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On the effects of L2 aptitude, phonological short-term memory, and L2 motivation on L2 listening performance

L2 learning is influenced by both individual learner variables and contextual factors. Contextual factors have been extensively researched, but although internal learner-specific variables have received attention, this has been to a lesser extent. Among these internal variables, L2 motivation and L2 aptitude are likely the most significant predictors of L2 learning progress and listening performance. This study explored the effects of (i) L2 motivation, following the L2 Motivational Self-System model; (ii) L2 aptitude; and (iii) phonological short-term memory (PSTM) on L2 listening performance. These variables combined have not yet been studied with reference to L2 listening. In this correlational study, a listening test was taken as a pre- and post-test in a sample of 104 Year 1 and Year 2 English language pre-service teachers from

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a Chilean University three months apart. L2 aptitude and PSTM measures were taken using the first two sections of the Modern Language Aptitude Test (MLAT) for the former variable, and a non-word repetition task for the latter. The results suggest that PSTM, but not L2 aptitude, predicted listening performance at time 2. Also, the results indicate that after adjusting for listening performance at time 1, the only motivational factor predicting listening performance at time 2 was learning experience.

Keywords: L2 aptitude, phonetic coding ability, phonological short-term memory, L2MSS, L2 listening performance.

Słowa kluczowe: zdolności do nauki języka, zdolność kodowania fonetycznego, fonologiczna pamięć krótkotrwała, system samomotywacji w języku obcym, umiejętność słuchania w języku obcym.

1. Introduction

L2 listening skills development, rather an "under-researched area of second language (L2) acquisition" (Wallace, 2020:6), implies that the learner engages in both physical and cognitive activity (Satori, 2021); it is greatly impacted by individual differences, linguistic knowledge (as is the case with lexical knowledge, Stæhr, 2009), phonological knowledge (use of weak forms, features of connected speech, Satori, 2010), and knowledge that is necessarily linguistic in nature (Satori, 2021). Thus, this study examines how individual difference variables such as L2 motivation, PSTM, and L2 aptitude relate to L2 listening performance, on which scant related research is available (Satori, 2010; Wallace, 2020).

In the working memory model first proposed by Baddeley et al. (1998), and later revisited by Papagno (2022), PSTM is often used interchangeably with short term memory (STM). PSTM and working memory (WM) are indeed closely related, with the latter corresponding to a broader construct encompassing PSTM. Both involve temporary storage and manipulation of (verbal) information. Therefore, whilst this study deals with PSTM in particular, we must be reminded that it is a component of WM, which explains the theoretical and empirical survey of the literature of both constructs presented below.

PSTM refers to the "capacity to keep a small amount of information in in the mind for a brief period of time" (Papagno, 2022:51) and differs from WM in its operativity, in that WM adds "processes that support manipulation" (Papagno, 2022:51). PSTM has been found to be related to L2 vocabulary learning in L2 English (Hummel, 2020) and made-up languages

(Martin, Ellis, 2012). Also, L2 aptitude is considered one of the strongest predictors of foreign language achievement and a prominent characteristic of talented foreign language learners (Biedroń 2019; Biedroń, Birdsong 2019; Biedroń, Pawlak 2016). L2 aptitude has been viewed as a combination of cognitive and perceptual abilities (Doughty, 2019; Granena, Yilmaz, 2019). Ellis (2004) regards language L2 aptitude as a prominent factor influencing language learning, while Dörnyei (2010) adds that L2 aptitude and language learning motivation can successfully predict language proficiency. Similarly, L2 motivation is regarded as a major variable affecting L2 learning as it is responsible for initiating the L2 process and sustaining it (Moskovsky et al., 2013). It has been found that motivation can play a significant role in L2 learning (Mikels, Reuter-Lorenz, 2019). In this respect, the L2 Motivational Self System (L2MSS), first proposed by Dörnyei (2005, 2009), comprises three main variables affecting learners' motivation, namely, (a) *the Ideal L2 Self*: an individual's vision of themselves as a proficient L2 speaker; (b*) the Ought-to L2 Self*: qualities an individual feels they should have; and (c) *the L2 Learning Experience*: motivation stemming from the specific context and environment of the learning situation. The L2MSS has been examined as associated with various SLA theoretical constructs (Dörnyei, Chan, 2013; Kong et al., 2018). It has been found, for instance, that the ideal L2 self is closely associated with motivated behaviour (Kong et al., 2018; Wong, 2018) and ultimately with L2 proficiency (Moskovsky et al., 2016). Thus, this study focuses on elucidating the possible relationship between PSTM, L2 aptitude, L2 motivation, and L2 listening performance. Part of the rationale for incorporating these variables lies in what Hyltenstam (2018:192) stated: "It appears that the combination of an extremely strong motivation and high levels of L2 aptitude is what makes polyglots the Jaguars of second language acquisition". Thus, the research questions we set out to answer are as follows:

