THE EFFECTS OF PRIMING IN THE PRODUCTION OF L2 MORPHOLOGY

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ABSTRACT

The Effects of Priming in the Production of L2 Morphology

Recent studies suggest that priming may be a useful method in facilitating second language (L2) learning, yet there has not been any investigation about how priming can trigger the development of morpho-syntactic forms in the L2. As such, this study was motivated by the need to investigate the effects of priming in the production of morphology, a domain which poses much difficulty for L2 learners. The study examines whether exposure to grammatical and ungrammatical morphological primes can affect the accurate production of the third person singular –s in L1 Turkish-L2 English learners. The study involved a pre-test-post-test design and data was based on oral production. Participants were asked to describe pictures shown on a computer screen subsequent to different prime sentences they hear from the researcher in the confederate-scripting paradigm. The grammatical primes consisted of English sentences with verbs marked with –s and the ungrammatical primes included sentences with an omitted –s. Participant's correct use of the target morpheme in their descriptions of the experimental items were then analyzed and compared to identify priming effects in the immediate and delayed post-tests. Results indicated an increase, for all groups, in the number of accurate use of –s from the pre-test to the post-tests; however, no significant difference was found among the groups in terms of accurate use of –s. These findings suggest that the interlanguage grammar of L2 learners cannot be altered on the basis of priming-a form of implicit learning, in the domain of inflectional morphology.

ÖZET

Çağrıştırmanın İkinci Dilde Biçimbirimsel Üretime Etkileri

Son yıllardaki çalışmalar çağrıştırmanın ikinci dil edinimini kolaylaştıran yararlı bir yöntem olabileceğini göstermektedir. Ancak çağrıştırmanın ikinci dil edinen yetişkinlerin biçimbirim-sözdizimsel yapılarının gelişiminde nasıl bir etkisi olduğu henüz araştırılmamıştır. Bu da, çağrıştırmanın ikinci dilde biçimbirim üretimindeki etkilerini incelemeyi hedefleyen bir araştırmayı gerekli kılmıştır. Bu çalışmada, çağrıştırıcı olarak kullanılan, biçimbirimsel açıdan dilbilgisel olan ve olmayan tümceleri duyduktan sonra, yetişkinlerin çağrıştırma etkisiyle bu yapıları kendi üretimlerinde doğru kullanıp kullanmadıkları incelenmiştir. Katılımcılar ana dili Türkçe olup İngilizceyi ikinci dil olarak öğrenmekte olan yetişkinlerdir ve araştırılan hedef yapı İngilizcedeki fiile eklenen–s uyum ekidir. Ön test-son test deseni kullanılan çalışmada katılımcılardan sözlü veri toplanmıştır. Sözlü veriler, katılımcı görüntüsünde çalışmada yer alan araştırmacının ürettiği dilbilgisel olan ve olmayan tümceleri takiben, katılımcıların bilgisayar ekranında gördükleri resimleri betimlemeleri ile toplanmıştır. Dilbilgisel tümceler için –s takısı içeren, dilbilgisel olmayanlar için de gerekli –s takısının atıldığı tümceler kullanılmıştır. Daha sonra, katılımcıların –s takısını doğru kullanım sayıları karşılaştırılalarak, gruplar arası potansiyel farklılıklar incelenmiştir. Araştırma sonuçlarında, tüm gruplar için, son-testlerde –s takısının doğru kullanımında ön-teste göre bir artış bulunurken, gruplar arasında hedef takının doğru kullanımı yönünden hiçbir anlamlı fark bulunamamıştır. Bu sonuçlar, ikinci dil öğrenenlerin aradilinin bir örtülü öğrenme biçimi olan çağrıştırma ile biçimbilimsel olarak değiştirilemediğine işaret etmektedir.

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To my loving parents,

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who have supported and believed in me

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CHAPTER 1

INTRODUCTION

Research on second language (L2) acquisition of English suggests that the acquisition of functional categories including inflectional bound morphemes such as plural, past tense, third person singular *–s* is one of the most difficult areas for adult learners (Bailey, Madden, & Krashen, 1974; DeKeyser, 2005; Dulay & Burt, 1974; Geçkin & Haznedar, 2008; Ionin & Wexler, 2002; O'Grady, 2006; Prévost & White, 2000a, b). Even long after individuals achieve a high level of proficiency in the L2, they still experience difficulty when it comes to the use of grammatical inflections because their production in the L2 is still characterized by morphological variability (i.e. fluctuation between correct use and incorrect use of morphemes in the form of omission and substitution) (Lardiere, 1998a, b, 2000, 2007; White, 2003). Indeed, L2 learners' problems with learning inflectional morphology has been well-documented in L2 acquisition research, and this is what has encouraged researchers to explore the ways in which such forms can be effectively learned/taught in the classroom environment.

As DeKeyser (1995) notes, in instructed L2 acquisition research, there has been much more emphasis on conscious, explicit learning taking place in the context of explicit grammar instruction than unconscious, implicit learning occurring when L2 learners internalize language forms without paying conscious attention (Ellis, 2005). Explicit learning (and/or instruction) is believed to speed up the L2 learning process (Norris & Ortega, 2000). Nevertheless, much research suggests that although classroom L2 learners generally receive formal explicit grammatical instruction, they often experience difficulties in producing them in online language use. The difficulties have

been argued to be caused by a lack of automaticity or implicit knowledge in production (Segalowitz & Hulstijn, 2005) as well as a lack of full-fledged abstract syntactic knowledge (Ellis, 2005). Ellis (2005), for example, argues that explicit information or instruction may facilitate the initial registration of a structure, but integration and synthesis of that pattern occur implicitly, for the most part through exposure to the target language.

To help facilitate this integration and synthesis, McDonough and Trofimovich (2011) suggest that 'priming' can be helpful as a method in L2 learning/teaching. They claim that priming as a form of implicit learning might encourage learners to produce language forms that they may be in the process of acquiring. Specifically, the term 'priming' refers to the phenomenon in which prior exposure to specific language forms or meaning influences a speakers' subsequent language production or comprehension. Though originally developed in cognitive psychology, priming, as a construct, has begun to gain interest in applied linguistics over the past two decades (see McDonough & Trofimovich, 2011). The findings that priming occurs with little awareness of the participants and that it persists over time and across intervening linguistic material/stimulus has led some researchers to suggest that it might represent a form of implicit learning (Bock & Griffin, 2000; Branigan, Pickering, & Cleland, 2000; Chang, Dell, & Bock, 2006; Chang, Dell, Bock, & Griffin, 2000). As an implicit and unconscious phenomenon, priming suggests that individuals' prior experience with a particular language form affects their subsequent use of it. In recent L1 acquisition research, Tomasello and his colleagues (Savage, Lieven, Theakston, & Tomasello, 2003) have found a positive relationship between priming and acquisition of English passives by young children. Similarly, in L2 acquisition research, McDonough and Mackey

(2008) have demonstrated that priming is associated with the L2 acquisition of questions.

Structural priming is a frequently studied phenomenon in applied linguistics, and it refers to the tendency of speakers to repeat a particular syntactic structure recently encountered. In other words, it is the tendency to reuse (unconsciously) the previously activated syntactic information/structure/form in a subsequent linguistic context (Bock, 1986). In fact, speakers tend to produce a recently encountered syntactic structure even if the initial and subsequent utterances do not share the same lexical items, semantic, phonological or prosodic properties (Bock, 1989; Bock & Loebell, 1990; Bock, Loebell, & Morey, 1992). For example, when a sentence such as *The man gave the boy the book* is spoken or heard, the same linguistic structure (i.e., double object construction) is often used to describe a similar event in a subsequent utterance such as *The girl handed the teacher the paintbrush* instead of an alternative and equally grammatical structure involving prepositional object construction such as *The girl handed the paintbrush to the teacher*. These sentences (i.e., *The man gave the boy the book* and *The girl handed the teacher the paintbrush*) are unrelated in terms of their lexis, phonology, or semantics, but they share a syntactic structure. In other words, both of them are double object constructions in the form of subject–verb–object–object). The linguistic structure of the sentence is what is believed to lead to priming. As in the L1 literature, research on L2 structural priming suggests that priming occurs in L2 speech production for a variety of equally acceptable (i.e., grammatically correct) structures such as double object versus prepositional phrase constructions (McDonough, 2006; Schoonbaert, Hartsuiker & Pickering, 2007) and actives and passives (Kim & McDonough, 2008).

In the L2 acquisition literature, McDonough and Trofimovich (2009) examined structural priming as a useful method to examine L2 processing and learning of newly acquired constructions. This means that priming can be seen not only in constructions which have two grammatical alternatives but also in constructions with grammatical and ungrammatical forms. For example, McDonough and her colleagues have demonstrated that through collaborative structural priming activities L2 learners are encouraged to produce wh-questions with correct auxiliary verbs rather than interlanguage questions with missing auxiliary verbs (McDonough & Kim 2009; McDonough & Mackey, 2008). Here, a grammatical form can be primed; thus, learners may be triggered to use them instead of an ungrammatical form that they can potentially produce. In this line of research, structural priming is being used to support L2 acquisition/development when learners have a choice between a developmentally-less-advanced and a developmentally-advanced form, or between a non-target-like form and an accurate form. The goal in those studies is to determine whether "flooding" the learners with a specific grammatically well-formed structure would facilitate (i.e., primes) the production of that structure rather than its developmentally-less-advanced (or ungrammatical) version/form (McDonough, Neumann, & Trofimovich, 2015, p.78).

Several structural priming studies conducted within the field of applied linguistics till now has shown that structural priming may be useful in facilitating language learning (e.g., Kim & McDonough 2008; McDonough, 2006; McDonough & Mackey, 2008); nevertheless, there is not any research on how priming can trigger the development of morphosyntactic forms such as inflectional morphemes in the L2. In other words, the question of whether or not a morphosyntactic form can be primed in adult L2 acquisition has, to our knowledge, not yet been studied in the field. As

mentioned in the beginning of this chapter, previous research based on spontaneous or elicited production has shown that L2 acquisition of inflectional morphemes is difficult and leads to persistent errors. Still, L2 development of inflectional morphology has not been explored within a research paradigm that directly implements the priming technique. Therefore, this study is an original and unique contribution to L2 language learning field in the domain of morphosyntax, namely the acquisition of the verbal inflection, third-person singular *–s* in English. Moreover, the present study aims to investigate not only grammatical but also ungrammatical morphosyntactic priming. In other words, the study will also investigate L2 speakers' susceptibility to structural priming of ungrammatical structures, in this case, the inaccurate use of the *–s* morpheme in the form of omission in obligatory contexts. The rationale behind this investigation is to examine L2 learners' liability to morphological variability as would be revealed by their production of an ungrammatical morphological form (i.e. omission of *–s*) as a result of ungrammatical primes. This issue also has not been studied before in the context of L2 use of inflectional morphology. Thus the findings of the study will, albeit indirectly, have implications for language learning in L2 classrooms.

The rest of the thesis is organized as follows: Chapter 2 gives a detailed summary of the difficulties L2 learners encounter in the acquisition of L2 morphology. Chapter 3 aims to provide a detailed summary of structural priming research in L1 and L2. Chapter 4 gives a thorough explanation regarding the design of the study. Chapter 5 reports on the results, and finally Chapter 6 presents the discussion of the findings.

CHAPTER 2

ACQUISITION OF MORPHOLOGY IN THE L2

Over the last three decades, many researchers in the field of second language acquisition (SLA) have examined the acquisition of functional categories and the corresponding morpho-syntactic forms, including tense/agreement markings on verbs, number marking on nouns, and gender marking on determiners and adjectives. Irrespective of their theoretical background, all these researchers seem to agree that acquisition of morphology is one area of particular difficulty for adult L2 learners (Bailey et al. 1974; DeKeyser, 2005; Dulay & Burt, 1974; Geçkin & Haznedar, 2008; Ionin & Wexler, 2002; Lardiere, 1998a, b, 2000, 2007; O'Grady, 2006; Prévost & White, 2000a, b). It is a widely-documented phenomenon that L2 speakers demonstrate variability particularly in the use of inflectional morphemes such as subject–verb agreement, tense and gender marking; that is, these morphemes are sometimes present and sometimes absent in their spontaneous production data (e.g., Haznedar & Schwartz, 1997; Lardiere, 1998a, b; Ionin & Wexler, 2002).

2.1 Morphological variability in the L2

Morphological variability in the L2 has been shown in L2 learners from different first language (L1) backgrounds (see e.g., Lardiere, 1998a, b for the acquisition of English by an L1 speaker of Chinese; Vainikka & Young-Scholten 1994, 1996a, b for the acquisition of L2 German by L1 speakers of Turkish, Korean, Spanish and Italian; White, 2003 for the acquisition of L2 English by an L1 Turkish speaker; Prévost, 2004 for the acquisition of L2 French as well as Gürel, 2000 and Haznedar, 2003 for the

acquisition of L2 Turkish by L1 speakers of English). Furthermore, this inconsistent use of inflectional morphemes has been found not only with L2 learners at the low-proficiency level (Vainikka & Young-Scholten, 1994, 1996a, b) but also with learners with advanced L2 proficiency (Hawkins & Liszka, 2003) and even with end-state L2 learners,[1] who have long periods of residence in and contact with the L2 community (Lardiere, 1998a, b).

