and check that all sound files had a descending staircase intonational contour with progressively lower pitch accents anchored around tonic syllables (Roettger & Gordon, 2017), because this is the common pattern in Spanish (Hualde, 2005).

For instance, processing of inflectional morphology is facilitated by phonology [e.g., \_@roll2009, @roll2010,\_ @sagarra2018suprasegmental].

Depending on the structure similarity, the effects of transfer on L2 acquisition and processing may be different, enabling L2 learners to start anticipating earlier or later, and more or less successfully.

An important notion associated with transfer is learned attention.

Learned attention refers to the bias caused by the previous knowledge of our L1 in what elements we pay attention to when learning new languages \_(James, 1980; Lado, 1957; Odlin, 1989)\_.

Learned attention can easily be applied at the phonological level in that a speaker may try to assimilate the new L2 categories to the pre-existing L1 phonological categories in their L1.

The pre-existence of the L1 phonological categories may thus block paying attention to new

## 2.3. Models of suprasegmental acquisition

When learning the phonology of an L2, speakers need to learn not only segmental (e.g., phonemes) but also suprasegmental phenomena (e.g., tones).

The acquisition of L2 suprasegmental phenomena is varied and not all populations attain the same results.

L1 Cantonese and L1 Mandarin speakers learn to discriminate lexical stress in L2 English [@chen2013chinese; @li2017effects], but L1 Koreans learn it with some difficulty [@hualde2015acquisition; @lee2019perception].

It is doubted whether L1 French speakers can learn or not to discriminate lexical stress in a foreign language [@dupoux2008persistent; @schwab2011french].

Taking a step further, L1 English speakers do learn to discriminate lexical stress and use it as a prediction cue but do it late in the L2 acquisition process [@sagarra2018suprasegmental].

Contrarily, Swedish pitch accents appear to be fairly easy to acquire as anticipatory cues even in L2 speakers whose L1 is non-tonal [@schremm2016implicit].

In light of these findings, we need a model of suprasegmental acquisition that takes into account the phonological and phonetic structure of the L1 and how transfer may affect positively or negatively acquisition and processing of L2 suprasegmentals.

No model has been proposed to the best of our knowledge that explicitly frames acquisition of L2 suprasegmental structures.

There have been some attempts to adapt models of L2 segmental acquisition [Perceptual Assimilation Model for Suprasegmentals, @best1995learning; @best2007nonnative].

The adaptation, however, was restricted to tones.

Two other models, the Speech Learning Model [SLM, @flege1995second] and the Second Language Linguistic Perception model [L2LP, @escudero2005linguistic; @escudero2009linguistic; @leussen2015larning], have the potential to be adapted to account for acquisition of other structures as well as tones while taking into account L1 transfer effects.

In the SLM, the characteristics of the segmentals (e.g., the sound /p/) are encoded in the long-term memory and this encoding evolves in both the L1 and the L2.

The encoding for these structures in the L1 can evolve to reflect changing properties of the category in the L1 or to adapt it to include L2 properties identified with that same category.

However, bilinguals will strive to keep the realizations for the category in each language apart, even if these two realizations exist in a common phonological space.

It could be similarly argued that suprasegmental structures such as lexical stress, tones or moras are also encoded in the long-term memory and associated to the segmental structures they usually accompany.

For instance, it could be argued that lexical stress in the first syllable of 'flower' is encoded as part of that word.

SLM proposes several hypotheses, of which are relevant for the current study:

- L1 and L2 categories are perceived as allophonic variations.

- If an L2 sound differs from an established L1 category, a new category can be formed as long as the speaker discerns some of the phonetic differences.

- L1 categories block L2 categories if they are perceived as equivalent, such that a single category is used to process both categories.

- L2 category representation may be different from the representations that L1 speakers of that language have because L2 speakers make an effort to deflect the L2 encoding from the encoding of their own L1 to maintain a contrast in the common phonological space, or because L2 representations are characterized with different properties or correlate weights than the ones used by L1 speakers.

