would be missed. Thus, longitudinal studies or the incorporation of proficiency into the cross-sectional design of aptitude-feedback research could allow us to probe deeper into how L2 learners draw on different language aptitude components at different learning stages and whether aptitude components could play a dynamic role across time (DeKeyser, 2015), the finding of which could provide us with valuable pedagogical implications for future language instructions.

REFERENCES

Asari, Y. (2017). Salience-enhanced recasts and their effects on learners' production of uptake and modified output. *Journal of Pan-Pacific Association of Applied Linguistics*, *21*(1), 65-84.

Atkinson, R.C., & Shiffrin, R.M. (1968). Human memory: A proposed system and its control processes. In K. W. Spence., & J. T. Spence (Eds.), *Psychology of learning and motivation* (pp.89-195). Academic Press. https://doi.org/10.1016/B978-0-12-121050-2.50006-5

Baddeley, A. & Hitch, G. (1974). Working memory. In G. Bower (Eds.), *The Psychology of Learning and Motivation* (pp. 47–89). Academic Press.

Baddeley, A. (2000). The episodic buffer: a new component of working memory? *Trends in Cognitive Science, 4*(11), 417-423. https://doi.org/10.1016/s1364-6613(00)01538-2

Baddeley, A. (2003). Working Memory and Language: An Overview. *Journal of Communication Disorders, 36*, 189-208. https://doi.org/10.1016/s0021-9924(03)00019-4

Baddeley, A. (2010). Working memory. *Current Biology*, *20*(4), 136-140. https://doi.org/10.1016/j.cub.2009.12.014

Carroll, J. B. (1981). Twenty-five years of research on foreign language aptitude. In K. C. Diller (Ed.), *Individual differences and universals in language learning aptitude* (pp. 83-118). Newbury House.

Carroll, J. B. & Sapon, S. M. (1959/2002). *Modern Language Aptitude Test (MLAT)*. The Psychological Corporation.

Conway, A. R. A., Jarrold, C., Kane, M. J., Miyake, A., & Towse, J. N. (2007). Variation in working memory: An introduction. In A. R. A. Conway, C. Jarrold, M. J. Kane, A. Miyake, & J. N. Towse (Eds.), *Variation in working memory* (pp. 3-17). Oxford University Press.

Cowan, N. (1999). An embedded-process model of working memory. In A. Miyake, & P. Shah (Eds.), *Models of working memory: Mechanisms of Active Maintenance and Executive Control* (pp. 62-101). Cambridge University Press. https://doi.org/10.1017/CBO9781139174909.006

Cowan, N. (2005). *Working memory capacity*. Psychology Press. https://doi.org/10.4324/9780203342398

DeKeyser, R. (2000). The robustness of critical period effects in second language acquisition.

Studies in Second Language Acquisition, *22*, 499–533.
DeKeyser, R. (2015). The future of aptitude research. In Z. Wen, M. B. Mota, & A. McNeill (Eds.), *Language Aptitude: Advancing theory, testing, research, and practice* (pp. 317-329). Routledge.
Dörnyei, Z., & Skehan, P. (2003). Individual differences in second language learning. In C. Doughty, & M. H. Long (Eds.), *The handbook of second language acquisition* (pp. 589-630). Blackwell.
Egi, T. (2007). Interpreting recasts as linguistic evidence: Roles of linguistic target, length, and degree of change. *Studies in Second Language Acquisition*, *29*(4), 511-537. https://doi.org/10.1017/S0272263107070416
Ellis, N. C. (2005). At the interface: Dynamic interactions of explicit and implicit language knowledge. *Studies in Second Language Acquisition*, *27*, 305–352.
Ellis, R. (2015). *Understanding second language acquisition.* Oxford University Press.
Gazzaniga, M., Ivry, R., & Mangun, G. (2014). *Cognitive neuroscience: The biology of the mind*. W. W. Norton & Company.
Goo, J. (2012). Corrective feedback and working memory capacity in interaction-driven L2 learning. *Studies in Second Language Acquisition, 34*(3), 445-474. http://doi.org/10.1017/S0272263112000149
Kim, S., & Cho, Y. (2017). The effects of recasts and working memory on Korean EFL learners' past tense accuracy. *English Teaching*, *72*(4), 105-132. https://doi.org/10.15858/engtea.72.4.201712.105
Kim, J. (2019). The relative effect of recasts on L2 Korean learners' accuracy development of two different forms and its relationship with language analytic ability. *Language Teaching Research*, 1-25. https://doi.org/10.1177/1362168819859910
Li, S. (2010a). Corrective feedback in perspective: The interface between feedback type, proficiency, the choice of target structure, and learners' individual differences in working memory and language analytic ability. (Publication No. 3432414) [Doctoral dissertation, Michigan State University]. ProQuest Dissertations Publishing.
Li, S. (2010b). The effectiveness of corrective feedback in SLA: A meta-analysis. *Language Learning*, *60*, 309–365. https://doi.org/10.1111/j.1467-9922.2010.00561
Li, S. (2013). The interactions between the effects of implicit and explicit feedback and individual differences in language analytic ability and working memory. *The Modern Language Journal*, *97*(3), 634-654. https://doi.org/10.1111/j.1540-4781.2013.12030.x
Li, S. (2015). Working memory, language analytic ability and L2 recasts. In Z. Wen, M. B. Mota, & A. McNeill (Eds.), *Working memory in second language acquisition and processing* (pp.139-159). Multilingual Matters. https://doi.org/10.21832/9781783093595-012
Linck, J. A., Hughes, M. M., Campbell, S. G., Silbert, N. H., Tare, M., Jackson, S. R. & Doughty, C. J. (2013). Hi-LAB: A new measure of aptitude for high-level language proficiency. *Language Learning*, *63*(3), 530-566. https://doi.org/10.1111/lang.12011
Long, M. H., & Robinson, P. (1998). Focus on form: Theory, research, and practice. In C. Doughty, & J. Williams (Eds.), *Focus on form in second language acquisition* (pp. 15-41). Cambridge University Press.
Long, M. H. (2007). Recasts: The story so far. In M. H. Long (Ed.), *Problems in SLA* (pp. 75-116). Erlbaum.
Lyster, R., & Ranta, L. (1997). Corrective feedback and learner uptake: Negotiation of form in communicative classrooms. *Studies in Second Language Acquisition*, *20*, 37-66.
Mackey, A., & Goo, J. (2007). Interaction research in SLA: A meta-analysis and research synthesis. In A. Mackey (Ed.), *Conversational interaction in second language acquisition: A series of empirical studies* (pp. 407–453). Oxford University Press.