Although the difficulty with the L2 acquisition of inflectional morphemes in adult learners is not disputed, neither its extent nor its causes has been conclusively identified. Therefore, this issue is still subject to controversial debate in SLA research. Several hypotheses have been proposed to identify the linguistic nature of L2 inflectional variability. These can be grouped as follows according to their basic premises: (1) L2 learners have impaired syntactic representations as suggested in the *Weak Transfer/Valueless Features Hypothesis* by Eubank (1993/94), the *Failed Functional Features Hypothesis* by Hawkins and Chan (1997), the *Representational Deficit Hypothesis* by Hawkins (2003), and the *Interpretability Hypothesis* by Hawkins and Hattori (2006), Tsimpli (2003), Tsimpli and Dimitrakopoulou (2007); (2) L2 learners have a fully specified syntactic representation but difficulty retrieving inflectional morphemes. This view has been referred to as the *Missing Surface Inflection Hypothesis* and assumed in the work of Haznedar and Schwartz (1997), Lardiere (1998a, 1998b, 2000), Prévost and White (2000b), and Schwartz and Sprouse (1996); (3) L2 learners' production of inflectional morphology is constrained by the prosodic properties of their L1s. This view is known as the *Prosodic Transfer Hypothesis* and proposed by

[1] End-state refers to the ultimate grammar reached by L2 learners, who, after that point, are believed to make no further progress in the L2 (White, 2000).

Goad, White, and Steele (2003), Goad and White (2006), and Lardiere (2007); (4) L2 learners come to the task of L2 learning with a set of fully assembled grammatical categories from their L1s and 'remap/reconfigure' the feature bundles assembled in the L1 into lexical items in the L2, as suggestd by the *Feature Reassembly Hypothesis* by Lardiere (2008, 2009).

These views have been put forward to account for the L2 data, discussed in the following section, consisting of substantial evidence for variability in the use of inflectional morphology, particularly tense and agreement morphemes. At this point, it is also important to highlight that although previous research investigating L2 morphological variability has focused mainly on production data, and to some extent perception data (DeKeyser, 2000; Johnson & Newport, 1989; McDonald, 2000), a growing body of research in the field of psycholinguistics has started to investigate real-time processing of inflectional morphemes by L2 learners within different lexical decision paradigms (Clahsen, Felser, Neubauer, Sato & Silva, 2010; Jiang, 2004, 2007; Silva & Clahsen, 2008). These L2 studies have also reported problems with the mental representation and computation of inflectional morphemes. It has been suggested that L2 learners' inability to do online morphological computations may be related with the way they are represented/processed in the mental lexicon (Gürel & Uygun, 2013).

Since the focus of this thesis research is the priming effects on L2 production of inflectional morphology, it goes beyond the scope of the present investigation to provide a detailed discussion of morphological comprehension studies. Therefore, in the section below only those studies which investigated the production of inflectional morphology will be discussed.

2.2 Previous L2 studies on morphological variability

The acquisition of functional categories, specifically tense and agreement marking on verbs, is one of the issues that has dominated the research agenda of the field of SLA. A common finding that has been observed is that L2 learners use the verbal inflections inconsistently; that is, they sometimes erroneously omit and sometimes correctly supply the verbal inflections in spontaneous production.

To illustrate, the following utterances (1), (2), (3) exemplify variability in the use of subject-verb agreement by L2 speakers of English, French and German, respectively.

(1) L2 English (SD)
And she *cleans* . . . the house. And *wash* the dishes. And, uh, she *makes* the bed.
(White, 2003: 134)

(2) L2 French (Zahra)
a. tout le monde *rester* à le salon
everyone stay-INF in the living room
b. deux *restent* le bureau
two stay- 3P (at) the office
(Prévost & White, 2000a: 210)

(3) L2 German (Zita)
a. ich *studieren* in Porto
I study-INF in Porto
b. ich *studiere* nicht
I study-1S not
(Prévost & White, 2000a: 210)

As can be seen in the italicized verbs, in these examples, the learners sometimes correctly use (*cleans*…*makes* in 1; *restent* in 2b; *studiere* in 3b) and sometimes omit tense and/or subject-verb agreement markings on the verbs (as in *wash* in 1). The use of infinitival forms is also commonly observed (as in *rester* in 2a and *studieren* as in 3a). Interestingly, these utterances in the respective language were elicited from the same learner during the same interview.

The inconsistency or variability is observed in child as well as adult L2 learners, as first documented in the early morpheme order studies on L2 English (Bailey et al. 1974; Dulay & Burt, 1974; Larsen-Freeman, 1975) as well as by much recent research on a variety of L2s, including, but not limited to French, German, and English (e.g., Haznedar & Schwartz, 1997; Haznedar, 2001; Lardiere 1998a, b; Prévost & White, 2000a, b; White, 2003).

The phenomenon of morphological variability in L2 production does not simply represent occasional and temporary slips of tongue; it is systematic (Hawkins, 2009), and it surfaces mostly in the form of omission in both child and adult L2 learners. For example, Haznedar and Schwartz (1997) and Haznedar (2001) reported that a Turkish-speaking child, Erdem, supplied the correct past tense and 3rd person singular agreement inflection on lexical verbs in English around 26% and 47% of the time, respectively. The major form of morphological problems was the use of (uninflected) bare forms. Similarly, Ionin and Wexler (2002) analyzed a set of oral production data from 20 Russian-speaking children (aged between 3-13) and found that the omission of morphology was quite high (58% for past tense and 78% for 3rd person singular agreement on lexical verbs).

It is also important to note that L2 morphological variability is mostly associated with developing grammars of L2 learners (e.g., Goad et al., 2003; Herschensohn, 2001; Vainikka & Young-Scholten, 1996a, b). In other words, it is perceived to be a developmental problem, which may eventually be eradicated.

For example, Vainikka and Young-Scholten examined this issue on the basis of longitudinal and cross-sectional production data from uninstructed L2 learners of German with different L1s (Turkish, Spanish, Korean, and Italian). The length of stay in

Germany ranged from 1.5 to 25 years. The learners were placed at different developmental stages according to their syntactic development. The results showed that all learners except for the ones in the highest developmental stage displayed high variability in their production of verbal morphology. The ones in the highest developmental stage (who were claimed to be not very advanced learners since they did not show full representation of Complementizer Phrase, CP projection) were found to use an incorrect verbal agreement suffix to a lesser extent (20% of the time).

Similarly, Herschensohn (2001) investigated the acquisition of verbal inflections by two L1-English L2-French adolescents. Although both had studied French as a second language for four years, the students had intermediate level proficiency in the L2. Herschensohn found that even though these two learners demonstrated the use of infinitival forms in finite contexts, they still achieved a high accuracy rate in the use of tense/agreement marking (the average percentage in the use of verb inflections was 81% and 86% in their spoken production).

In another study, Goad et al. (2003) examined data from L1-Mandarin learners of English, who had lived in Canada for a period ranged from 6 months to 5 years. Their proficiency level was assessed to be high-intermediate/low advanced. Goad et al. found that the learners omitted the past tense and 3rd person agreement markers to a great extent. The suppliance rates for regular and irregular marking were 57% and 78%, respectively. The rate was only 28% for the 3rd person singular marker. Goad et al. propose that these learners were unable to construct prosodic representations required for English since these representations are disallowed in Mandarin, and they believe that L1 effects are permanent; that is, L2 competence should always be constrained by L1 prosodic representations.

Despite studies reporting an L2-proficiency-based increase in the accuracy rate in using L2 morphology, variability does not appear to be a temporary problem. In other words, it is not observed only in developing grammars but also observed in L2 learners, who are believed to reach an end-state L2 but still demonstrate divergent use of L2 morphology despite prolonged L2 exposure (e.g., Lardiere, 1998a, b, 2007; White, 2003).

For example, Lardiere's (1998a, b) data from an L1-Chinese-speaking adult L2 English learner confirms this observation. Lardiere's participant, Patty was described to be an end-state L2 learner, who had been living in the L2 country for 10 years at the time of first testing and had received extensive exposure to L2 English. Patty's second and third recordings covered a period of approximately 8 years. Despite this prolonged exposure, Patty's correct suppliance of verbal inflection in obligatory contexts was quite low. She produced the past tense and 3rd person singular agreement morpheme only at a rate of 35% and 5%, respectively. In another longitudinal study with an end-state adult L2 learner of English, White (2003) analyzed oral production data from an L1-Turkish-speaking participant named as SD, who moved to Canada from Turkey when she was 40. In Canada, she attended college where she began her significant exposure to English. Four interviews were conducted over a two-month period. Additionally, a fifth interview was conducted after eighteen months to determine any change over time. The results showed that although SD had certain problems in the nominal domain (i.e., article use), she was quite accurate on English verbal morphology. White's data also indicated an important determinant of morphological variability in the L2, namely, L1 influence. For example, SD's accuracy in the use of verbal morphology was substantially higher than that of Patty in the Lardiere's study. The mean percentage of accuracy in verb inflection

was around 80% in SD's data. White (2003) argues that the difference between SD and Patty might be attributed to L1 influence. Turkish is rich with respect to verbal inflection while Chinese lacks inflection. Thus, White suggests that the presence of overt morphology in the L1 "appears to sensitize the L2 speaker to morphology in the L2, and to facilitate its use" (p. 139).

Another study which attributes differences in L2 learners' performance to L1 influence is Hawkins and Liszka (2003), who studied morphological variability in past tense marking in oral production of advanced learners of L2 English from Chinese, Japanese and German L1 backgrounds. Hawkins and Liszka observed much lower suppliance of past tense marking in obligatory contexts in L1-Chinese learners (63%) than in L1-Japanese (92%) or L1-German learners of English (96%). The researchers argue that since Japanese and German have morphosyntactic exponents of 'past tense' but Chinese does not, the difference in performance is due to syntactic transfer.

In adult L2 studies, the omission of verbal morphology has also been reported in the acquisition of languages with richer morphological paradigms than English, such as French and German. For example, Prévost and White (2000b), examined the acquisition of tense/agreement morphology in L2 French and German. The L2 French data was from two L1-Moroccan Arabic speakers, and the L2 German data was obtained from one L1-Spanish and one L1-Portugese-speakers. The results revealed that the use of verbal agreement was largely correct in adult L2 learners (i.e., around 95% accuracy). L2 learners did not use finite forms in non-finite contexts. However, Prévost and White also reported high rates of omission of finite inflectional morphology in both L2 French and German: the adult learners frequently supplied infinitival forms in place of finite forms in clearly finite contexts.

To sum up, morphological variability in the use of the verbal inflection is a robust phenomenon in L2 production. Moreover, it does not only occur in early stages of L2 acquisition (i.e., in learners with low to intermediate L2 proficiency), but also persists into advanced L2 stages. Although morphological variability is commonly observed in L2 learners from a variety of L1 backgrounds, the available data still suggests that the morphological richness in the L1 in general and the absence or presence of a particular target morpheme in the L1 in particular might have an effect on how well and how fast L2 morphemes could be mastered.

Besides L1 effects, there may be L2-specific (i.e., intralingual) properties that might influence native-like acquisition of L2 morphemes. For example, DeKeyser (2005), in his discussion of what makes inflectional morphology difficult to acquire, mentions three factors: complexity of meaning, complexity of form, and complexity of form-meaning relationship. For complexity of meaning, he lists the following linguistic elements as sources of difficulty; novelty of meaning, abstractness of meaning, or combination of both: articles, classifiers, grammatical gender and verbal aspect are discussed in this context. DeKeyser adds that these elements are "are extremely hard to infer implicitly or explicitly from the input" and thus they "strongly resist to instructional treatments" (p. 5). DeKeyser describes the complexity of form "as the number of choices involved in picking all the right morphemes and allomorphs to express these meanings and putting them in the right place" (pp. 5-6). He highlights that while the acquisition of basic word order has been evidenced to be non-problematic after initial stages, L2 learners struggle with basic morphology even after many years of exposure to the target language, whether it be in natural settings or in classroom contexts. DeKeyser suggests that complexity of form-meaning emerges when the link

between form and meaning is not transparent. He lists the following as factors making forms less transparent: redundancy (e.g., verb ending in the presence of explicit noun phrase or pronoun subject in a sentence), optionality (e.g., null subjects in pro-drop languages such as Italian or Turkish), frequency and opacity. A clear example of opacity can be seen in the case of the English morpheme *–s*, which can be added to nouns to mark possession (or genitive case) (e.g., Tony's cars) and plurality (e.g., a lot of cars) and to verbs to mark 3rd person singular present tense (e.g., Tony likes his car). Adding to this complexity, this particular English morpheme has different allomorphs. Its surface form differs according to the stem to which it is affixed (/s/, /z/, and /ɪz/ are all its variants), and only one of these allomorphs is syllabic. DeKeyser suggests that in cases such as the morpheme *–s* in English, "…the correlation between form and meaning becomes very hard to detect" for L2 learners (p. 8).

A common failure in the acquisition of verbal inflection morphology is what has led some researchers to investigate pedagogical aspects of L2 morphology. In other words, the relevant question for this group of researchers has been "how L2 learners can be assisted to acquire such morphosyntactic forms".

This thesis has also been motivated by this question. As will be discussed in the subsequent chapters, the present research looks at this commonly observed L2 problem from the acquisitional and pedogogical perspectives on the basis of a psycholinguistic paradigm, namely structural priming. The study focuses on the acquisition of the 3rd person singular agreement morpheme *–s* in English by L1-Turkish-speaking adult learners.