Research questions

(i) To what extent are L2 aptitude, L2 motivation, and PSTM related to L2 listening performance in English language teacher education students?

(ii) Which factor of those under study can best predict L2 listening performance in English language teacher education students?

Below we briefly survey the constructs under consideration, together with the most widely used instruments to measure L2 motivation, following the L2MSS model; L2 aptitude; and PSTM – as they relate to L2 learning and L2 listening.

2. Literature Review

2.1. L2 aptitude: A test-driven approach

In the 1950s, when a frenzy of L2 aptitude test development activity began in the United States, a psychometric approach emerged. As Véliz-Campos (2018) argued, the adoption of a test-driven methodology for assessing L2 aptitude led to the creation of The Modern Language Aptitude Test (MLAT), the most extensively utilized language aptitude assessment to this day, developed by Carroll and Sapon in 1959. Their approach involved identifying language aptitude elements based on multiple test administrations, focusing on factors that demonstrated the strongest correlation with language proficiency. This method suggests rather an atheoretical approach to the construction of the L2 aptitude model. The MLAT comprises four components, which are briefly described in Table 1.

Table 1 L2 aptitude components

Component	Description
Phonetic coding ability	It measures the capacity to discriminate, code, assimilate and remember speech sounds.
Grammatical sensitivity	It assesses the capacity to identify the function of words in a sentence.
Inductive language learning ability	It evaluates the capacity to infer and extrapolate rules and patterns relating to meaning or syntax.
Rote learning activity for foreign language materials (associative memory)	It measures the capacity to learn and memorise new words.

Note. Based on Dörnyei and Skehan (2003)

As can be observed in Table 1, the MLAT measures different cognitive abilities related to L2 learning, such as phonetic coding, grammatical sensitivity, inductive learning, and rote learning. In the case of this study, we only made use of the Phonetic Coding Ability component of the test, as the use of the other sections may prove confounding because they tap both into L2 aptitude and language proficiency when administered to non-native speakers of English, as suggested by Stansfield (personal communication, April 23, 2013).

2.2. WM, PSTM, and L2 aptitude

Over the last two decades, language aptitude has been found to be linked to WM (DeKeyser, Koeth, 2011; Sáfár, Kormos, 2008). WM is defined as “the cognitive capacity that allows us to maintain a limited amount of information in our mind (e.g., be it linguistic or visual), temporarily available for use in thought or action” (Wen, Jackson, 2022:54). Also, Wen and Skehan (2011) indicate that the consensuses over WM are that: (i) WM involves a central executive responsible for information coordination, control, and attention allocation; (ii) WM involves two slave systems: The phonological loop, in charge of handling phonological information, and the visuospatial sketchpad, responsible for processing visual-spatial information; (ii) WM contains an episodic buffer with a limited-capacity store and is in charge of integrating information from different sources in a multidimensional code; (iii) WM is tightly connected to long term memory. The consensuses mentioned by Wen and Skehan (2011) allow for the relationship between the construct of L2 aptitude and WM; notably, WM plays a crucial role in the processing of sensory input, as DeKeyser and Koeth (2011) and Sáfár and Kormos (2008) have shown, which impacts directly L2 learning.