It can be deduced from these hypotheses that the creation of an L2 phonological system does not occur in isolation, but suffers from cross-linguistic effects.

According to these hypotheses, an L2 speaker will take their L1 phonological system as reference to create new L2 categories or assimilate them to the L1 categories, and to assign the correct phonetic characteristics to the new categories.

In the L2LP, a copy of the L1 sound system is created at the beginning stages and it is adjusted through a comparison algorithm.

L2LP thus assumes and takes as basis for L2 phonological acquisition and processing that the L2 phonological system will be a result of L1 transfer.

L2LP differs from SLM in that it deals with isolated segments, while the SLM deals with contrasts between L1 and L2 sounds.

The comparison a learner makes between their L1 original sound and the new L2 sound has three possible outcomes:

1. the new sound is assimilated to multiple L1 sounds,

2. the new sound is perceived as similar to another one in the L1 system,

3. the new sound does not equal any category in the L1, requiring the development of a new phonetic category for itself.

Following the L2LP's line of reasoning, lexical stress in an L2, for example, would be compared with the lexical stress or tone category in the L1, and depending on the amount of overlap of acoustic correlates and function, it would be encoded as more or less similar or as a completely new category.

One last point worth mentioning from the L2LP is that perceiving and recognizing are different processes.

That is, being able to perceive contrastively two or more foreign sounds does not entail that words containing them will be encoded with the contrast [e.g., @curtin1998phonological].

Alternatively, two L2 lexical items may be encoded as different words, while the contrasting sounds are not reliable discriminated during perception [e.g., @cutler2006asymmetric].

Following the L2LP, we could hypothesize that the fact that L2 speakers are able to perceive tones or lexical stress in an L2 does not imply that they will necessarily be able to recognize them in speech to use them as cues for morphosyntactic outcomes.

## 2.1. Language anticipation

In a predictive processing view of language, language processing is facilitated and preceded by prediction of linguistic information based on cues already available at different linguistic and non-linguistic levels [e.g., @federmeier2007thinking; @wicha2003potato]. These cues are associated with an outcome and the mapping helps generate the correct prediction [@delong2005probabilistic; @dikker2011before]. Speakers used a wide range of phonological, morphosyntactic, semantic and contextual cues to anticipate linguistic outcomes in their L1. Morphosyntactic anticipation in particular is very important because it modulates anticipation at other linguistic layers, like semantic choices [@guajardo2014morphosyntax].

L2 processing is oftentimes difficult, and L2 anticipation is not a typical event. Studying the influence of L1 prediction mechanisms on L2 anticipation might explain why learning and understanding an L2 is so troublesome, and why attaining native-like proficiency in an L2 is rare. This influence might be mediated by cognitive capacities. Understanding and processing a L2 is more cognitively taxing than speaking a L1 because the L2 overtakes the pool of executive functions usually applied in L1 anticipation [@linck2014working], especially at non-proficient levels. So when the cognitive executive resources are excessively loaded, they are undermined and this overtaxing may also hindered L2 predictive processing.

### 2.1.1. L1 processing and anticipation

Language anticipation is a productive and dynamic cognitive mechanism in our L1. Speakers use a wide range of morphosyntactic [@gruter2016l2], syntactic [@linzen2016uncertainty], semantic [@kamide2003time; @pozzan2016semantic] and phonological cues to generate predictions on semantic [@altmann1999incremental], morphosyntactic [@gruter2016l2; @lew2010real] and syntactic-discoursive outcomes [@gruter2013l2]. Among the phonological cues we use, we encounter coarticulation [@salverda2014immediate], intonation [@nakamura2012immediate; @weber2006role], lexical stress [@correia2013word; @sagarra2018suprasegmental], pauses between clauses [@hawthorne2014pauses; @kjelgaard1999prosodic], vowel duration [@rehrig2017acoustic], and tone [@roll2015neurolinguistic; @roll2011activating]. Phonological cues are oftentimes associated with word suffixes [@roll2010word; @sagarra2018suprasegmental; @soto2001segmental].