In line with DeKeyser's (2005) predictions, this particular morpheme has been reported to be problematic not only for adult L2 learners but also for children (Brown,

1973; de Villiers & de Villiers, 1973). O'Grady (2006) further suggests that the agreement *-s* morpheme in English is difficult to learn also because of its low perceptual saliency. Perceptual salience is of crucial importance for L2 learners since it has been shown to have a facilitative effect on L2 learning (Goldshneider & DeKeyser, 2005). To this end, this thesis aims to explore whether a psycholinguistic phenomenon (i.e., structural priming) can be used as a possible mechanism to facilitate the acquisition of L2 morphology. A detailed discussion of structural priming and how it has been utilized in the SLA context can be found in the next chapter, Chapter 3.

CHAPTER 3

STRUCTURAL PRIMING AND L2 LEARNING

3.1 What is structural priming?

A fundamental phenomenon in experimental psychology is *repetition,* defined, in general as, the performance of an action that is the same in some ways as a previous action performed or observed by the actor (Pickering & Ferreira, 2008). As Pickering and Ferreira suggest, repetition is essential in experimental psychology because it can reflect the operation of several distinct underlying cognitive mechanisms such as learning, development, imitation, and executive control. In the last century, researchers in cognitive psychology have revealed a prominent form of repetition called *priming*. In technical terms, priming is the phenomenon whereby an encounter with a stimulus (the *prime*) facilitates the subsequent processing of the same or a related stimulus (the *target*) (Tulving, Schacter, & Stark, 1982; Branigan, 2007). As Pickering and Ferreria (2008) point out, this phenomenon is central in different domains of cognitive psychology and has been examined heavily because the tendency to repeat certain aspects of knowledge help researchers diagnose the nature of that knowledge. For instance, *lexical priming* in the word recognition literature (McNamara, 2005) has helped researchers illustrate how words are stored and processed in the mind of a language user. The observation that people process a word such as *doctor* faster when they previously process a semantically related word like *nurse* showed that strongly associated words (e.g. *nurse – doctor*) are stored together or somehow linked in the mind of a language user and both get activated due to having such links.

Among all forms of repetition, one that has received much attention in the field of psycholinguistics over the past three decades is *structural priming* (also called *syntactic priming*). Structural priming, in a narrow sense, refers to the tendency of speakers to repeat a particular syntactic structure recently encountered. In a more comprehensive definition, it is a tendency to reuse or better process a current syntactic information/structure/form because of its structural similarity to a previously experienced (prime) sentence (Bock, 1986). For example, when speakers produce or hear a double-object (DO) construction such as *The man gave the boy the book*, they are more likely to describe a similar event in a subsequent utterance using the same linguistic structure such as *The girl handed the teacher the paintbrush* instead of an alternative and equally grammatical structure involving prepositional-object (PO) construction such as *The girl handed the paintbrush to the teacher.*

Speakers' tendency to repeat their own or others' structural choices was first documented in naturalistic studies. The first systematic analysis of structural repetition was carried out by Schenkein (1980), who documented repetition of syntactic forms in dialogues between robbers over walkie-talkies. Weiner and Labov (1983) found that the most likely predictor of one's producing a passive sentence in interviews was the presence of a passive sentence shortly before. The experimental work on structural repetition began with Levelt and Kelter (1982), who demonstrated that the form of a question (e.g., *What time do you close?* or *At what time do you close?*) influences the form of an answer produced (in Dutch) (e.g., *Five o'clock* or *At five o'clock*). However, in all these cases of structural repetition, it is very difficult to determine whether these syntactic repetition effects were due to syntactic priming or to priming at another level (e.g., lexical priming of the preposition) (Levelt & Kelter, 1982) or to discourse factors

such as register (e.g., Weiner & Labov, 1983) (Branigan, 2007; Branigan, Pickering, Liversedge, Stewart, & Urbach, 1995).

These early investigations were followed by a highly influential experimental demonstration from Bock (1986). Under the guise of a memory task, individual speakers first repeated any one of the two alternatives (prime sentences) and then described semantically unrelated target pictures. Bock manipulated the syntactic structure of the prime sentences. For example, the prime sentence was an active sentence in one condition (e.g., *One of the fans punched the referee*) and a passive sentence in the other condition (e.g., *The referee was punched by one of the fans*). She designed the target pictures in such a way that they could potentially be described by using either an active or passive form. Importantly, the prime and target pairs were not related in meaning and did not form a connected discourse. Bock found that participants showed an increased tendency to produce an active sentence to describe a target picture (e.g., *Lightning is striking the church*) even after a semantically unrelated active prime (e.g., *One of the fans punched the referee*). Similarly, there was a tendency to use a passive sentence to describe a target picture (e.g., *The church is being struck by lightning)* after a passive prime (e.g., *The referee was punched by one of the fans).* Bock's investigation was a pioneer in the structural priming literature because it showed that priming occurs in a task presented to participants as a memory test that involved repeating and producing sequences of unrelated sentences. Such a finding convincingly ruled out most alternative accounts of structural priming such as communicative intentions, register-related discourse factors (Weiner & Labov, 1983), or lexical repetition (e.g., Levelt & Kelter, 1982) and showed that priming effects can indeed be automatic and purely structural (Pickering & Ferreira, 2008).

After this initial investigation, Bock and colleagues and other researchers produced further publications on structural priming, verifying the previous result that structural priming happens on purely structural grounds, independent of lexical, thematic, or metrical information. For example, the sentence, *The secretary baked a cake for her boss* primed *The girl handed a paintbrush to the man* just as well as *The secretary took a cake to her boss* would, thus eliminating the possibility that structural priming is due to repetition of closed-class words (Bock, 1989). Likewise, the locative sentence, *The foreigner was loitering by the broken traffic light* primed the passive sentence *The referee was punched by one of the fans* given their similar surface structure although the by-phrase has different thematic roles in the two sentences (locative in the first one vs. agentive in the second), indicating structural priming does not depend on repetition of thematic roles (Bock & Loebell, 1990). Finally, Bock and Loebell (1990) showed that the sentence, *Susan brought a book to Stella* primed the sentence, *The girl gave a brush to the man*, but not the prosodically similiar sentence, *Susan brought a book to study*. This indicates that priming effects are not due to repetition of overall sound or prosodic contour of sentences. Pickering and Branigan (1998) further found that the magnitude of structural priming is not sensitive to repetition of verb inflections such as tense, aspect or number. In other words, a dative sentence (DO or PO form) functioned as a prime no matter whether the morphological form of the verb was the same or different between the prime and the target sentence (e.g., *shows, show, showed, is showing*).

In sum, these studies clearly demonstrated that structural priming emerges due to structural reasons (the linguistic structure of the sentence), but not as a result of other factors (Pickering & Branigan, 1999).

When we look at the history of priming studies, in the past 30 years, structural priming has been scrutinized in a large number of studies involving naturalistic (corpus) data (e.g., Gries, 2005), experimental data (e.g., Bock, 1986; Bock & Griffin, 2000), and experimental data in the form of dialogue (e.g., Branigan et al., 2000). Several studies has shown priming in different populations, including children (e.g., Savage et al., 2003; Sarılar, Matthews, & Kuntay, 2015), amnesiacs (e.g., Ferreira, Bock, Wilson, & Cohen, 2005), Broca's aphasics (e.g., Hartsuiker & Kolk, 1998a; Rossi, 2015), and bilinguals/adult L2 learners (e.g., Ameri-Golestan & Nezakat-Alhossaini, 2012; Bernolet, Hartsuiker, & Pickering, 2007, 2013; Biria & Ameri-Golestan, 2010; Boston, 2010; Cai, Pickering, Yan, & Branigan, 2011; Conroy & Antón-Méndez, 2015; Fleischer, Pickering, & Mclean, 2012; Hartsuiker, Pickering, & Veltkamp, 2004; Kim & McDonough, 2008; Loebell & Bock, 2003; McDonough & Chaikitmongkol, 2010; McDonough & Kim, 2009; McDonough & Mackey, 2006, 2008; McDonough, 2006; Salamoura & Williams, 2006, 2007; Schoonbaert et al., 2007; Shin & Christianson, 2012; Weber & Indefrey, 2009). Furthermore, structural priming has been examined in both spoken and written modalities (e.g., Branigan, Pickering, & Cleland, 1999; Hartsuiker & Westenberg, 2000) and in comprehension as well as production involving production-to-production (e.g., Bock, 1986; Bock & Loebell, 1990) comprehension-to-production (e.g., Bock, Dell, Chang, & Onishi, 2007; Cleland & Pickering, 2003), and comprehension-to-comprehension priming (e.g., Arai, Van Gompel, & Scheepers, 2007; Branigan, Pickering, & McLean, 2005). Also, it has been observed not only in English but also in other languages such as Dutch (e.g., Hartsuiker & Kolk, 1998b), German (e.g., Pappert, & Pechmann, 2013; Scheepers, 2003), Turkish (e.g., Bahadır, 2012), and Mandarin Chinese (e.g., Cai, Pickering, & Branigan, 2012). Lastly, structural priming

has been demonstrated across a wide range of constructions, involving transitives and datives (e.g., English, Pickering & Branigan, 1998; Dutch, Hartsuiker & Kolk, 1998b; German, Melinger & Dobel, 2005), word order (e.g., Dutch, Hartsuiker, Kolk, & Huiskamp, 1999; Spanish, Flett, 2006), the order of auxiliary and past participle (e.g., Dutch, Hartsuiker & Westenberg, 2000), relative clause attachment (e.g., German, Scheepers, 2003; Dutch, Desmet & Declercq, 2006), noun phrase structure (e.g., English, Cleland & Pickering, 2003), optional complementizer *that* constructions (e.g., English, Ferreira, 2003), and genitive-possessive constructions (e.g., Turkish, Bahadır, 2012). In recent years, structural priming has also been investigated with ungrammatical structures in the L1 and L2 contexts (Ivanova, Pickering, McLean, Costa, Branigan, 2012; Schutter, 2013, respectively).

Of special interest to this thesis are those studies which investigate priming in L2 acquisition/learning. The studies in this line of research have attempted to answer the question of whether the natural occurrence of structural priming could aid L2 acquisition.

However, before turning our attention to structural priming in L2 learning, it is important to understand why structural priming occurs and how it is used as an experimental paradigm. This will help establish the rationale behind the present investigation that looks at structural priming as a tool to support L2 learning. In the sections that follow, first some existing experimental paradigms used in structural priming research are explained, and then a brief review of mechanisms behind structural priming is provided. In the final section, the relationship between L2 learning and structural priming is discussed.

3.2 Structural priming as an experimental paradigm

Structural priming has been examined in several paradigms involving picture description tasks (Bock, 1986), sentence recall tasks (Potter & Lombardi, 1998), sentence fragment completion tasks (Pickering & Branigan, 1998), and confederate-scripting tasks (Branigan et al., 2000). Bock's (1986) picture description paradigm has been developed to investigate whether structural priming occurs across two utterances which are unrelated in meaning. In this paradigm, participants are told that the experiment is a memory test so that the participants' attention to their speech and structural features are aimed to be minimized. Before the experiment, participants are asked to study some sentences and pictures. During the experiment, participants hear a sentence (from the researcher) and they are asked to repeat it and they decide whether the sentence was in the study list. This is the priming phase where participants process the prime sentence. Immediately after the priming phase, participants, upon seeing a semantically unrelated picture, are asked to describe it and decide whether they have seen the picture in the study list. This is the target phase during which participants' responses are recorded. The prime sentences are constructed using one of two alternative constructions: transitives (active or passive forms), and datives (PO or DO forms). Similarly, the target pictures are designed to elicit such constructions, with participant using either one of two alternative constructions in their descriptions. Several filler items which are not semantically or syntactically related to target sentences intervene between experimental items in order to mask the purpose of the study.

In Potter and Lombardi's (1998) sentence recall tasks, participants read a prime sentence presented on a computer screen using a rapid serial visual presentation (RSVP) paradigm. In RSVP, each word automatically appears in the center of the screen and

stays there for 100ms. Experimental trials consist of prime and target items. On each trial, a distractor numerical task follows the RSVP of words, and then participants are asked to recall the sentence they have previously read. In this paradigm, participants reconstruct the sentences from the memory, and the structure of reconstructed sentences (target sentences) is predicted to be influenced by the syntax of prime sentences.

In sentence completion tasks used in Pickering and Branigan (1998), participants are given sentence fragments in a booklet and asked to complete them in any way they want as quickly as possible. Both the prime and target phases consist of sentence fragments. Prime fragments are designed to elicit one of the alternative constructions, either a PO or a DO construction. For example, a fragment such as [*The racing driver gave the torn overall...*] is predicted to elicit a PO dative. Similarly, a DO fragment such as [*The racing driver gave the helpful mechanic…*] is expected to elicit a DO construction. In the target (i.e. testing) phase, participants are given a fragment such as [*The patient showed....*] that can be completed in either a PO or a DO form. If participants follow the syntactic form they use in the priming phase while completing the fragment in the target phase, priming is said to occur.

Another method used in priming studies is the confederate-scripting task first introduced by Branigan et al. (2000). In this task, a participant and a confederate play a card game, in which they take turns to describe pictures to each other. Unbeknownst to the participant, the confederate, who is helping the researcher, follows a script while pretending to describe a picture. After the confederate's "description" (i.e., prime), the participant is asked to decide whether the picture s/he sees matches the picture the confederate has just "described." Then the participant describes a new picture (target) to the confederate who then pretends to do the matching task. Priming occurs if the

participant's production is influenced by the structure of the sentence the confederate provides. The confederate-scripting paradigm has been widely used and adapted in structural priming research (e.g., Branigan, Pickering, McLean, & Cleland, 2007; Hartsuiker, Bernolet, Schoonbaert, Speybroeck, & Vanderelst, 2008) as it does not require a memory disguise, is more similar to natural dialogue, hence more interactive, and has been shown to produce larger priming effects than previous paradigms (Branigan et al., 2000). As can be seen in Chapter 4, for the above-mentioned reasons, this particular paradigm is employed in the thesis research, with the difference that a computerized version of it is used in the present experiment. As discussed in the next section, different studies used different paradigms to explore the mechanisms of structural priming. There are different views on how structural priming occurs. Although this thesis does not aim to test these competing views, a brief discussion of these accounts is necessary as a background note to identify the underlying mechanisms of structural priming.