Following Baddeley (2003), one of the components of WM that plays a critical role in language learning is the phonological loop – referred to as PSTM herein –, which “is responsible for temporarily holding sound-based information through the process of articulatory rehearsal” (Biedroń et al. 2022), which aids the learning of the phonological forms of new words (Baddeley et al., 1998). Some of the most commonly used measures of PSTM are simple span tasks, such as the digit span or the nonword-repetition test. Indeed, PSTM has been found to correlate positively with L2 proficiency with Spanish as the L2 (Oportus et al., 2016).

Since WM, and PSTM, in particular, have been found to play a significant role in both L1 and L2 learning with diverse proficiency levels (Hummel, 2020), we decided to include a PSTM test to add to the cognitive variable measured by the MLAT to be able to assess L2 aptitude more comprehensibly. Thus, in this study, the construct of L2 aptitude was assessed by measuring the Phonetic Coding Ability component of the MLAT (Carroll and Sapon, 1959) and PSTM.

2.3. L2 motivation: The L2MSS model

There seems to exist a consensus on the significant weight of L2 motivation in L2 learning success (Yousefi, Mahmoodi, 2022), so much so that even highly skillful yet de- or un-motivated language learners will not (fully) achieve their language learning objectives (Al-Hoorie, 2018; Dörnyei, Kubanyiova, 2014; Dörnyei, 2020). Put differently, arguing against the need to reinforce and maintain motivation in language learners is cannot be justified (Moskovsky et al., 2013). This study draws on the L2 Motivational Self System, a system where the emphasis is placed on the interplay between learning, social context, and motivation. The theoretical underpinnings of the L2MSS are based on developments in the study of personality and motivation. In particular, the proposal draws on the notion of "self" and L2 learning theories. It is a model that incorporates various aspects, viz., the learner, the context, and the learning experience. The model proposed by Dörnyei (2005, 2009) is made up of three components:

Table 2 Components of the L2 Motivational Self system

Component	Description
(i) Ideal L2 Self	It represents the L2 speaker that the language learner wishes to become, which drives the L2 learner to reduce the gap between the current speaker status and the ideal one.
(ii) Ought-to L2 Self	It corresponds to the L2 learner's aspirations others have about the learner to avoid any possible negative outcomes
(iii) L2 Learning Experience	It corresponds to any motives related to the immediate learning environment and learning experience

As we can see in Table 2, the three components that make up the L2MSS relate to (i) the inner desire to become a successful speaker of the corresponding L2, (ii) the outer pressure exerted on the learner in their attempt to become a successful speaker of an L2, and (iii) the experience of engaging in the L2 learning process (Dörnyei, Chan, 2013).

The L2MSS model has proven applicable in various cultural and linguistic contexts. Taguchi et al. (2009) conducted a comparative study on learners from different linguistic and cultural backgrounds and concluded that the model is perfectly applicable in diverse contexts. Ueki and Takeuchi (2013) validated the L2MSS in Japanese students. Notwithstanding its proven validity, the findings of the various studies conducted using this model might seem, on the surface, contradictory or culture-bound. As a way of illustration, the results from research conducted by Kormos and Csizér (2008) and Papi and Teimuri (2014) suggest that the Ought-to Self does not affect motivated behaviour as greatly as does the Ideal L2 Self. Nonetheless, Taguchi et al. (2009) found in their study, conducted in three different contexts, that there was a strong positive correlation between a promotional aspect of instrumentality and Ought-to Self levels. To make the matter even more complicated, Moskovsky et al. (2016) found that three components of the motivational model can predict motivated behaviour, yet found no correlations with language proficiency.