Phonological cues exert an influence on the predictions that are generated in both proximal and distal sentential contexts. Lexical stress in English is signaled through proximal cues like syllable's F0, duration, and amplitude, but also through distal cues like meter patterns [@brown2015metrical], such that distal cues interact with the proximal ones during lexical segmentation and word recognition [@brown2011expectations]. As a consequence, violating lexical stress expectations created by distal cues in terms of location and syllabic structure elicit anormal brain activity associated with a more costly processing [@domahs2008processing].

Phonological phenomena are closely tied to morphosyntactic suffixes, with relationships that vary across languages. In Central Swedish, a low tone cues the singular suffix in a noun (\*fisken\* 'fish~[SG]~'), and a high tone cues the plural suffix [\*fiskar\* 'fish~[PL]~,' @roll2010word; @soderstrom2015using; @roll2013word]. Likewise, low tone cues present tense ( \_skrämmer\_ 'I scare'), and a high tone cues past tense [\*skrämde\* 'I scared,' @soderstrom2012processing; @roll2015neurolinguistic]. Similarly, lexically stressed syllables in Spanish cue present tense (\*CANta\* 'he sings'), while lexically unstressed syllables cue past tense [\*canTÓ\* 'he sang,' @sagarra2018suprasegmental]. The presence or absenece of lexical stress at the beginning of a noun in Spanish can also signal what noun should be activated when several segmental competitors are possible [\*PRINcipe\* 'prince' vs. \*prinCIPIO\* 'beginning,' @soto2001segmental]. Lastly, shorter vowel duration in verbs in English is associated with active voice ('the girl was pushing the boy'), whereas longer vowel duration is associated with passive voice ['the girl was pushed by the boy;' @rehrig2017acoustic].

Individual variability in cognitive capacities (i.e., WM) does not exert a great impact on linguistic anticipation in typical adult individuals, at least in simple morphological structures or in speech [@ye2008involvement]. The few online studies so far on the connection between WM and language anticipation generally suggest that WM variability is not a factor in determining the efficacy and characteristics of morphosyntactic prediction generation in Dutch [@otten2009does], Spanish [@sagarra2018suprasegmental] or English [@pakulak2010proficiency; @tanner2014erps]. Although @huettig2016prediction did find in a different study that WM could account for variability in Dutch gender morphosyntax anticipation. Since this last study shares with the previous one either language studied, or structure researched, or methodology employed, none of these can explain the different results on the influence of WM on language anticipation.

In sum, L1 speakers generate predictions at different linguistic levels. If, when and how WM could affect the capacity to generate L1 predictions has still not been established, although findings suggests WM plays a minor role. Behavioral performance and brain activity may largely be conditioned by different levels of linguistic complexity or linguistic experience, so that WM only affects linguistic anticipation in certain cases.

### 2.1.2. L2 processing and anticipation

\*L1 transfer and L2 proficiency\*

Anticipation in a L2 is not as straightforward as in a L1. Results are especially mixed in the morphosyntactic domain. Morphosyntactic anticipation has been researched with gender [@dussias2013gender; @hopp2016learning; @lew2010real], verbal tense [@sagarra2018suprasegmental; @schremm2016implicit], number [@marull2017second], case [@hopp2015semantics; @mitsugi2016use], and cross-linguistic form similarity. The mixed results have been accounted for by factors like L1 transfer, or L2 proficiency.

Regarding gender, L2 German speakers may not be able to generate gender predictions [@hopp2016learning], while L2 Spanish speakers may be able to do so [@dussias2013gender], although only under specific linguistic circumstances [@lew2010real]. Contrary to gender, number is more difficult to anticipate, so only advanced speakers can make number predictions [Spanish, @marull2017second], and L2 case is not predicted [German, @hopp2015semantics; Japanese, @mitsugi2016use]. For verbal tense, only L2 learners at advanced levels of proficiency can generate predictions in Spanish [@sagarra2018suprasegmental], but intermediate learners can already make predictions in Central Swedish [@schremm2016implicit].