3.3 Why does structural priming occur?

To explain the mechanisms behind structural priming, there have been two accounts in language production research: a lexicalist residual activation account (e.g., Pickering & Branigan, 1998), emphasizing lexical constraints on structural priming, and an implicit-learning account (e.g., Bock & Griffin, 2000; Chang et al., 2006; Chang et al., 2000), underlining the abstract structural constraints on structural priming. These two theoretical accounts diverge in regard to the relative contributions of abstract syntactic processes or words in formulating sentences.

The lexicalist residual activation account of Pickering and Branigan (1998) is based on Roelofs's (1992) computational model of lexical access in production. Roelof's (1992, 1993) model incorporates a lemma stratum which is concerned with the syntactic properties of lexical entries. Pickering and Branigan extend Roelofs's model arguing that at the lemma level, there exist categorical nodes specifying grammatical category (e.g., noun, verb, and preposition) and feature (e.g., number, gender, and tense), and combinatorial nodes specifying the argument structures of a verb. For example, the verb "give" could either be combined with a DO form (e.g., *The man gave his child the book*) or a PO form (e.g., *The man gave the book to his child*). Each of these options is represented with a combinatorial node [V-NP-NP or V-NP-PP, respectively]. Pickering and Branigan (1998) also claim that these combinatorial nodes are in turn linked to each lemma that can appear with that construction (e.g., verbs *give* and *send* share the combinatorial nodes, PO and DO). Under this account, processing a prime sentence activates a combinatorial node, and then the link between the relevant lemma and combinatorial node becomes more active. The combinatorial nodes' residual activation leads to an increased probability of selecting the same syntactic structure in subsequent production. For example, when the sentence, *The client gave the document to his lawyer* is spoken or heard, the lemma of *gave* and its combinatorial node [V-NP-PP] are activated. The residual activation increases the probability of producing the sentence, *The boy sent a letter to his father* in a subsequent utterance that shares the same combinatorial node instead of producing the alternate structure, *The boy sent his father a letter*.

This account is supported by the finding that larger priming effects are observed in the case of verb repetition between the prime and the target (Pickering & Branigan,

1998). In other words, larger priming effects occur when the prime sentence and the target sentence share a common verb. The researchers named this the *lexical boost* to syntactic priming, and certainly this finding was critical for the development of their model. The model accounts for *lexical boost* the following way: If the target sentence has the same verb as the prime sentence, there occurs an extra activation from the verb to combinatorial node via the active link between the repeated verb lemma and combinatorial nodes, and this, in turn, leads to an increased priming effect.

According to the lexical residual activation account, explicit memory for the prime sentence's surface structure contributes to structural priming. Prime sentences act as a retrieval cue so that speakers are likely to remember the prime sentence's structure from their explicit memory and reuse it in their subsequent production. This explicit memory contribution to structural priming is also reflected in Bock et al.'s (1992) results. They found that providing instruction to participants influenced the magnitude of structural priming. Specifically, participants instructed to remember the syntax of a given sentence displayed greater structural priming than those instructed to remember its meaning. Ferreira and Bock (2006) argue that this finding "suggests that structural priming is sensitive to explicit memory for syntax, which in turn is consistent with the possibility that structural priming might be due to explicit-memory functioning" (p.7).

The group of researchers adopting the residual activation account has taken it one step further and proposed that structural priming may have the function of supporting alignment in a dialogue[2] (e.g., Branigan et al., 2000; Branigan, Pickering, Pearson, & McLean, 2010; Garrod & Pickering, 2004; Pickering & Garrod, 2004). The initial

[2] The alignment view suggests that " interlocutors do not use language to encode and decode messages, but rather as a means by which they can align their mental states, so that they come to have the same ideas about the topic under discussion" (Garrod & Pickering, 2007, p. 443).

evidence came from Branigan et al.'s (2000) finding that suggests that not only priming is observed in dialogue but also priming effects are much larger in dialogue paradigms compared to those in monologue production paradigms. Pickering and Garrod (2004) integrated this idea into the construct of *alignment*. They claimed that during a dialogue, interlocutors seek to align their situation models, or in other words, their understanding of the current context, hence making conversation more successful. Interlocutors are thought to align on many levels, including both lexical and syntactic levels, by using the same words and structures to describe similar events. In brief, structural priming may directly reflect communication among speakers. Priming as an alignment tool in a dialogue is generally claimed to occur unconsciously.

In contrast to the lexicalist residual activation account, in the implicit learning account of structural priming (e.g., Bock & Griffin, 2000; Chang et al., 2000; Chang et al., 2006), abstract structural configurations play a leading role in sentence production rather than lexically activated information based on combinatorial nodes. This account assumes that structural priming occurs during the mapping of meaning and structure (Bock & Griffin, 2000). The processor keeps tracks of the mapping frequency between particular conceptual messages and specific syntactic configurations. Once such a link is formed frequently, the probability to compute the same link is strengthened. For example, if a certain event (e.g., a dative event) is mapped on a certain structure (e.g., a PO form), similar events are likely to be mapped on the same (e.g., PO) structure. This can, in turn, lead to long-term adjustments in the production system. Indeed, structural priming as implicit learning is in line with the connectionist models of Chang and colleagues (2000, 2006). They conducted a series of large-scale simulations that were specific implementations of the implicit learning approach. More specifically, they

designed algorithmic models that learn through previous experience to form linguistic utterances and found that these models showed patterns of structural priming much like those observed in the literature. In Chang et al.'s connectionist models, structural priming emerges as a result of error-based learning. That is, the model continues to learn during the production of sentences. When a syntactic construction (PO) is produced, the model weights are adjusted such that it will be more probable to produce the same construction on a following utterance. According to this account, structural priming effects are expected to be long-lasting, as the change in model weights will remain in place until the next time the same syntactic choice is met.

The most relevant evidence suggesting that structural priming involves a form of implicit learning (as opposed to explicit learning) comes from three sources. First, structural priming effects can be relatively long lasting (Bock & Griffin, 2000; Hartsuiker & Kolk, 1998b; Hartsuiker et al., 1999; Hartsuiker et al., 2008). Bock and Griffin (2000) found that structural priming was just as strong when the target sentences were produced immediately after the prime sentence as it was when 10 neutral (i.e., filler) sentences intervened between the prime and target. This result provided evidence against Pickering and Branigan's (1998) activation-based account because the phenomenon emerged from residual activations is short-lived (e.g., Branigan et al., 1999; Levelt & Kelter, 1982) with lexical activation disappearing in milliseconds (Chang et al., 2006). Furthermore, Bock and Griffin' (2000) finding has demonstrated that structural priming effects can be enduring to the extent they persist across long intervening time and many processing material (Ferreria & Bock, 2006). Second, structural priming appears to be largely an unconscious process in that language users are not aware of the fact that they are being primed, nor are they using syntactic

structures consciously to organize their utterances (Pickering & Ferreria, 2008). Third, the tendency to repeat syntactic structures is incidental and automatic. One piece of evidence that priming is incidental comes from Bock et al.'s (1992) study: Although they found that task instructions affected the magnitude of priming, significant priming was still present regardless of task instructions. Furthermore, as Pickering and Ferreria (2008) point out, no studies up to date has shown that structural priming is affected by nonlinguistic dual-task effort or interference, "suggesting that structural priming is indeed an automatic phenomenon" (p.447).

In addition to being long-lived, unconscious and incidental, three other observations suggest that structural priming reflects a form of implicit learning. The first observation is that structural priming often exhibits an *inverse-preference* effect. That is, structures that are less common or less preferred display stronger priming relative to more preferred ones. Among the less preferred structures are passives (Bock, 1986) and non-canonical locatives (Hartsuiker et al. 1999; Hartsuiker & Westenberg, 2000; Scheepers, 2003). Structural priming in this sense is similar to situations where less well-known things lead to greater learning than already well-known things. The second observation is that patients suffering from anterograde amnesia, who have severely impaired expliciy memory display similiar levels of priming relative to a healthy control group (Ferreira et al., 2005). Thirdly, as noted by Bock et al. (1992), priming appears to be independent of explicit memory. For example, if, in a structural priming experiment, speakers are also asked to explicitly remember whether they encountered certain sentences, the sentences that cause priming are not the same as the sentences that speakers explicitly remember.

In short, both of these accounts (i.e. the lexicalist residual activation account and implicit learning account) have certain limitations. For example, although the lexicalist residual activation account (Pickering & Branigan, 1998) well explicates structural priming, it falls short of an explanation for the long-lasting priming observed in Chang et al. 2000; Chang et al. 2006). The implicit learning account (e.g., Bock & Griffin, 2000; Chang et al., 2000, 2006), on the other hand, fails to account for the lexical boost to priming observed in many studies. This discrepancy has led some researchers (e.g., Ferreira & Bock, 2006; Pickering & Ferreira, 2008) to suggest a multifactorial account of structural priming. In this view, the assumption is that structural priming results from abstract, long-term implicit learning mechanisms, and can be facilitated by lexically-specific, short-term mechanisms. Indeed, the main difference between long-term and short-term priming seems to stem from whether or not there is lexical repetition between a prime and target. Studies which reported long-term priming (e.g., Bock & Griffin, 2000) used different verbs between a prime and target while those which reported short-term priming (e.g. Branigan et al., 1999) used the same verb. Recently, Hartsuiker et al. (2008) investigated this difference directly by looking at priming of dative constructions both in written (i.e., chatting on a computer) and spoken dialogue. The prime and target sentences were either adjacent or separated by two, four, or six filler items. They also manipulated the repetition of prime and target verbs. The results showed that regardless of the modality (spoken or written), the lexical boost was short-lived, lasting only from one sentence to the next, whereas priming effects were long-lived, enduring over several intervening sentences. Based on this evidence, Ferreira and Bock (2006) suggest a two-locus account of structural priming: Long-term priming effects result from implicit learning mechanism; however, repeating verbs in the prime and target may make the

memory of the event more explicit, thus short-lived. This explicit, short-lived activation is what forms the basis of alignment in a dialogue discussed above.

As presented in this section, structural priming is a robust cognitive phenomenon and has been extensively investigated over decades in language processing and learning research.

Furthermore, as a cognitive phenomenon, structural priming can be a reliable method to investigate subtle processes underlying L2 learning as suggested by recent research on structural priming. Pickering and Ferreira (2008) have noted the need for research in this area, especially considering the possible role of implicit learning in structural priming. Thus, in the next section, the relationship between L2 learning and structural priming is discussed.

3.4 Structural priming and L2 learning

Although there has been extensive research on structural priming in the L1 context, it is only recently that the phenomenon has attracted attention in L2 research. Most of the research with L2 participants uses cross-linguistic priming in which the prime and target are in different languages. These studies have mainly investigated the extent to which syntactic representations in the bilingual mind are shared across languages. The findings of many studies conducted in this area suggest that there is a shared-syntax, where syntactic representations (at least the syntactic structures with similar surface structures) are shared by languages (e.g., Bernolet et al., 2007; Cai et al., 2011; Fleischer et al., 2012; Hartsuiker et al., 2004; Loebell & Bock, 2003; Salamoura & Williams, 2006, 2007; Schoonbaert et al., 2007; Weber & Indefrey, 2009). Although several studies have looked at cross-linguistic priming, single language research examining within-L2

priming (i.e., both the prime and target are in L2) is much less common. Only recently, studies looking specifically at structural priming only among L2 speakers have started to emerge in the literature (Kim & McDonough, 2008; McDonough, 2006; McDonough & Mackey, 2006, 2008; McDonough & Kim, 2009; Shin & Christianson, 2012).

The researchers working on within-L2 priming have focused on the potential role of structural priming in facilitating L2 learning. The ultimate goal of L2 learning is to access (i.e. understand and produce) L2 words and sentences fluently (Kroll & Dijkstra, 2002). However, much research suggests that classroom L2 learners who generally receive formal explicit grammatical instruction often experience difficulties in online use of L2 structures. The difficulties have been argued to be caused by a lack of automaticity or implicit knowledge in production (Segalowitz & Hulstijn, 2005) as well as a lack of full-fledged abstract syntactic knowledge (Ellis, 2005). Ellis (2005) argues that explicit information or instruction may facilitate the initial registration of a structure, but integration and synthesis of that pattern occur implicitly, for the most part through exposure to the target language. At this point, structural priming, as a form of implicit learning, has been proposed as a possible mechanism for language learning in order to help the integration and synthesis of language forms (Bock & Griffin, 2000; Bock et al., 2007; Chang et al., 2000; Ferreira & Bock, 2006; Pickering & Ferreira, 2008). Additionally, it has been put forward that structural priming as implicit learning might encourage L2 learners to produce language forms that they may be in the process of acquiring (McDonough & Trofimovich, 2011). In brief, within-L2 structural priming studies have used priming as a tool to promote L2 learning/acquisition and focused on the question of whether structural priming activities can encourage increased production of specific grammatical structures.