2.4. WM, L2 aptitude, L2MSS, and L2 listening

The relevant literature indicates that general cognitive abilities limit language comprehension, implying that they may have a direct impact on listening performance (Baddeley, 2003; Clark, Clark, 1977; Gathercole, Baddeley, 1993; Kintsch, van Dijk, 1978). Besides instructional factors, cognitive variables such as WM and L2 aptitude could influence L2 listening, as these are theoretically significant factors for this skill. This is because L2 listening involves various real-time processes, including processing auditory stimuli, recognizing words within a stream of sounds, parsing sequences of words, understanding the propositions in the input, and making inferences based on auditory information. For these processes to work effectively, it is necessary to temporarily retain the information (Sakai, 2018:1).

Research into the influence of any of these factors on listening comprehension is scarce and the results are contradictory. Several studies applying both simple and complex WM tests have reported that L2 listening and WM are positively correlated (Brunfaut, Révész, 2015; Gu, Wang, 2007; Kormos, Sáfár, 2008; Masrai, 2020; Vafaee, Suzuki, 2020; Vandergrift, Baker, 2015, 2018). However, in some studies, marginal or no correlation has been found (Andringa et al., 2012; Duman et al., 2021; Wallace, 2020). Moreover, evidence has been found for WM effect on listening in beginner learners, rather than in advanced learners (Satori, 2021; Vandergrift, Baker, 2015, 2018). As a way of illustration, in a large-scale study, Andringa et al. (2012) used an individual differences approach to investigate listening comprehension among 121 native and 113 non-native Dutch speakers. They examined how linguistic knowledge, processing speed, memory, and IQ could account for variations in listening comprehension. The study found that there were only slight correlations between WM and listening comprehension, linguistic knowledge, and processing speed. Indeed, WM did not explain variance in listening comprehension alone.

Vandergrift and Baker (2015, 2018) found that while working memory (WM) showed a significant correlation with L2 listening in the early stages of analysis, it did not significantly contribute to listening comprehension at higher proficiency levels. In contrast, Masrai's (2020) study with 130 upper intermediate students revealed that WM was a significant predictor of L2 listening comprehension, as assessed by the IELTS exam. Masrai

(2020) reported that WM accounted for an additional 14% of the variance in L2 listening skills, beyond what was explained by vocabulary knowledge.

In their study, Vafaee and Suzuki (2020) investigated the impact of working memory (WM) on L2 listening comprehension using two spatial WM tasks, designed to engage both spatial information processing and storage. This approach aimed to prevent any confusion between WM and L2 proficiency. The findings revealed that WM capacity emerged as a notable predictor of L2 listening ability among 263 Iranian EFL learners.

Whilst the study conducted by Duman et al. (2021), aimed to determine if WM and L2 aptitude play a role in L2 listening comprehension, concluded that neither WM nor language aptitude were significant predictors of L2 listening comprehension scores, other investigations (e.g., Satori, 2021) have found that WM does play a key role in listening comprehension, yet not in equal measure across proficiency levels.

Clearly, there is no current agreement on the role of working memory (WM) in explaining L2 listening comprehension. Research on L2 aptitude and L2 listening is even scarcer and also inconclusive. Li (2016) conducted a meta-analysis, revealing an average correlation of .30 between L2 aptitude and L2 skill acquisition. Specifically, the correlation between L2 aptitude and listening skill was weak (r = .12), with phonemic coding ability being the poorest predictor of listening comprehension. Other studies have shown moderate (Nagata et al., 1999) to weak (Sáfár & Kormos, 2008) relationships between L2 aptitude and listening skill in EFL contexts, or no relationship in ESL contexts (Ranta, 2002). The method of measuring learning gains may affect the varying correlations of L2 aptitude and its components (Li, 2019). Consequently, previous research has produced inconclusive results regarding the actual impact of WM and L2 aptitude on L2 listening.