Studies varied in whether morphosyntax was used as the cue, the outcome, or both. The L1s were also different, so L1 transfer could have interacted with the role of morphosyntax in determining whether the L2 speakers were able to generate gender morphosyntactic predictions. L2 proficiency and maybe even WM can also partially account for the ability to make L2 predictions. All these conditioning factors have often been entangled in research, so it is difficult to tease their inluence apart. In gender anticipation, having a similar morphosyntactic system in the L1 can help generate predictions in the L2, even at lower levels of proficiency. This is the case of L1 Italian speakers anticipating gender suffixes in L2 Spanish at beginner stages [@dussias2013gender]. Extrapolating L1 knowledge is also the case of L1 English speakers using definiteness in articles to predict nouns at intermediate proficiency stages [@lew2010real]. And L1 transfer can also be seen in L1 English speakers generating predictions in L2 Dutch more efficiently when they use cue determiners that share similar forms with their L1 determiners [@liburd2014investigating]. In contrast, lacking such L1 system may hinder the generation of L2 predictions. This would be the case of L1 English speakers generating gender suffix predictions in L2 Spanish [@dussias2013gender].

The stability and nature of the encoded L2 morphosyntactic system may influence whether predictions are generated or not. In German, L2 speakers are able to generate comprehension gender predictions only when they are also able to use the L2 gender system target-like in production [@hopp2013grammatical; @hopp2016learning]. In L2 Spanish, speakers may only predict gender suffixes when the nouns are highly frequent [@lew2010real].

Overcoming this anticipation hurdle might be facilitated when at least a phonological layer is involved and the L2 linguistic experience is larger. English is a poor language in terms of verbal morphology when compared to Spanish. However, when morphosyntax is cued phonologically through lexical stress, advanced L2 Spanish speakers overcome the obstacle and generate verb suffix predictions [@sagarra2018suprasegmental]. L2 speakers of Swedish are also able to generate tense suffix predictions based on tones beginning at intermediate stages of proficiency [@schremm2016implicit].

However, there are a few considerations to bear in mind when studying transfer effects in phonological cues, since having a similar structure in the L1 does not guarantee it can be used for anticipation in the L2. Whereas advanced L2 Spanish speakers whose L1 is English learn to use lexical stress as a cue [@sagarra2018suprasegmental], L1 French speakers rarely if ever learn to encode lexical stress as an anticipatory cue in L2 Spanish, simply because they do not learn to discriminate it [@dupoux2008persistent] even if French has lexical stress. In contrast, L1 Cantonese and L1 Mandarin speakers learn to discriminate lexical stress in L2 English [@chen2013chinese; @li2017effects], and L1 Koreans also learn to a certain extent [@hualde2015acquisition; @lee2019perception], even though none of these three languages encodes lexical stress. Although it has not been investigated whether these three populations learn to use lexical stress as a cue, these results suggest that the suprasegmental structure in the L1 can not only affect positively or not affect processing of L2 suprasegmental structures, but also affect L2 processing negatively depending on the L1 suprasegmental characteristics. This hypothesis would align with previous results that suggest that L1 non-tonal speakers can learn to use L2 tones as suprasegmental cues to morphosyntax [@hed2019neural; @schremm2016implicit].

In the case that L2 speakers create the mappings between prosodic cue and morphosyntactic outcome thanks to L1 sound encoding transfer, the mapping may not always reach native-like efficiency [@perdomo2019prosodic]. This loss of efficiency has not been accounted for in any model of L2 phonological acquisition. There are some models nevertheless on L2 segmental acquisition that could be adapted to explain how L1 transfer affects L2 prosody-based linguistic anticipation. Here I focus on the Second Language Linguistic Perception model [L2LP, @escudero2005linguistic; @escudero2009linguistic; @leussen2015learning] because it was thought out to explain and predict L2 sound perception phenomena. In L2LP, L2 sounds are perceived through the L1 filter, that is, how they would be perceived if they were pronounced in the speaker's L1. Therefore, the acoustic similarities and discrepancies between the two phonological systems will shape the development of the encoding in the bilingual's mind. In L2 sound acquisition, a copy of the L1 system is created during the initial stages, this copy starts to adjust with exposure via the Gradual Learning Algorithm, a comparison of the L1 system and the perceived L2 sounds. The algorithm offers three possibilities: a new sound is assimilated to multiple L1 sounds, a new sound is perceived as similar to another one in the L1 system, or a new sound does not equal any category in the L1 so it requires a new category for itself. Recent revisions to the model have further proposed that perceiving is not the same thing as recognizing, but there is still not enough research in this direction to formulate any hypothesis.