McDonough (2006) has conducted one of the first experimental studies of structural priming in L2 learners. She employed a confederate scripting paradigm within a pre- and post-test design in order to investigate the priming of English dative constructions and subsequent learning effects in slightly less advanced L2 English learners with various L1 backgrounds. She observed priming effects for prepositional-object datives that persisted into the post-test, but not for direct-object datives. Interestingly, those participants who produced at least one double-object dative during the baseline condition were more likely to produce double-object targets during the priming phase. McDonough concluded that priming may not be possible if L2 learners lack the abstract syntactic information (morphological, semantic, and discourse constraints on the double-object dative alternation) of the target structure that could otherwise be activated by the confederates' primes. She suggested that her participants might have associated the use of the double-object dative form with specific lexical items or with specific discourse. Therefore, they were not primed. McDonough's findings showed that depending on the target structure, structural priming effects are possible in within-L2 priming studies.

As discussed below, in a series of studies, McDonough and colleagues continued to address the potential role of structural priming in L2 learning (McDonough & Chaikitmongkol, 2010; McDonough & Kim, 2009; McDonough & Mackey, 2008). In many of these studies, structural priming was investigated within an interactional context. In other words, the question was whether interaction facilitates L2 development. In an L2 interactional environment, structural priming occurs in dialogues among learners or between learners and native speakers (or between learners and the teacher). For example, priming might emerge during the process in which L2 speakers develop

their competence through interaction with developmentally more advanced speakers (e.g. native speakers or more advanced L2 speakers), who prime them to produce more advanced structures. In one study with LI Korean-L2 English learners with low, middle, and high proficiency, Kim and McDonough (2008) investigated priming of passives. In the study, participants interacted with a researcher in a picture description task. Participants first listened to the researcher describe a picture and then they described their own picture. It was found that all groups experienced a significant lexical (verb) boost, meaning that they produced more passives when they were prompted by verbs that occurred in their interlocutor's preceding passives. However, the magnitude of this boost was greater for the lowest proficiency group than for the other two groups. Unfortunately, Kim and McDonough do not mention if the priming effect they obtained in their study was in general significant or not. Also, no pre- or post-test data were collected in this study. This makes it impossible to reach any conclusions about learning effects.

In another study looking at priming within an interactional context, Boston (2010) investigated priming of passives among L1 Japanese-L2 English speakers via an oral picture description task in which learners interacted with each other in a classroom. The results showed no priming effects: the treatment group performed similarly to a control group, and very few passive structures were produced by either group. Boston argues that the results are either due to the fact that the learners were not developmentally ready for passive structure or the task was not successfully designed to prime learners to produce passive. In contrast, a recent study by Ameri-Golestan and Nezakat-Alhossaini (2012) demonstrated large and significant priming effects for

passives among L1 Persian-L2 English speakers. All these findings suggest that the results of within-L2 priming studies are varied.

The design of L2 priming studies discussed so far reflects the design of the previous L1 priming studies as both groups of research always involved two alternative constructions (e.g., the passive versus the active), between which speakers can make a choice to produce a grammatical alternation in the target language. Another set of studies including within-L2 structural priming take a different approach: Namely, instead of investigating speakers' production of structures that have semantically equivalent grammatical alternatives, they scrutinize learners' tendency to produce either a grammatical or an ungrammatical form or either a developmentally more advanced target form or a developmentally-less advanced interlanguage form. These researchers build their approach on a widely accepted assumption that the interlanguages of L2 speakers are cognitively real linguistic representations independent of speakers' L1 representations and of the L2 target language (Selinker, 1972). Also, it is also assumed that both less and more advanced forms are interchangeably used by L2 learners. Therefore, via priming (i.e. upon hearing or producing) of an advanced form might potentially encourage the subsequent use of that form as opposed to the less advanced form.

The need for studies investigating priming 'in contexts in which an interlanguage system provides an L2 speaker with a choice between structures that are not equally acceptable' has already been pointed out by McDonough (2006) in her first experimental within-L2 priming study (p.199).

McDonough and Mackey (2008) were the pioneer researchers in investigating L2 learners' production of a target form compared to its interlanguage variant. They used a

pre-test/post-test design to study the effects of collaborative structural priming activities on L1 Thai-L2 English learners' subsequent production of *wh*-questions. They set out to investigate whether Thai learners of English who carried out structural priming activities subsequently produced more target-like *wh*-questions with supplied auxiliary verbs rather than target-deviant interlanguage question forms with missing auxiliary verbs. Participants were exposed to a priming treatment designed to help their production of 'developmentally advanced' questions along the stages of Pienemann's (2007) developmental sequence. Participants engaged in a dialogue with a confederate (a more advanced L2 speaker), who had been scripted with target-like *wh*-questions. Participants were also expected to ask questions to the confederate. Their production of questions was then tested in two different post-test sessions (one week and five weeks post priming). The results showed that the participants who had the highest amount of primed production in the treatment session performed significantly better on the two delayed post-tests than those in the control group, who did not receive any treatment. A classroom-based follow-up study (McDonough & Chaikitmongkol, 2010) similarly reported that participants who were engaged in syntactic priming activities with their peers in a classroom context displayed greater subsequent production of target *wh*-questions than learners in the control group who followed the regular curriculum.

Recent research on L2 structural priming has started to investigate novel target structures (i.e., structures that were not previously investigated in structural priming research). Biria and Ameri-Golestan (2010), for example, examined structural priming effects for a previously unexplored structure in L2 priming research: English indirect questions and requests (e.g., *He is asking how the cell-phone works*). They looked at the oral production and retention of those structures by L1 Persian learners of L2 English.

Biria and Ameri-Golestan reported large priming effects that also transferred across modalities (from speaking to writing) in an immediate post-test. They interpreted the priming effects as evidence of implicit learning of L2 grammar. In another study, Shin and Christianson (2012) investigated the priming effects on the production preferences of L1 Korean-L2 English learners regarding two English structural alternations: separated vs. non-separated phrasal verb constructions (e.g., *The man is putting the fire out* vs. *The man is putting out the fire*) and double object vs. prepositional object datives. The study employed a pre- and post-test design. During the treatment session, participants were primed for one structure within each alternation: the double object dative and the separated phrasal verb. Also, one day after the priming session, participants took a delayed posttest to assess the temporal durability of priming. Overall, Shin and Christianson found relatively large priming effects and attributed these effects to implicit learning of L2 structure. A recent study by Conroy and Antón-Méndez (2015) furthermore explored whether a specific L2 interlanguage context, stranded prepositions (e.g., *A pillow is something you sleep on*), could be primed in L2 learners of English in a pre- and post-test design. They hypothesized learners would produce more sentences containing stranded prepositions and fewer null prep sentences during and just after a structural priming treatment than in the pre-test. The results indicated that stranded preposition production indeed increased significantly, a finding which the researchers interpreted as a learning effect. However, null prep production did not decrease significantly either during the priming session or in the post-test. Conroy and Antón-Méndez explain this finding by referring to the existence of free variation or optionality in L2 development.

Very recently, a new study integrated the acquisition of morphosyntax into within-L2 structural priming research. McDonough and Fulga (2015) investigated the detection and primed production of a novel construction with morphological and structural features by L1 Thai and L1 Farsi speakers of L2 English. The target structure was the transitive construction in Esperanto—which is marked by accusative case marking (*–n*) and flexible word order (subject-verb-object and object-verb-subject). Participants first completed an auditory construction learning task that provided the novel target input, then they tried to generalize what they learned to new lexical items in the next task. Finally, they carried out a priming activity where they heard a prime sentence. They then did a picture-matching task and finally provided a spoken sentence for the subsequent prompt picture. Results of the primed production task revealed that only those participants who detected the target construction in the auditory construction task were able to be primed. Consistent with this finding, McDonough and Fulga concluded that L2 speakers can access only those structures for which they have a mental representation for production.

In sum, the findings of L2 research on structural priming are not converging. In order to better grasp the effect of structural priming activities on the learners' production of L2 target-like structures, research needs to target more diverse constructions.

In light of this background, the thesis study aims to examine a structure other than the ones examined so far. More specifically, the study focuses on grammatical L2 English sentences involving the verbal inflectional morpheme, third person singular agreement *–s* and corresponding ungrammatical forms without *–s*. Including these two alternatives (grammatical and ungrammatical morpho-syntactic forms) in the study is believed to provide an opportunity for us to investigate whether a morphosyntactically

correct and incorrect form can be primed in adult L2 acquisition. Recall that the study by McDonough and Fulga (2015) also focused on the priming of morphosyntax. However, their aim was to investigate priming effects for novel constructions. The target language was Esperanto and it is a constructed international language with which participants were unfamiliar. The present study does not focus on the acquisition of novel morphosyntactic forms but on the acquisition of one of the most troublesome morphosyntactic forms in English, namely the agreement *–s*, morpheme, which is observed to be difficult even for advanced L2 learners. To our knowledge, there is only one study that investigated morphosyntactic priming of English verbal inflectional morphemes. This is a child bilingualism study by Fitzpatrick (2011), who observed that bilingual elementary students with varied language exposure were influenced and learned from morphosyntactic priming. The morphosyntactic structures targeted included the third person singular and past tense in English. Although Fitzpatrick's study stands as a pioneer in the morphosyntactic priming research, it has two important limitations: the small number of participants across a wide age range (only three), and the qualitative data analysis procedure.

Thus, there is a need for empirical research that examines whether morphosyntactic priming is possible during L2 speech production. The present study aims to explore the occurrence of morphosyntactic priming in an experimental session with L1-Turkish speaking adult learners of L2 English and its impact on their subsequent production of the third person singular *-s*.

Although the primary research objective of the study is to explore morphosyntactic priming in L2 production, it will also scrutinize L2 speakers' susceptibility to structural priming of ungrammatical structures. Indeed, there is recent

evidence that even native speakers can be primed into producing ungrammatical sentences under specific conditions. For example, Ivanova et al. (2012) showed that with native speakers, ungrammatical verb-construction combinations like **The dancer donates the soldier the apple* could be primed after exposure to related ungrammatical structures. Similarly in the L2 context, Schutter (2013) demonstrated that near-native Dutch learners of English could be primed into producing ungrammatical post-nominal genitive structures.

Thus, the present study will explore the issue of priming in the production of grammatical as well as ungrammatical morpho-syntactic constructions among L2 learners. Such study will be revealing as to the potential effects of morpho-syntactic priming (as a form of implicit learning) among late classroom L2 learners. Furthermore, testing L2 speakers' (unconscious) tendency to copy an ungrammatical structure in their language production could, albeit indirectly, shed light on what goes on in L2 classroom contexts, where students might sometimes be exposed to the ungrammatical input (primes) by the teacher or the peers.

CHAPTER 4

METHODOLOGY

4.1 Introduction

This study investigated whether a grammatical and an ungrammatical morpho-syntactic form can be primed in adult L2 acquisition. More precisely, the aim was to explore whether grammatical or ungrammatical morpho-syntactic priming has any impact on L1 Turkish-L2 English learners' (in)accurate use of the inflectional morpheme, the third person agreement *–s*. The study involved a randomized experiment to be able to examine potential increase in the accurate or inaccurate production of the target morpheme subsequent to the exposure to grammatical or ungrammatical primes, respectively. The ungrammatical primes in this experimental context were sentences with missing *–s*. Three groups of participants were created for the study: the grammatical priming group that was exposed to grammatical primes; the ungrammatical priming group that was exposed to ungrammatical primes, and the control group that received no treatment. The study also explored the duration of priming (i.e., how long the priming effects persisted after the experiment).

As noted above, to examine the short-term and long-term effects of morpho-syntactic priming, the study looked at potential differences among the three groups across three conditions: the baseline condition (i.e., pre-test) and the immediate post-test (Post-test 1) and delayed post-test (Post-test 2). The comparison identified whether accurate and inaccurate production of agreement *-s* in the pre-test condition and the post-test conditions occurring after the priming session was quantitatively different. The data were collected via an elicited production task based on picture description. Any

performance differences among the groups in the immediate and delayed post-tests were taken to indicate priming effects.

The primes involved English sentences constructed in the simple present tense and only lexical NPs (not pronouns) used as sentential subjects. The reason why sentences with pronominal subjects were not used is because it has been shown, in the literature, that L2 speakers have much more difficulty with the use of agreement *–s* in sentences with lexical NP subjects than in sentences with pronominal subjects (Ellis, 1988; Tode, 2003).

4.2 Research questions and hypotheses

The study addresses the following research questions:

1. Does grammatical versus ungrammatical priming affect the accurate production of the third person agreement *–s* morpheme in sentences with lexical NP subjects for adult L2 learners of English coming from L1 Turkish background?
2. Do (un)grammatical priming effects (if any) last in the delayed post-test given three days after the priming session?

As for the first research question, it is predicted that morpho-syntactic priming effects regarding the English verbal inflectional morpheme the third person singular -s will occur in learners of L2 English. In other words, compared to their performance in the pre-test, L1 Turkish learners of L2 English in the grammatical priming group (G) will demonstrate significantly increased number of correct *–s* use in the immediate post-test after the priming session involving extensive exposure to grammatical sentences with –s morphology while L1 Turkish learners of L2 English in the ungrammatical priming group (U) will show similar or lower number of accurate use of the target

feature after the ungrammatical priming session, which involves exposure to sentences with a missing *–s* morpheme. The participants in the control group (C) are expected to display similar performance across all tests. Briefly, the following ranking is expected in terms of the rate of accurate *–s* use: G > C ≥ U.