Motivation, in the form of the L2MSS model, has been found to be related to language proficiency in general terms. Given the multi-componential nature of the L2MSS model of motivation, each one of its constitutive elements has been investigated in relation to L2 proficiency (Nishida, Yashima, 2017; Taguchi et al., 2009). Research has indicated that, for the most part, the Ideal L2 Self and Learning Experience are stronger predictors of language proficiency and better L2 learning gains. For instance, Nishida and Yashima (2017) found that EFL Japanese learners who had had early and positive learning experience showed higher levels of language proficiency. Similar findings can be found in a study by Dunn and Iwaniec (2021). Conversely, the Ought to L2 Self has yielded conflicting findings when examined in relation to L2 proficiency/L2 learning gains (Li, Zhang 2021) ranging from very weak correlations to marginal negative ones. To the researchers' knowledge, no studies have been conducted on the relationship between L2MSS (components) and L2 listening.

3. Materials and Methods

3.1. Participants

A stratified non-probability opportunity sample was used, with one hundred and four students, whose ages ranged from 18 to 30 years old (*M* = 21.10, *SD* = 2.15). Most of them attended high-schools under a voucher system (*N* = 51), followed by those that attended a private high-school (*N* = 20), public high-school (*N* = 13), and both voucher and public (*N* = 3). Most students indicated that they spoke Spanish at home (*N* = 82), followed by both Spanish and English (*N* = 4), and both Spanish and Japanese (*N* = 1). Finally, the majority of participants declared that they studied between 1–2 hours of English for their courses at home (*N* = 37), followed by between 3 and 4 hours (*N* = 23), less than one hour (*N* = 18), and more than 5 hours (*N* = 9).

2.2. Methods, tests administration, and procedure

This correlational study made use of the instruments described below for the variables under consideration:

a) MLAT for L2 aptitude measures: this study employed the first two sections of the MLAT, which are part of Phonetic Coding Ability component and deal with learning foreign sounds. The first part, *Number Learning*, assesses the individual's ability to manipulate (and store) auditory material by having the test-taker auditorily learn numbers in a made-up language. The second part, *Phonetic Script*, measures the test-taker's ability to learn to relate speech sounds to phonetic-like symbols.

The pilot test for *Number Learning* and *Phonetic Script* sections led to slight adjustments in the testing procedure, ultimately enhancing the contextualized level of reliability for this particular component. For instance, it was found that participants had to be closely monitored during the test, as some of them insisted on rewinding the audio tracks to listen to the recording again, which is not allowed. Also, after consulting with the test developers in the US, it was decided that directions could be given in Spanish as well, which would contribute to strengthening the test's reliability without distorting the scores (Stansfield, Reed, 2004; for review of official sample items of the MLAT, you may visit https://lltf.net/mlat-sample-items/). Both sections combined take less than 15 minutes.

b) PSTM measures: PSTM was measured using a nonword repetition test comprising six sets of six stimuli each, four of which conformed to the various phonotactic Spanish language combinations, while the remaining two followed English language phonotactic combinations. Word length ranged primarily from two syllables to five syllables with varying lexical stress and syllable prominence patterns, featuring lexical stress variability in both languages, as they appear to have an effect on recall (Janse, Newman, 2013). For the Spanish stimuli, lexical stress represents the tendencies observed in Spanish (see Finch, Ortiz-Lira, 1982), i.e., a stronger preference for early stress in two-syllable words and a fairly strong preference for stress on the penultimate syllable in three- and four-syllable words. As per the English stimuli, for two- and three-syllable words, the dominant stress and prominence pattern was stressed/prominent syllable, followed by unstressed/weak syllable(s). The test also incorporates three introductory practice sets of five stimuli each. The first two followed Spanish phonotactics and lexical stress patterns. The third set conformed to English phonotactics, syllable prominence, and lexical stress patterns.

Participants received all directions in Spanish during the nonword repetition span task. A three-second pause was given after the instructions had been read, which was followed by a new set of nonwords. Once the participants heard all the stimuli in the sequence, separated by a one-second pause, they were given 10–12 seconds to repeat them. In all, the test took less than 10 minutes.