This model might be able to explain L2 suprasegmental acquisition and its use for predictive processing because it proposes that the 'components' of the L1 sound will affect how the L2 sound is perceived, so having practice perceiving a correlate in the L1 should in theory ease L2 perception of that same correlate. This hypothesis would be supported by L1 tonal speakers learning L2 tones more easily than L1 non-tonal speakers [@chan2019lexical]. The fact that L2 speakers can learn to perceive or discriminate L2 suprasegmentals like lexical stress or tones even when the suprasegmental is absent in their L1, does not necessarilty mean that the L2 speakers can further use the learned sound to generate anticipation. The recent revisions to the L2LP specifically offer a trampoline into accounting for this step from discrimination processing to anticipatory processing.

A problem that this or other models of L2 phonological acquisition have is that they might not be able to answer how the function of the suprasegmental in the L1 affects acquisition of the L2 suprasegmental structure, and how the function could influence perception even if acoustically the L1 and L2 structures are different. Speakers of two languages that have a function in common might transfer the function also when the acoustic correlates that characterize the function in each language differ. If function transfer were the case, the models would need to be adapted to cover this transfer too, and to explain how function transfer and acoustic correlate transfer differ.

\*Working memory\*

Linguistic knowledge and experience affect language processing and anticipation, especially in L2s. Evidence for that is French L1 speakers struggling to process L2 lexical stress in Spanish [@dupoux2008persistent], arguably because their French lexical stress encoding blocks acquisition of L2 lexical stress with different properties. However, even in these non- or barely sensitive individuals, there are individual differences. Those individuals displaying greater sensitivity to stress differences also retain stress information longer in their WM [@schwab2020working]. We should therefore consider cognitive differences beside linguistic factors when studying L2 acquisition, processing and anticipation.

WM is the cognitive skill that allows to store incoming information temporarily and process it so other complex cognitive actions can be executed [@baddeley2007working]. Three main models of WM stand out: @just1992capacity’s domain-specific single-resource model, @baddeley2007working’s domain-specific multiple-resource model, and domain-free connectionist models. In the domain-specific single-resource model [@just1992capacity], WM capacity constrains language learning and processing. There is also a trade-off between the ability to process and to store linguistic information. This trade-off comes as a consequence of the competition amongst the different actions required for a shared pool of cognitive resources that need to be divided. Therefore, when a task depletes or overtax the WM capacity of a person, their storage capacity diminishes and their processing slows down. In domain-specific multiple-resource model [@baddeley2007working’] WM capacity also constrains linguistic performance, but the cognitive resources are organized differently. A central executive controls three subsystems: the short-term storage phonological loop, the short-term storage visuospatial sketchpad, and the episodic buffer. These three slave systems have independent limited capacities. The two short-term memory systems focus on content, while the episodic buffer connects its sister systems with the long-term memory. The central executive coordinates the activity of the whole entity by filtering the information received, assembling information from different sources into meaningful episodes, regulating the flow of information among the subsystems, shifting tasks, and shifting retrieval strategies. Lastly, connectionist models are domain-free as language capacities are determined by domain-general cognitive abilities. Specifically, by the ability to select which information to pay attention to and which information to inhibit, regardless of the nature of that information. In connectionist models there is no difference between processing and storage. Instead, WM is the activation of part of the long-term memory according to short-term patterns of activations related to domain-specific stores [e.g., @cowan2016working].