As for the second research question, the priming effects for the grammatical and ungrammatical priming are predicted to last in the delayed post-tests, which will be given three days later. That is, the participants in the grammatical and ungrammatical groups will show persistence in their (un)grammatical production of the third person singular *–s*.

4.3 Participants

Sixty-six participants (53 female, 13 male) were recruited from the Foreign Language Education Department at Boğaziçi University, an English-medium state university located in Istanbul, Turkey. All participants were native speakers of Turkish and started learning English as their L2 in Turkey. To hold participants' English proficiency level constant, they were given the Oxford Quick Placement Test (Syndicate, U. C. L. E. 2001) before they participated in the experiment. In this 60-item-test, the scores ranged between 38 and 55 with a mean of 45.13, SD = 3.96. According to their test scores, they were randomly and equally assigned into three groups: grammatical, ungrammatical and control. Consequently, each group had an equal number of low-intermediate, upper-intermediate and advanced learners of English: There were one low-intermediate, fourteen upper-intermediate and seven advanced learners of English in each group. While grammatical and ungrammatical groups took the treatment (i.e., priming) session, the control group did not receive any treatment. Three participants later failed to appear

for the second phase of the experiment; thus, their incomplete data was discarded, leaving sixty-three participants (50 female, 13 male) whose data were analyzed.

The participants were also asked to fill in a background questionnaire, which was adopted from Gürel (2004), to obtain demographic and linguistic information about them (See Appendix A). They were homogeneous in terms of their L1 except for four Kurdish-Turkish bilinguals who, however, reported to have low academic language skills in Kurdish. All participants were late L2 English learners who got exposed to English formally in a classroom environment except for three participants who reported to have been exposed to English informally at home at a young age. Only four participants lived in an English-speaking country (USA or England) for 3–18 weeks period (mean length of staying abroad: 12.25 weeks). Table 1 summarizes the demographic and linguistic background of the participants.

Table 1. Background Information about the Participants

Groups	Gender	Age (Mean)	Age of First Exposure to English (Mean)	Years of Exposure to English (Mean)
Control (n = 21)	17 F 4 M	21 (range 19-22)	9.33 (range 6-11)	11.33 (range 9-15)
Grammatical (n = 21)	16 F 5 M	21 (range 19-22)	9.33 (range 6-11)	11.38 (range 9-16)
Ungrammatical (n = 21)	17 F 4 M	21 (range 19-22)	10 (range 6-12)	10.81 (range 9-13)

4.4 Procedure

The study consisted of four sessions: a pre-test; a priming session; an immediate post-test; and a delayed post-test.

For each participant, the experiment was completed over a two-and-a-half week period. The participants completed the tests in front of a laptop in a quiet room; the researcher was present in the room in all sessions. The researcher first arranged meeting dates with the participants in all groups for the pre-test in which they performed a picture description task for 6-15 minutes, varying by individual's own pace. The next meetings were arranged so that each participant appeared exactly two weeks later after he/she had taken the pre-test. In this session, the participants in the grammatical and ungrammatical groups first had the treatment (priming) session for 15-25 minutes. After the treatment session, they performed the immediate post-test (picture description) for 6-13 minutes. The participants in the control group only performed the immediate post-test in the second meeting. For each participant, the meetings for the final session were set 3 days after their second meeting. On the final day, the participants in all groups performed the delayed post-test (picture description) for 6-12 minutes. A schematic representation of the procedure in the study is given in Table 2.

Table 2. Sequence of the Sessions in the Experiment

Day	Session	Tasks
1	Pre-test	Picture description
14	Priming session	Picture description game
14	Post-test 1	Picture description
17	Post-test 2	Picture description

4.5 Materials

220 action verbs (60 targets, 160 fillers) were used in the study. 60 target verbs were chosen according to the following criteria: (1) the frequency measure of the relevant part of speech (i.e., verb) extracted from the SUBTLEX-US (Brysbaert & New, 2009), a corpus of 51 million word tokens based on American English subtitles from films and television programs, (2) syllable length, and (3) syllable form. For the target verbs, the frequency measure of verbs inflected with third-person singular *-s* was extracted from this corpus. Out of 1 million, the mean surface frequency count of the target verbs (i.e., the frequency of the *–s*-inflected form of the verbs) was 14.30, *SD* = 12.12, with a range of 4.05-64.58. All target verbs were one or two syllable long and did not end with consonant clusters, CC except for a few verbs used in prime sentences (See Appendix B).

After the verbs were prepared, 220 sentences were constructed using 220 verbs. The sentences were checked by a native speaker of English for clarity of wording, meaning, and grammar, and items which were unclear or ungrammatial were revised. Finally, 220 pictures (line drawings) depicting those sentences were created. Before determining which pictures would be in each test, two undergraduate students, who were at the same language proficiency level as the participants, were asked to describe those pictures, and they were audio-recorded. To eliminate possible effects of fatigue, the students were asked to take a 5-minute break after every 60 items. After the descriptions were completed, they were asked to further analyse the clarity of the drawings and items. Based on the feedback received, necessary revisions were made. Finally, 220 items were grouped into pre-test, treatment, post-test and delayed post-test. In total, as mentioned above, there were 60 target items, those including *–s* morpheme. Forty of

those target items were used in treatment sessions: 20 items as primes and 20 items as targets. The remaining twenty target items were used in pre-test and post-tests sessions, meaning the same verbs/items were employed in pre-test and post-tests (See Appendix C and D for the target sentences and pictures included in the tests and the treatment). The rest 160 items were used as fillers: 80 fillers for the treatment sessions, 40 fillers for the pre-test and 40 fillers for the post-tests.

4.6 Instruments

In this part, data collection instruments in the study are described in detail referring to the materials, task and scoring procedure used in each session.

4.6.1 Pre-test

This was the baseline phase of the experiment. The aim was to determine how accurate the participants were in producing the target agreement morpheme in L2 English in their current interlanguage development. To identify this, the participants were given a controlled oral production task in the form of picture description.

4.6.1.1 Materials

20 target pictures were included in the pre-test. Each target picture depicted a different event. That is, there were 20 different target verbs. Each picture depicted an action carried out by a single agent. Crucially, a lexical subject NP (not a pronoun subject) was expected to be elicited in each picture. To ensure this, the sentential subject NPs (i.e., single agent names such as *the teacher, the lady, a doctor,* etc.) were given in the pictures (see Figure 1). Some subject NPs were used more than once (e.g., *the man, the*

woman, the boy, the girl, etc.) with the caution that the drawing of the agents was different in each picture. Also, the target verb in the bare form as well as the time adverbial (*always, every week, last week, yesterday,* etc.) to be used in the sentence were also given/typed on each picture to ensure the use of target (i.e., the simple present tense) and the filler (i.e., past tense) forms with those given sentential subjects. Thus, for each picture, the subject NP, the bare verb and the adverbial to be used were provided to the participant (See Figure 1).The participants were instructed to use all of the words provided on the pictures in their descriptions.



Fig. 1 Example of target pictures in the pre-test

To disguise the target linguistic form of the study, the pre-test also included 40 pictures as filler items. The filler pictures depicted past actions that required the use of regular and irregular verbs (20 each). The agents in the filler pictures were either singular or plural (See Figure 2). The position of the labels for the subject, verb, and adverbial were randomly arranged for each picture so that they did not always appear in the same order.

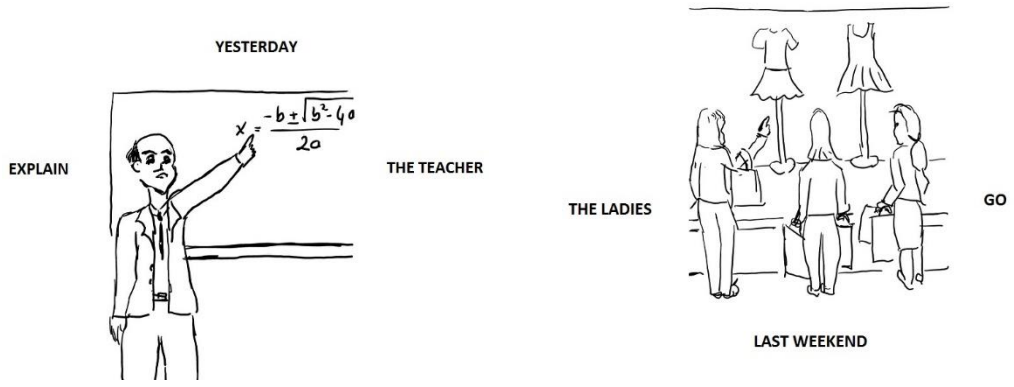


Fig. 2 Example of filler pictures in the pre-test

One target item was further removed from the test because 60% of the participants failed to produce the intended target form while describing the picture. In other words, instead of using the given subject (a single agent), they used a plural agent in describing the relevant picture. Thus, that this item was discarded from the test, leaving 19 target items to be analyzed. The test's internal consistency (Cronbach alpha) was .658.

4.6.1.2 Procedure

The researcher met each participant individually in a quiet room. The participants were seated in front of a laptop and asked to click on the program to start the test. First, an instruction text appeared, and they read the instructions before clicking the "OK" button to start test. In the test, they were asked to describe pictures that appeared on screen by forming one affirmative sentence for each picture, and they had to use all the words provided around the picture. They had 25 seconds for each picture; when the 25-second-period ended or when they clicked the 'Next' button, the next picture was displayed. The items were arranged in the following order: two filler items always preceded the target item. The test started with 2 filler items to ensure that the participants understood the

task. The target and the filler items were shown to each participant in the same order because the items were arranged in such a way that no items with a similar context or a similar subject appeared one after another to ensure that context similarity did not act as a confounding variable for the study. The pre-test lasted approximately 6–15 minutes, varying on the basis of individual's own pace.

4.6.1.3 Scoring

The pre-test was audio-recorded on a digital recorder as well as on the computer, and the participants' descriptions were transcribed. Each transcription was checked by two researchers. For each participant, the correct use of the third person agreement *–s* in 19 obligatory contexts was counted. One-point scoring was administered for every correct *–s* agreement produced by the participant, setting the maximum score as 19. Then, the accuracy percentage was calculated for each participant.

Descriptions including sentences with a verb other than those provided in the pictures were given one point for correct *–s* agreement as well. Pronunciation errors (wrong allophone use) were ignored. Errors were also analyzed and categorized as omission, substitution, and other errors. Self-corrected utterances were also counted. For scoring, first utterances produced by the participants were taken into account; that is, when they produced an agreement error (omission or substitution of *-s*) but immediately corrected their errors, only the initial erroneous utterance was scored (e.g., *The manager usually leave…..leaves the office at six o'clock*). These cases were scored zero and labeled as *self-corrections.* The following utterances were also scored zero and labeled as "*other errors"*: i) sentences formed in a tense/aspect other than present simple (e.g., *The boy rode to school every day*) and those formed with a modal verb (e.g., *A*

hairdresser can usually cut his own hair); ii) missing items where the participants mistakenly double-clicked on the 'Next' button and did not see an item; iii) utterances containing subject-verb errors (e.g., *The greengrocers always *sells fruits*); iv) utterances with pronoun-antecedent errors (e.g., *The woman often changes *their hair style*); v) utterances involving tense errors (e.g., *A hairdresser cuts my hair *yesterday*); vi) utterances with number agreement errors (e.g., *A *hairdressers usually cut my hair*); vii) utterances where *–s* was attached to a verb not in bare form (e.g., *reads as **/rɛdz/, begans, gaves*).

4.6.2 The priming session (the treatment)

There were two priming sessions: one with the grammatical items, the other one for the ungrammatical ones. As noted earlier, different participants took these treatment/priming sessions. Even though the materials/items were different in the two sessions, the procedure was the same. In the section below, for the sake of clarity, first the procedure was described and then the materials were described.

4.6.2.1 Procedure

In the priming sessions, a computerized version of the confederate-scripting paradigm was used. As noted in the previous chapter, in this paradigm, a confederate (i.e., a researcher who pretends to be a naïve participant) and a naïve participant takes turns to describe some pictures to each other, and they are asked to verify by clicking the 'Yes' or 'No' button whether the description they have heard from the other participant matches the picture on their screen (Bernolet et al., 2007; Branigan et al., 2000). Unknown to the naïve participant, the confederate follows a script to produce his/her

descriptions. That means that the confederate simply reads the description sentences prepared in advance.

The same paradigm was used in the study to see the extent to which the confederate's grammatical (in the grammatical group) and ungrammatical (in the ungrammatical group) target items triggered (i.e. primed) the use of correct and incorrect morphology by the naïve participant. The rationale behind choosing this priming paradigm is that previous experiments carried out with a confederate scripting paradigm (where the confederate is physically present) appears to produce larger priming effects than the ones in Bock's (1986) original paradigm. Furthermore, this task resembles a dialogue that would typically take place in a classroom setting.

The procedure for ungrammatical priming was basically the same in grammatical and ungrammatical priming. The only difference was the grammaticality of the prime sentences used (see below for the items in each session).

Two weeks after the participant had taken the pre-test, she/he was invited for the treatment session. The participants were told that the study was investigating how L2 speakers communicated to each other in their L2. Although the participants were tested individually, they were made to believe that they were tested in pairs because the confederate pretended to be the second participant in the experiment. The experimenter, thus, treated the confederate and the participants in the same way throughout the whole experiment. The confederates were two adult female Turkish speakers of English, who were senior students in the Foreign Language Education Department at the same university.