MacKey, A., & Philp, J. (1998). Conversational interaction and second language development: Recasts, responses, and red herrings? *The Modern Language Journal, 82*(3), 338–356. https://doi.org/10.2307/329960
Mackey, A., Philp, J., Egi, T., Fujii, A., & Tatsumi, T. (2002). Individual differences in working memory, noticing of interactional feedback and L2 development. In P. Robinson (Ed.), *Individual differences and instructed language learning* (pp. 181-208). John Benjamins. https://doi.org/10.1075/lllt.2.12mac.
Meara, P. (2005). LLAMA language aptitude tests: The manual (Tech. Rep.). Swansea: Lognostics.
Ono, L. & Witzel, J. (2002). Recasts, salience, and morpheme acquisition. Scholarly Paper, University of Hawaii, Manoa, HI, USA.
Panova, I., & Lyster, R. (2002). Patterns of corrective feedback and uptake in an adult ESL classroom. *TESOL Quarterly*, *36*(4), 573-595. https://doi.org/10.2307/3588241
Revesz, A. (2012). Working memory and the observed effectiveness of recasts on different L2 outcome measures. *Language Learning*, *62*(1), 93-132. https://doi.org/10.1111/j.1467-9922.2011.00690.x
Robinson, P. (2003). Attention and memory during SLA. In C. Doughty, & M. Long (Eds.), *Handbook of second language acquisition* (pp. 631-678). Blackewell Publishing Ltd.
Sagarra, N., & Abbuhl, R. (2013). Optimizing the noticing of recasts via computer-delivered feedback: Evidence that oral input enhancement and working memory help second language learning. *The Modern Language Journal*, *97*(1), 196-216. https://doi.org/10.1111/j.1540-4781.2013.01427.x
Schmitt, N., Dôrnyei, Z., Adolphs, S., & Durow, V. (2003). Knowledge and acquisition of formulaic sequences: A longitudinal study. In N. Schmitt (Ed.), *The acquisition, processing, and use of formulaic sequences* (pp. 55-86). John Benjamins. https://doi.org/10.1075/lllt.9.05sch
Sheen, Y. (2006). Exploring the relationship between characteristics of recasts and learner uptake. *Language Teaching Research*, *10*(4), 361-392. https://doi.org/10.1191/1362168806lr203oa
Sheen, Y. (2007a). The effects of corrective feedback, language aptitude, and learner attitudes on the acquisition of English articles. In A. Mackey (Ed.), *Conversational interaction in second language acquisition* (pp. 301-322). Oxford University Press.
Sheen, Y. (2007b). The effect of focused written corrective feedback and language aptitude *on* ESL learners' acquisition of articles. *TESOL Quarterly*, *41*(2), 255-283. https://doi.org/10.1002/j.1545-7249.2007.tb00059.x
Skehan, P. (1998). *A cognitive approach to language learning*. Oxford University Press.
Skehan, P. (2016). Foreign language aptitude, acquisitional sequences, and psycholinguistic processes. In G. Granena, D. Jackson, & Y. Yilmaz (Eds.), *Cognitive individual differences in L2 processing and acquisition* (pp.15-38). John Benjamins. https://doi.org/10.1075/bpa.3.02ske
Trofimovich, P., Ammar, A., & Gatbonton, E. (2007). How effective are recasts? The role of attention, memory, and analytic ability. In A. Mackey (Ed.), *Conversational interaction in second language acquisition* (pp. 171-195). Oxford University Press.
Van de Noort, M., Bosch, P., & Hugdahl, K. (2006). Foreign language proficiency and working memory capacity. *European Psychologist, 11*(4), 289-296. https://doi.org/10.1027/1016-9040.11.4.289
Wen, Z., Biedroń, A., & Skehan, P. (2016). Foreign language aptitude theory: Yesterday, today and tomorrow. *Language Teaching*, *50*(1), 1-31. http://dx.doi.org.ezproxy.cul.columbia.edu/10.1017/S0261444816000276
Yilmaz, Y., & Yuksel, D. (2011). Effects of communication mode and salience on recasts: A

first exposure study. *Language Teaching Research, 15*(4), 457–477. https://doi.org/10.1177/1362168811412873
Yilmaz, Y. (2013). Relative effects of explicit and implicit feedback: The role of working memory capacity and language analytic ability. *Applied Linguistics, 34*(3), 344-368. https://doi.org/10.1093/applin/ams044
Zhao, Y (2013). Working memory and corrective recasts in L2 oral production, *Asian Journal of English Language Teaching, 23*, 57-82.