WM influences L2 processing but the specific nature of this influence has still not been completely figured out. Some studies have found facilitating effects of WM on morphosyntactic processing [e.g., @sagarra2016eye; @sanz2016one], while others have found no effect [e.g., @foote2011integrated; @grey2015role]. These differences might be explained by the interaction with factors explained above, like variability in L2 proficiency and the cognitive load imposed by the task and the WM test [@sagarra2017longitudinal]. Speakers at a lower proficiency might then be more susceptible to WM overload [@serafini2016evidence]. In L2 anticipation, higher WM learners may anticipate more easily agreement elements than lower WM individuals [@reichle2016working]. Although the communication context may condition this ability: WM may mediate morphosyntactic prediction only under cognitively taxing conditions [@lozano2020], although this finding is not definitive, as a previous study revealed no effecs of WM on L1 and L2 Spanish speakers’ capacity to anticipate verbal tense based on lexical stress [@sagarra2018suprasegmental].

The literature in L2 anticipation show that speakers can achieve some success in L2 anticipation depending on their L1, the cues they need to process, their level of proficiency, and maybe their WM capacities, but their performance will rarely be native-like [@perdomo2019prosodic]. A possible explanation for the varied results on L2 perception and anticipation might be found in what speakers are transferring from their L1 (acoustic knowledge vs. function knowledge) that interacts with the new L2 structures they need to encode. Whereas L2 speakers’ anticipation performance might depend on their ability to perceive the cues and what needs to be anticipated, asymmetries amongst studies and the lack of cognitive measures also difficult comparison of results. The lack of a common theoretical framework, the use of non-standardized measures to assess proficiency [self-assessment, @lew2010real], the variety of tasks [e.g. eye-tracking, @sagarra2018suprasegmental; vs offline, @dupoux2008persistent], a variety of L1s [@hed2019neural], and the unclear distinction of variables [e.g., @schremm2016implicit] call for further research where the possible factors accounting for L2 anticipation patterns are better distinguished.

L2 speakers are able to transfer prosody encoding abilities from their L1 to their L2 [@krishnan2010effects], so they learn to discriminate and process L2 phonological information even when the phenomena is absent in their L1 [e.g., @li2017effects]. Sometimes, they can even use acoustic and prosodic resources in the L2 to anticipate oncoming nouns [@perdomo2019prosodic] and verbal morphosyntax [@lozano2019slowly; @sagarra2018suprasegmental; @schremm2016implicit]. @lozano2019slowly provided evidence that L1 English speakers could use lexical stress as an anticipation cue to verbal tense in L2 Spanish at advanced levels of proficiency. While English and Spanish share the presence of lexical stress, the acoustic correlates are different in each language, so L1 English speakers might presumably have transferred function knowledge. Speakers of languages without lexical stress may learn to perceive it too [@chen2013chinese; @li2017effects], but in their case, it would be knowledge of the acoustic properties of their L1 that may help in the perception of the L2 phonological phenomenon [@li2017effects].

Taking a step further, the current study aims to address the question of how the type of knowledge transferred affects language predictive processing. Specifically, this study first examines whether the acoustic properties of the L1 help not only in perceiving prosodic elements in a different language with different phonological structures but also in using those elements to anticipate oncoming linguistic information, even when the acoustic properties are used for different purposes in each language (i.e., for tone vs lexical stress). Second, this study also explores how acoustic transfer compares to function transfer, when the L1 shares the function of a suprasegmental structure, but its realization is different.

The populations selected to address these questions were L1 Mandarin and L1 English speakers who speak L2 Spanish at a proficiency level ranging from intermediate to near native. They completed an eye-tracking task that measures their prediction abilities in Spanish when they use lexical stress as a cue to verbal tense suffixes. They were compared to a L1 Spanish control group. The research questions therefore are:

, but WM will not be responsible for individual variability [@otten2009does; @sagarra2018suprasegmental; @tannen2014erps]

The role of tone is thus integration of the activated lexical item in the higher context.