Both the participant and the confederate were seated opposite to each other, each in front of a laptop computer, and they were told that they would be playing a dialogue

game: their task was to describe pictures to each other and also to verify each other's picture descriptions. Neither of them could see what appeared on the opposite screen (See Figure 3). The program was set up so that the confederate always took the first turn. The lists for the confederate and the naïve participant were designed to be run simultaneously in a synchronized fashion on two different laptops (See Appendix E for the screenshots of an experimental trial).



Fig. 3 Computerized version of dialogue game

An experimental trial consisted of the following steps:

1. A (pre-designated) scripted sentence (i.e., description) appears on the screen of the confederate's laptop. Simultaneously, the participant sees, on his/her computer screen, the picture that the confederate describes.
2. From the computer screen, the confederate gives (in fact, reads out) the description of that picture. In the grammatical priming session, this description involves a grammatical English prime sentence with a lexical subject NP and a verb marked with the third-person singular, *-s*. In the ungrammatical priming

session, the prime description the confederate reads involves an ungrammatical English prime sentence with a lexical subject NP and a bare verb unmarked with the third-person singular *–s*.

3. Upon hearing the confederate's (prime) description of a picture, the participant responds to it by clicking 'Yes' (if the description s/he hears matches the picture on his/her screen); or 'No' (if the description and the picture does not match). The participant has 25 seconds to verify the picture. When either of the Yes or the No options is clicked, a beep is heard. This notifies the confederate that the participant has responded. Right after that, this time, a different picture appears on the participant's screen for her/him to describe. Simultaneously the confederate sees a note on his/her screen saying, "Click the 'OK' button when the participant finishes his/her description." Once the description is given by the participant, the confederate clicks the 'OK' button pretending to provide a response as to whether the picture matches the description provided by the participant. Again, a beep notifies the participant this time that the confederate has responded. The procedure continues like this until all the pictures were described and verified.

As described in the section below, two fillers intervened between the experimental items. This means that after two filler descriptions in the confederate description set, there appeared target (prime) descriptions. The participant always saw a picture on the screen (with a subject, verb and adverbial) when it was her/his turn to give descriptions. The confederate, on the other hand, only saw the sentences on his/her screen. The treatment session also included six sets of trial items (verification and description) to ensure that the participant understood the task.

4.6.2.2 Materials in grammatical priming

A total of 120 pictures (2 sets of 60 pictures) were constructed for the participants. The first set was the *participant's description set* consisting of the pictures the participant was asked to describe. The other set was the *participant's verification set*, and this included pictures that the participant was asked to verify with the description the confederate produced. For the confederate, just the *confederate's description set* (60 sentences) was constructed because the confederate was just pretending to play the matching game. Every time the participant finished describing a picture, the confederate saw the following command on her computer screen: "Press the OK button when the participant finishes his/her description." As noted above, since the naïve participant did not see the confederate's screen, she/he did not know that the confederate was not in fact being tested but simply verifying the pictures. Thus, what the confederate described was verified by the participant, and what the participant described was pretended to be verified by the confederate. Therefore, the *participant's verification set* was paired with the *confederate's description set.* Crucially, 20 sentences in the *confederate's description set* functioned as the primes, and 20 pictures in the *participant's description set* functioned as the targets in which the participants were asked to produce utterances with the third person singular *–s*. Thus, overall, the participant was asked to describe 60 pictures (20 targets and 40 fillers), and s/he was asked to verify another 60 pictures (20 targets and 40 fillers) that the confederate described. Table 3 summarizes this:

Table 3. List of Items in the Priming Sessions

Items		
The participant's description set (pictures)		
1. Targets (Affirmative simple present sentences with singular subject NPs)	20	
2. Fillers	40	
a. Past tense fillers	20	
✓ Affirmative past sentences (regular verbs)	10	
✓ Affirmative past sentences (irregular verbs)	10	
b. Future tense fillers (Affirmative future sentences)	20	
Total number of items	60	
The confederate's description set (sentences) paired with the participant's verification set (pictures)		
1. Targets (prime items) (Affirmative simple present sentences with singular subject NPs)	20	Matching items: 10
2. Fillers	40	
a. Past tense fillers	20	
✓ Affirmative past sentences (regular)	10	Matching items: 5
✓ Affirmative past sentences (irregular)	10	Matching items: 5
b. Future tense fillers (Affirmative future sentences)	20	Matching items: 10
Total number of items	60	

The pictures in the *participant's description set* were constructed in the same format as those in the pre-test. As can be seen in the Table 3, the *participant's description set* included 20 target pictures illustrating a single agent (with agent/subject NPs or referent printed on the picture) (e.g., *the maid, the boy, the hunter,* etc.). A bare verb depicting an action was provided along with a time adverbial (frequency adverbs such as *sometimes, often, everyday*) that required the use of the simple present tense. The participant was instructed to use a given verb in his/her descriptions (See Figure 4). Each target picture depicted a different event, meaning that there were 20 different target verbs.



Fig. 4 Example of a target picture in the priming session

The remaining 40 pictures in the *description set* were the filler items (i.e., filler pictures) depicting different actions. In the half of the filler pictures (i.e., 20 of them), a time adverbial referring to the past such as *yesterday, last week, in 2010* was provided on each picture. The fillers targeting the past tense aimed to elicit regular as well as irregular verbs. In the rest of the filler pictures, a time adverbial referring to the future such as *tomorrow, soon, next year* was provided on each picture. The agents in the filler pictures were either singular or plural (*Tony and Anna, the dog, the businessmen,* etc.), and the verbs were given in the bare form (see Figure 5).



Fig. 5 Examples of filler pictures in the priming session

The *confederate's description set* contained 60 scripted sentences that the confederate was asked to read while pretending to describe pictures to the participants. The 20 sentences in the *confederate's description set* served as the critical prime sentences that provided a correct use of the target morpho-syntactic form in the sentences with a lexical subject (e.g., *The mother tells a story to her children every day*). Each experimental prime sentence from the *confederate's description set* was paired with an experimental target picture from the *participant's description set*. In other words, immediately after the participant verified a description read by the confederate including the correct target form with third person singular -s, he/she was asked to describe a different picture in the target form. The remaining 40 sentences in the *confederate's description set* were fillers involving descriptions in the past and future with plural or single agents. Twenty of the 40 filler pictures in the *participant's verification set* matched the descriptions in the *confederate's description set*. Ten of the target pictures in the *participant's verification set* matched the descriptions in the *confederate's description set*. In other words, for 10 of the target pictures described by the confederate using the target morpheme, the participant saw a matching picture on his/her screen. For the matching items, the participant was asked to click a YES button on the screen. For the other 10 of the target pictures described by the confederate, the participant saw a mismatching picture on his/her screen. For the mismatching items, the participant was asked to press a NO button on the screen.

A randomized list was prepared with the constraints that at least two fillers intervened between the experimental items and that no items with a similar context or a similar subject appeared one after another. An experimental trial consisted of a prime sentence produced by the confederate that contained the provided third person

agreement -*s* within a sentence with a lexical NP subject. The participant was asked to verify the description with the picture s/he saw on her computer screen at the moment. Then the target picture appeared on the participant's screen, and this time the participant was asked to describe it. Each participant completed the priming session with the same randomized list for the same concerns regarding the pre-test (see Table 4 for the sequence of these actions).

Table 4. The Flow of Events in the Priming Session and Examples

Type of item	What the Participant does	Sentence	Matching Status
Filler	Verification	Freddie wasted a lot of money on shoes last Sunday	Yes
Filler	Description	The dog buried the bone in the ground yesterday	
Filler	Verification	Emma felt sick after dinner last night	No
Filler	Description	Brad quit his job last week	
Prime	Verification	The actress always drives an expensive car	Yes
Target	Description	A thief often steals jewelery	

While preparing the targets and the primes, a special attention was paid to the following issues: Firstly, prime sentences and target pictures contained different verbs since in the case of lexical repetition between prime and target, structural priming has shown to primarily involve residual activation in explicit memory (Hartsuiker et al., 2008; Shin & Christianson, 2012). Secondly, the target verbs in the priming/treatment session differed from the target verbs in the pre-test and post-test sessions. Additionally, the critical prime sentences read by the confederate were carefully constructed so that they were phonologically clear within the co-articulation of a sentence. For example, the

participant can more accurately identify the production of the 3rd person singular *–s* in a sentence such as "*The boy eats an apple*" than in "*The boy eats salmon*", where the inflection of *–s* in 'eats' would be indistinguishable from the onset of the word 'salmon'. Finally, the items that require the use of auxiliaries *be*, *do,* and *have* were not included in the primes and targets (See Appendix F for the prime-target pairs used in the treatment sessions).

4.6.2.3 Materials in ungrammatical priming

The materials of the ungrammatical priming session were identical to the materials of the grammatical priming session, except that the critical prime sentences in the *confederate's description set* purposefully consisted of ungrammatical sentences with the third person singular *–s* omitted in the obligatory context (e.g., *The mother *tell a story to her children every day*). Thus, the participants in the ungrammatical group were presented with the primes that only included ungrammatical use of the target structure. Since the purpose of the treatment might have been noticeable for the participants if only the prime sentences had included ungrammatical form in the *confederate's description set*, some filler items were also changed to include ungrammatical sentences with wrongly provided morphology in the past tense or with the omission of the past tense morpheme *(e.g., The boy *bited the apple five minutes ago, The boy *paint the fences last week).*

4.6.3 Post-tests

There were two post-tests: immediate and delayed. The immediate post-test was given right after the treatment, and the delayed post-test was given 3 days later.

4.6.3.1 Materials

Materials of the post-test session (the immediate and delayed post-tests) were identical to the materials of the pre-test except for the filler items included in the post-tests. 40 different filler items meaning 40 different verbs were included in the two post-tests so that the pre-test and the post-tests were not completely identical. The filler items in the post-tests included pictures that included a lexical NP, a bare verb, and an adverbial ("last month") requiring a past tense form. Besides, the filler items in the post-tests and the items in the treatment session involved different verbs as well. The problematic target item that was removed from the pre-test was not also included in the post-tests, leaving 19 items to be analyzed. The immediate post-test's internal consistency (Cronbach alpha) was .562, and the delayed post-test's internal consistency (Cronbach alpha) was .484.

4.6.3.2 Procedure

The procedure for both post-tests was identical to that of the pre-test. The participants in grammatical and ungrammatical groups individually performed the immediate post-test five minutes after the treatment session. The participants in the control group were called upon just for the immediate post-test two weeks later after they had taken the pre-test. Three days later after taking the immediate post-test, the same participants individually performed the delayed post-test.

4.6.3.3 Scoring

Both post-tests were audio-recorded on a digital recorder as well as on the computer, and the participants' descriptions were transcribed. As in the pre-test, each transcription was

checked by two researchers. The scoring procedure of both post-tests was identical to that of the pre-test. For each participant, the obligatory context and the correct use of the third person agreement –s was counted. One-point scoring was administered for every correct –s agreement produced by the participant, setting the maximum score as 19. Then, the accuracy percentage was calculated for each participant. Error analyses were also carried out for both post-tests.

CHAPTER 5

RESULTS

This chapter reports on the results of the experiment described in the previous chapter. First, the data analysis procedure is explained. Then, the findings are presented.

5.1 Data analysis

To answer first and second research question, the accuracy scores across three groups (grammatical, ungrammatical, and control) and three tests (pre-test, immediate post-test, and delayed post-test) were analyzed. Prior to conducting an analysis of variance (ANOVA), the distribution of the scores in each test was examined for each group. The data was not normally distributed in the immediate post-test and delayed post-test across groups according to a series of normality tests. Firstly, skewness and kurtosis coefficients were not within the limits of normality in the immediate post-test (skewness: -1.21_C, -1.56_G, -1.3_U; kurtosis: 1.71_C, 2.16_G, 2.71_U) and in the delayed post-test (skewness: $-.49_C$, -1.02_G, $-.88_U$; kurtosis: $-.99_C$, $.12_G$, 2.23_U). Moreover, the Shapiro-Wilk test of normality revealed that the distributions of scores were not normally distributed either in the immediate post-test (W_C=.02, $p< .05$; W_G =.00, $p<.05$; W_U =.01, $p<.05$) or in the delayed post-test (W_C=.02, $p< .05$; W_G =.00, $p<.05$; W_U =.03, $p<.05$). Thus, different transformations were performed including logarithm 10 transformation and arcsine transformation; however, the transformations were not helpful in approaching the data to normal distribution. As such, the analysis was conducted with raw data. Although the normality assumption of ANOVA was not met, the results were

analyzed by means of parametric tests since the F-test is considered to be robust to violations of the normality assumption when the sample sizes are equal (Huck, 2004).

The plan of data analysis began with a comparison of groups' pre-test data to ensure that there were no pre-existing differences among the three groups before the treatment. As described in the methodology section, this task was the baseline for all the groups before the training phase. A one-way between subjects ANOVA revealed no significant difference among the groups $F(2, 60) = .467$, $p > .05$, showing equal performance levels (i.e., accuracy in the use of *–s*) for all groups prior to treatment. Following this analysis, to address the research questions, the accuracy scores were entered into a 3 (group) × 3 (time) mixed-design ANOVA, with treatment group (control, grammatical, ungrammatical) as a between-subjects factor and time (pre-test, post-test, delayed post-test) as a repeated-measures factor. While testing all *a priori* hypotheses, a nominal type I error rate of 0.05 was used; accordingly, post hoc tests of significance had family-wise error rates set at the 0.05 level. A Bonferroni procedure was used to control for type I error across the pairwise comparisons. The effect sizes are also reported in all comparisons.