As far as the scoring procedure goes, we followed the following criteria: (i) three points were given to each nonword accurately repeated in the correct order; (ii) two points were given to an accurately repeated nonword in the wrong order; (iii) one point was given to a partly accurately repeated word in the right order; and (iv) no points were given to nonwords that were either not repeated, or were partly accurately repeated, but in the wrong order. To determine repetition accuracy, it was decided that phonemic substitutions, omissions, or phonemic deviances from the target phonemic forms were considered incorrect. Allophonic or intonational variations did not affect accuracy judgements (Archibald, Gathercole, 2006), nor did epenthesis, as long as it did not deviate from the syllable sequence (Kaushanskaya, Yoo, 2013). Some sample items following Spanish phonology and phonotactics for the two-syllable group are as follows: *prena*, *urpa*, *parni*; other sample items following English phonology and phonotactics for the two-syllable group are as follows: *rubid*, *prindle, rindle*, *ballop*.

c) L2 motivation as L2MSS: An L2MSS survey on a 4-point Likert scale was used, which went from 1 (strongly disagree) to 4 (strongly agree). The survey comprised eight items tapping into the Ideal L2 Self, six for the Ought-to L2 Self, and six for L2 Learning Experience. The survey was adopted and translated from Taguchi et al. (2009) and has been validated and used in previous investigations in Chile (Véliz-Campos et al. 2020). The instrument was given in the participants' native language to ensure comprehension, as they were from courses with varying levels of English proficiency, and it took less than 10 minutes to complete. Regarding the reliability of the survey, the coefficients showed that the instrument was reliable, with the following scores: (a) Ideal L2 Self: 0.83; (b) Ought-to L2 Self: 0.72; (c) L2 Learning Experience: 0.83.

A sample of an item in the survey can be found below. As pointed out earlier, the survey was administered in Spanish; for ease of comprehension, the sample item has been translated into English:

	Totalmente en desacuerdo / ***Completely disagree***	**En desacuerdo /** ***Disagree***	**De acuerdo /** ***Agree***	**Totalmente de acuerdo /** ***Totally agree***
Me puedo imaginar a mí mismo/a viviendo en el extranjero y teniendo una conversación en inglés */ I can imagine myself living abroad and having a conversation in English*. (**Ideal L2 Self**)	◯	◯	◯	◯
Aprender inglés es necesario porque las personas a mi alrededor esperan que lo haga / *Learning English is necessary because people around me expect me to do so.* (**Ought-to L2 Self**)	◯	◯	◯	◯
Me gusta el ambiente general de mis clases de inglés / *I like the overall atmosphere of my English classes.* (**L2 learning experience**).	◯	◯	◯	◯

d) Listening performance: The Oxford Online Placement Test was used three months apart, which yielded two data sets of listening performance, which allowed us to determine whether possible increments in listening performance correlated with L2 aptitude, PSTM and/or L2 motivation. During both administrations, participants were all exposed to regular English language instruction comprising both skills-specific development and integrated L2 teaching. The test is divided into two parts, namely Use of English and Listening. Whilst participants took both parts, scores for the Listening section alone were used for the study. The rationale for using this instrument was that it is self-adaptive, which guarantees that questions will most likely be different from administration to administration. Also, scores were instantly available to the researchers and exportable to a data analysis software. Raw scores were used for both administrations. The whole test often takes between 45 minutes and an hour; the section used for this study usually takes between 20–30 minutes due to its self-adaptive nature. The Listening Section was comprised of three sub-sections: For the first subsection, participants were asked to listen to a short dialogue and identify what the speaker meant in a four-option multiple choice format. The subsection consisted of some 10 items. For the second subsection, participants were asked to listen to a longer conversation and identify what the speaker meant in a four-option multiple choice format. Also, the subsection consisted of some 10 items. For the third subsection, participants were asked to listen to a monologue or a dialogue and identify what the speaker meant in a four-option multiple choice format. The subsection also consisted of a similar number of items.