Knowledge of the nature and function of tones in the L1 can affect L2 tone learning both positively and negatively by providing a background knowledge to which learners resort to acquire the L2 tones and compare them. @li2017effects examined the influence of the L1 tonal knowledge in the acquisition of L2 tones in children. These children were L1 Cantonese speakers learning L2 Mandarin, and they had issues in categorizing Mandarin tones 1 and 4, as these tones would be assimilated to the same tone 1 category in Cantonese. In the case of these children, being a native speaker to a tonal language helped them in the perception of Mandarin tones 2 and 3, but it hindered perception of other L2 tones because the knowledge transfer from L1 tones disagreed from the L2 tone structure and interfered with it.

The role of tones in Mandarin is different from the role of lexical stress in Spanish. Mandarin speakers need to pay attention to the pitch variations in order to assign the correct tone to the word they are hearing. Since pitch variations are the basis for lexical stress in Spanish, Mandarin speakers might be able to transfer their sensitivity to pitch changes to process and use pitch to anticipate linguistic information more easily than English speakers. In comparison, pitch variation is not as important an acoustic correlate in English lexical stress, so L1 English speakers may not be sensitive to L2 pitch information in lexical stress, at least in beginning and intermediate stages of proficiency. Therefore, L1 English speakers need to learn to distinguish pitch variations since they can only transfer function knowledge, while Mandarin speakers may transfer pitch knowledge but need to learn function in using lexical stress to anticipate verbal tense in L2 Spanish.

When speaking another language, speakers need to learn the new cue-outcome associations, although this learning may require time. L1 English-L2 Spanish bilinguals in an L2-environment only use lexical stress as a cue to morphology at high proficiency and when the cueing syllable has a CVC structure [@sagarra2018suprasegmental].

The difficulty in establishing the associations between phonological cues and the outcome may stem from how the L1 phonological categories are encoded.

That is, the English lexical stress encoding did not match the Spanish lexical stress encoding and thus prevented the Spanish L2 speakers from using lexical stress properly until they reached a certain level of linguistic experience.

Following a similar line of reasoning, @vickie2010cross suggested that language background in the L1 can affect how lexical stress is perceived in an L2 and what correlates are used to discriminate the L2 stress.

This rationally would entail that the L1 filters how L2 suprasegmentals are perceived and processed, at least at lower levels of proficiency.

Thus, studying the influence of L1 prediction mechanisms on L2 anticipation might explain why learning and understanding L2 morphosyntax is so troublesome, and why attaining native-like morphosyntactic anticipation performance is more often than not impeded. In addition, understanding and processing an L2 is more cognitively taxing than speaking an L1 because the L2 overtakes the pool of executive functions usually applied in L1 anticipation [@linck2014working], especially at non-proficient levels. Given that the transfer happens in our brains and that L2 processing depletes cognitive resources, the L1 influence and our cognitive capacities are likely to interact with each other, such that both factors contribute to the difficulty of L2 morphosyntactic processing and anticipation.

Individual variability in cognitive capacities (i.e., WM) does not exert a great impact on linguistic anticipation in typical adult individuals in their L1, at least in simple morphological structures or in speech [@ye2008involvement].

The few online studies so far on the connection between WM and language anticipation generally suggest that WM variability is

Regarding gender, L2 German speakers may not be able to generate gender predictions [@hopp2016learning], while L2 Spanish speakers may be able to do so [@dussias2013gender], although only under specific linguistic circumstances [@lew2010real]. Contrary to gender, number is more difficult to anticipate, so only advanced speakers can make number predictions [Spanish, @marull2017second], and L2 case is not predicted [German, @hopp2015semantics; Japanese, @mitsugi2016use]. For verbal tense, only L2 learners at advanced levels of proficiency can generate predictions in Spanish [@sagarra2018suprasegmental], but learners of Central Swedish can already make predictions at an intermediate proficiency [@schremm2016implicit].

The studies above varied in whether morphosyntax was used as the cue, the outcome, or both. The L1s were also different, so L1 transfer could have interacted with the role of morphosyntax in determining whether the L2 speakers were able to generate gender morphosyntactic predictions. L2 proficiency and maybe even WM can also partially account for the ability to make L2 predictions. All these conditioning factors have often been entangled in research, so it is difficult to tease their influence apart. In gender anticipation, having a similar morphosyntactic system in the L1 can help generate predictions in the L2, even at lower levels of proficiency. This is the case of L1 Italian speakers anticipating gender suffixes in L2 Spanish at beginner stages [@dussias2013gender]. Extrapolating L1 knowledge is also the case of L1 English speakers using definiteness in articles to predict nouns at intermediate proficiency stages [@lew2010real]. And L1 transfer can also be seen in L1 English speakers generating predictions in L2 Dutch more efficiently when they use cue determiners that share similar forms with their L1 determiners [@liburd2014investigating]. In contrast, lacking such L1 system may hinder the generation of L2 predictions. This would be the case of L1 English speakers generating gender suffix predictions in L2 Spanish [@dussias2013gender].

Adding a phonological layer and increasing the L2 linguistic experience may aid in overcoming the morphosyntactic anticipation hurdle, especially when the structure to be predicted is absent in the L1. English is a poor language in terms of verbal morphology when compared to Spanish. However, when morphosyntax is cued phonologically through lexical stress, advanced L2 Spanish speakers overcome the obstacle and generate verb suffix predictions [@sagarra2018suprasegmental]. L2 speakers of Swedish are also able to generate tense suffix predictions based on tones at beginning and intermediate stages of proficiency [@schremm2016implicit].

There are a few considerations to bear in mind when studying phonological effects, as they are possible mediated by L1 transfer. While having a similar structure in the L1 can facilitate L2 anticipation, it does not guarantee any kind of anticipation success. Whereas advanced L2 Spanish speakers whose L1 is English learn to use lexical stress as a cue [@sagarra2018suprasegmental],

Similarly,. It is however an open question whether these populations learn to use lexical stress as

The question remains whether these three populations learn to use lexical stress as a cue.

Linguistic knowledge and experience affect language processing and anticipation, especially in L2ers. Evidence for that is French L1 speakers struggling to process L2 lexical stress in Spanish [@dupoux2008persistent], arguably because their French lexical stress encoding blocks acquisition of L2 lexical stress with different properties. However, even these non- or barely sensitive individuals display individual differences.

Cognitive differences should therefore also be considered when studying L2 acquisition, processing and anticipatoin beside linguistic factors.

The literature in L2 anticipation show that speakers can achieve some success in L2 anticipation depending on their L1, the cues they need to process, their level of proficiency, and maybe their WM capacities, but their performance will rarely be native-like [@perdomo2019prosodic]. A possible explanation for the varied results on L2 perception and anticipation might be found in what speakers are transferring from their L1 (acoustic knowledge vs. function knowledge) that interacts with the new L2 structures they need to encode. Whereas L2 speakers’ anticipation performance might depend on their ability to perceive the cues and what needs to be anticipated, asymmetries amongst studies and the lack of cognitive measures also difficult comparison of results. The lack of a common theoretical framework, the use of non-standardized measures to assess proficiency [self-assessment, @lew2010real], the variety of tasks [e.g., eye-tracking, @sagarra2018suprasegmental; vs. offline, @dupoux2008persistent], a variety of L1s [@hed2019neural], and the unclear distinction of variables [e.g., @schremm2016implicit] call for further research where the possible factors accounting for L2 anticipation patterns are better distinguished. Here, I focus on WM and on acoustic and function transfer of suprasegmental phenomena to anticipate verb endings in Spanish.

In the case that L2 speakers create the prosodic cue-morphosyntactic outcome mappings to L1 sound encoding transfer, the mapping may not always allow for native-like anticipation efficiency [@perdomo2019prosodic]. There has been no model accounting for the transfer of suprasegmentals and loss of efficiency, although the

but WM will not be responsible for individual variability [@otten2009does; @sagarra2018suprasegmental; @tanner2014erps].