2.3. Procedure

Permission from the university was sought and granted in writing. Then, the participants were contacted via email and invited to participate in a meeting where the study details were presented. Both classes used for the study agreed to participate in the investigation, and all students signed a consent form.

The Listening Performance test, the MLAT, and the nonword repetition task were administered in a relatively large language lab with good sound quality to the two separate groups of participants. The L2MSS was administered in class time. After the first Listening Performance test administration, and once the other data gathering instruments had all been administered, the second Listening Performance test was applied. The whole data gathering process was conducted over three months. Also, the researchers ensured that no more than test was administered per week.

3. Results

We tested whether PSTM, L2 aptitude, and motivation were associated with increments in listening performance. To test these hypotheses, we used linear regression analyses including PSTM, L2 aptitude, and motivation as predictors of listening performance at time 2. To specifically address changes over time in listening performance (i.e., increments), we also included listening performance at time 1 as an additional predictor. Results from these analyses are shown in Table 4. These results indicate that after adjusting for listening performance at time 1, PSTM, but not L2 aptitude, predicted listening performance at time 2. In other words, participants higher in PSTM experienced significant increments in listening performance. Furthermore, after adjusting for listening performance at time 1, the only motivational factor predicting listening proficiency at time 2 was learning experience. This suggests that participants scoring higher in learning experience exhibited increments in listening performance. Importantly, when including phonological short-term memory, L2 aptitude, and motivational indicators in the same linear regression model, only PSTM predicted changes in listening performance. In summary, the main predictor of changes in listening performance was PSTM.

4. Discussion

The current study aimed to investigate the relationship between L2 aptitude, PSTM, motivation and L2 listening proficiency. The results showed that out of the three factors PSTM was the strongest predictor for L2 listening performance, supporting the notion that working memory plays a crucial role in L2 listening comprehension. This finding aligns with recent studies in that, as argued by Sakai (2018), several L2 listening operations tap into the main function of PSTM which deals with maintaining information for a brief period of time and facilitating the efficient allocation of attention to linguistic cues, leading to improved comprehension, based on greater and/or accurate decoding and interpretation of the linguistic input. While previous studies examining the relationship between PSTM (or WM at large) have yielded conflicting results, with some suggesting that they correlate positively (Masrai, 2020; Vandergrift, Baker, 2018), others have found very marginal or no correlations (Wallace, 2020), with stronger correlations in beginner L2 learners, not distant from this study's participants.

On another note, the findings of this study seem aligned with previous research, in that L2 listening appears weakly correlated with L2 aptitude, as

Table 3 Descriptive statistics and correlations matrix

Variable	M	SD	1	2	3	4	5	6	7
1. L2 aptitude	31.35	6.30	1						
2. PSTM	20.43	7.48	.37*	1					
3. Ideal L2 self	4.61	0.42	.14	-.11	1				
4. Ought to L2 self	2.72	0.47	-.14	.07	.08	1			
5. Learning experience	3.98	0.58	.08	.08	.43***	<.01	1		
6. Listening performance (t1)	76.71	20.41	.29*	.16	<.01	-.14	.06	1	
7. Listening performance (t2)	79.07	19.95	.46***	.37*	.05	-.11	.22	.87***	1

* p < .05 ** p < .01 *** p < .001

Table 4 Linear regression models

	Model 1					Model 2					Model 3				
	b	**se**	***t***	***p***	**β**	***b***	***se***	***t***	***p***	**β**	***b***	***se***	***t***	***p***	**β**
Intercept	1.32	7.99	0.17	.870		0.91	19.26	0.05	.963		-9.47	19.74	-0.48	.637	
Phonological short-term memory	0.77	0.19	4.07	<.001	.35						0.64	0.20	3.15	.005	.26
L2 aptitude	-0.10	0.32	-0.30	.767	-.03						0.02	0.32	0.07	.942	-.07
Listening performance (t1)	0.80	0.08	9.77	<.001	.79	0.86	0.07	12.04	<.001	0.86	0.78	0.09	9.12	<.001	.83
Ideal L2 self						-5.39	4.03	-1.34	.188	-0.10	-3.26	3.74	-0.87	.394	-.02
Ought to L2 self						2.70	2.95	0.92	.365	0.07	1.10	2.79	0.39	.698	-.08
Learning experience						7.10	3.15	2.25	.029	0.17	5.93	2.98	1.99	.061	.18
	F (3, 22) = 60.40, p < .001, R^2 = .89					F (4, 44) = 39.90, p < .001, R^2 = .78					F (6, 19) = 32.20, p < .001, R^2 = .91				

Note: *b* indicates unstandardized coefficient and β indicates standardized coefficient noted by Li's (2016) meta-analysis. Notably, the weakest predictor was found to be phonetic coding ability, which was the L2 aptitude measure used in this study. This may be explained by the narrow focus on acoustic cues, which may not necessarily translate into overall comprehension in an L2.

As per the role of L2 motivation – as measured from the L2MSS perspective – in L2 listening, although no studies have examined it thus far, conflicting results have been found when relating motivation and L2 learning gains in general. Our findings suggested that none of the constitutive aspects of the L2MSS predict L2 listening, save for learning experience – somewhat aligned with Li and Zhang's (2021) findings. Learning experience has proven to play a significant role in predicting L2 proficiency in general (Nishida, Yashima, 2017), which may apply to L2 listening performance in particular, with potentially rich pedagogical implications.

Future longitudinal studies, with more L2 listening measures, could provide a better understanding of the developmental impact on L2 listening proficiency. Moreover, the current study focused on a specific population of L2 learners, and caution should be taken when generalizing the findings to different learner populations, or diverse linguistic contexts.

Lastly, the findings are informative as they provide us with valuable information about the weight of individual factors in reference to L2 listening. Also, this investigation has shown that profiling students' aptitudes and affect can certainly contribute to more effective pedagogical practices by displaying instructional models that best suit diverse learners (Robinson, 2002) as suggested by Doughty (2019).

5. Conclusion

It became apparent that PSTM emerged as the strongest predictor for L2 listening, outweighing the influence of both L2 aptitude and overall L2 motivation. In this respect, several studies have highlighted the crucial role of PSTM in language learning, particularly in tasks involving the processing and retention of phonological information, as is the case of Vafaee and Suzuki (2020), who found a positive correlation between WM – not PSTM in particular – and L2 listening skills, which suggests that individuals with higher WM capacity are better able to retain and manipulate phonological representations, enabling them to comprehend and process spoken language more successfully. Conversely, the impact of L2 aptitude, specifically phonetic coding ability, on L2 listening proficiency seems to be relatively less influential, at least in this study. This aligns with findings from the research conducted by Li (2016), who found a weaker relationship between L2 aptitude and L2 listening performance. The authors propose that while phonetic coding ability may contribute to initial phonological acquisition by focusing on discrete acoustic aspects, it may not significantly affect the development of listening skills in the long term, which may encompass other complex cognitive tasks. Furthermore, the L2 Motivational SelfSystem model did not prove to be a strong predictor as a whole for L2 listening performance in this study. The exception to this finding is *learning experience*, albeit with a moderate predictive power, which supports Dörnyei's (2019) claim that L2 learning experience can be a strong predictor for motivated behaviour – and ultimately proficiency-, which foregrounds the role of teachers and methodologies in the learning process. These findings are consistent with the work of Artieda-Gutiérrez (2015), who argued that L2 motivation is one of the two strongest predictors of overall L2 learning, although its impact on specific skills like listening may be less prominent.

Conflict of interests
The authors declare that they have no conflict of interest.
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