5.2 Findings

Table 5 presents the accuracy percentages for each group across three tests, and Figure 6 illustrates the participants' performance across three tests.

Table 5. Descriptive Statistics for Participants in the Experimental and Control Groups at Each Time of Measurement

	M	SD	Min	Max
Control				
Pre-test	84.21	12.34	52.63	100
Immediate post-test	87.72	10.57	57.89	100
Delayed post-test	90.48	8.58	73.68	100
Grammatical				
Pre-test	80.95	14.55	42.11	100
Immediate post-test	88.72	12.71	52.63	100
Delayed post-test	92.23	7.92	73.68	100
Ungrammatical				
Pre-test	80.19	15.78	36.84	100
Immediate post-test	88.72	8.53	63.16	100
Delayed post-test	88.22	10.64	63.16	100

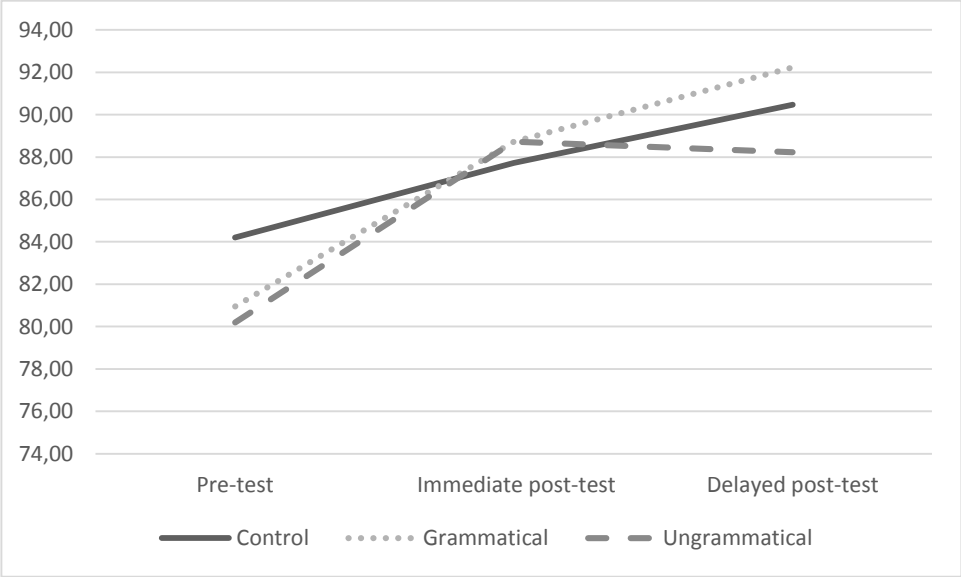


Fig. 6 Performance of all groups across three tests

A 3 (group) × 3 (time) mixed-design ANOVA was conducted to examine whether participants' scores differed significantly across the treatment groups over time. Since the Mauchly's test for sphericity was found to be significant ($p < .05$), Greenhouse-Geisser adjustment to degrees of freedom was used. According to Levene's test, the homogeneity of variance assumption was sustained for all variables, pre-test: $F(2, 60) = .497$, $p > .05$; immediate post-test: $F(2, 60) = .594$, $p > .05$; delayed post-test: $F(2, 60) = .638$, $p > .05$.

The ANOVA results revealed a significant main effect of time $F(1.67, 100.25) = 19.48$, $p < .01$ /.001 with a large effect size partial $eta^2 = .25$. On the other hand, there was neither a significant main effect of group, $F(2, 60) = .216$, $p > .05$ nor a significant interaction effect of time by group, $F(3.34, 100.25) = .993$, $p > .05$. These findings indicate that there were no significant differences among the three groups in the experiment and the participants' performance differed across the tests regardless of the group.

To investigate the time main effect, paired samples t-tests were conducted controlling for the family-wise error rates across the tests at the 0.05 level, using the Bonferroni procedure. The results indicated that both the immediate post-test and delayed post-test scores were significantly higher than the pre-test scores; however, the scores were not significantly different between the immediate post-test and the delayed post-test (see Table 6). The effect sizes calculated using Cohen's *d* was -0.52 and -0,72 (respectively), indicating a moderate effect. This result shows that the change in scores between the pre-test and the immediate post-test was sustained over the three days after the treatment.

Table 6. Paired Samples t-test Results

Comparison	Mean Difference	Standard Deviation	t(62)	Adjusted p value	Cohen's d
pre-test vs. immediate post-test	-6.600	13.33	-3.929	.000*	-0.52
pre-test vs. delayed post-test	-8.522	11.40	-5.934	.000*	-0.72
immediate post-test vs. delayed posttest	-1.922	8.934	-1.708	.093	

*p < 0.05

Overall, these findings suggest that participants in the three groups produced more accurate utterances using the third person agreement *–s* morpheme in the immediate and delayed post-tests than in the baseline pretest. However, no difference was found among groups.

Recall that the first research question of the study asked whether grammatical priming would affect the accurate production of third person agreement *–s* morpheme in L1 Turkish learners of L2 English. The results suggest that L1 Turkish learners of L2 English demonstrated a significant increase in accuracy in the use of *–s* morpheme from the pre-test to the immediate- and delayed post-test. At first sight, that can be interpreted as the effects of priming in the treatment session. However, given that the control group also demonstrated a significant increase in accuracy in their use of *–s* morpheme makes this interpretation less sustainable. The first research question also asked whether ungrammatical priming would affect the accurate production of *–s* morpheme in L1 Turkish learners of L2 English. As presented above in the analyses, no significant differences were found among groups' accuracy scores. Regardless of the treatment, all groups improved their performance with the target structure in the immediate and

delayed post-tests in contrast with the pre-test. The absence of a main of effect of group or group X time interaction might have resulted from a confounding factor, which might be related to the design of the study, or from the small number of participants included for the analysis. This result will be discussed in detail in the next chapter. As for the second research question concerning the duration of priming, all groups' performance in the immediate post-test was sustained over the three days in the delayed post-test. However, because the increase in accurate production of *–s* in the groups cannot be linked to priming effects, it is not possible to draw any conclusions regarding the duration of priming effects.

As mentioned in the methodology section, in addition to the formal statistical analysis of scores, participants' errors were also analyzed and categorized into omission, substitution, and other errors; self-corrected utterances were also counted. Table 7 below presents the distribution of errors of all participants for these four categories across three tests.

Table 7. Distribution of Errors across Three Tests

	Total number of Errors		Error Types						Self-correction	
			Omission		Substitution		Other			
	N	%	N	%	N	%	N	%	N	%
Pre-test	217	18.1	156	71.9	44	20.3	17	7.8	86	39.6
Post-test	132	11.0	82	62.1	38	28.8	12	9.1	54	40.9
Delayed post-test	116	9.7	66	56.9	38	32.8	12	10.3	49	42.2

Note: N=number; there were 1197 items in total in each test (19 descriptions by 63 participants)

As it was clear from the result of the statistical analysis, participants' error rates decreased from the pre-test to the delayed post-test. The omission errors were more common than substitution or other errors in all tests. In general, the participants self-corrected themselves most of the time. Since the focus of the study is not analyzing and categorizing morpheme errors, formal statistical analyses were not conducted regarding the error distribution.

CHAPTER 6

DISCUSSION AND CONCLUSION

This study investigated the priming effects in L2 English. More specifically, the aim was to examine whether grammatical and ungrammatical priming has any effects on L1 Turkish-L2 English learners' subsequent production of the third person singular *-s* in English. Examining the duration of priming (i.e., how long it lasts) was also among the research questions. A pre-test-post-test randomized experiment was adopted to test these issues. More specifically, the study looked at potential differences among the three comparison groups (grammatical, ungrammatical, and control) across the baseline condition (i.e., pre-test) and the immediate (post-test 1) and delayed (post-test 2) post-tests. The comparison examined whether accurate production of agreement *-s* in the pre-test condition and the post-test conditions occurring after each respective priming session (i.e. grammatical and ungrammatical) were quantitatively different. If priming effects were observed, then L1 Turkish-L2 English learners in the grammatical priming session would demonstrate significantly increased number of correct *–s* use after the priming session involving extensive exposure to grammatical sentences with *–s* morphology while those in the ungrammatical priming group would show similar or increased number of inaccurate use of *-s* after the ungrammatical priming session, which involved exposure to ungrammatical use of the target morpheme. The participants in the control group would be expected to display similar performance in all tests.

The results of the experiment showed that the group that received grammatical priming sentences demonstrated an increase in accuracy across the three sessions. While their percentage accuracy was 80.95% in the pre-test, this rate went up to 88.72% in the

immediate post-test and to 92.23% in the delayed post-test. However, these findings cannot be linked to priming effects because a similar trend was also observed in the control group, who did not receive any treatment/priming. The mean accuracy scores of the control group were 84.21, 87.72, and 90.48 in the pre-test, immediate post-test and the delayed post-test, respectively. As for the participants in the ungrammatical priming condition, their baseline score (i.e., 80.19%) increased to 88.72 in the first pre-test and it stayed almost the same in the delayed post-test (i.e., 88.22). In other words, in contrast to the prediction, the participants in the ungrammatical priming group did not do more errors due to ungrammatical priming.

Thus, overall, in all groups, both the post-test and delayed post-test scores were significantly higher than the pre-test scores. That means that all three groups' performance regarding the production of the third person singular *-s* increased in the two post-tests compared to their performance in the pre-test. Crucially, however, no difference was found among groups. On the basis of these findings, the observed higher accuracy in the grammatical priming group cannot be attributed to the effects of priming that they received. Thus, with respect to the first research question concerning the occurrence of morpho-syntactic priming of the third person singular *–s* in L2 learners, the findings do not point to any priming effects.

Regarding the second research question about the duration of priming, both the controls and the grammatical priming group showed an increasing accuracy patterns across the three tasks. In other words, their scores in the two delayed post-tests were significantly higher than their pre-test scores. Nevertheless, their two post-test scores did not differ significantly from each other. The ungrammatical priming group also showed a significant increase in accuracy between the pre-test to the immediate post-test. Their

delayed post-test scores remained the same as the immediate post-test scores. Since the increasing accuracy scores observed in the groups cannot be linked to priming effects, it is not possible to draw any conclusions about the question of whether priming effects last over a 3-day delay within these findings.

Thus, an important question emerges here concerns the reason why the attempt to prime learners in the production of a morpho-syntactic form was not successful. Previous structural priming studies have shown that L2 learners show priming effects on a variety of syntactic structures including alternative constructions such as the PO versus DO constructions, the passive versus active sentences, well-formed wh-questions vs. their target divergent forms as well as indirect questions, phrasal verb constructions, and stranded prepositions (Conroy & Antón-Méndez, 2015; Kim & McDonough, 2008; McDonough, 2006; McDonough & Mackey, 2006, 2008; McDonough & Kim, 2009; Shin & Christianson, 2012). Given these findings, the prediction was that structural priming would also be observed in the production of morpho-syntactic structures; however, this prediction was not borne out.

One possible explanation of the unexpected results could be that the target structure, the third person singular *–s*, is not susceptible to structural priming (or implicit learning) given its low salience and low transparency. As DeKeyser (2005) suggests, the third person singular *–s* might be one of those particular morphological features which are unlikely to be implicitly induced from the input. Some support for this explanation is provided in a recent study by McDonough and Fulga (2015), who observed significant priming of a morpho-syntactic structure: the transitive construction in Esperanto—which is marked by accusative case marking (*–n*) and flexible word order. Although the structure was novel for their participants, those who detected the target construction in

auditory construction task (i.e., those who were able to implicitly detect the target structure from the input) were able to be primed in their subsequent production. This finding clearly demonstrates that morpho-syntactic forms can be primed when they are not low in salience or transparency. However, there are key differences between their study and the present study in terms of the research aims and the design, making a direct comparison between them merely tentative.

Another reason for the unexpected findings could be related with the design of the study. Given that all groups (grammatical, ungrammatical, control) performed better in the two post-tests compared to the pre-test, the increased accuracy rate in the use of *–s* morpheme may be an artifact of the task (i.e., the testing procedure), in which the participants might have become consciously aware of the purpose of the study and paid more attention to their oral production of the target morpheme. This issue is raised by Marsden (2009), who claims that the long repeated exposure to the same morphological or syntactic feature followed by multiple test items might affect the internal validity of a priming study since it might not be known whether there is a cumulative effect of the exposure and/or the test items. Considering the advanced proficiency of the participants and their field of study, foreign language teaching, they are likely to have a high metalinguistic awareness. Thus, it seems probable that despite the large number of fillers, they have predicted the purpose of the task and monitored their speech during picture description tasks. That the number of errors reduced by half in the delayed post-test demonstrates that participants might have monitored their oral production much more in the delayed post-test compared to the pre-test.

It is also possible that no priming effects were observed in the current study because the analysis focused exclusively on the comparison of learners'

accurate/inaccurate production of third person singular *–s* across the pre-test and the post-tests. Including other measures in the study might have revealed important findings. For example, in this study, priming effects within the treatment sessions (grammatical and ungrammatical) were not examined; that is, the participants' production data within grammatical and ungrammatical priming sessions could have been investigated to see whether their production of *–s* was affected following the confederate's prime sentences. This data could potentially provide additional data to check priming effects. Secondly, measures of reaction times (i.e., the speed of correct or incorrect morpheme production) during the pre-test and the post-tests could have potentially been revealing for the study.

At this point it is important to note the limitations of the study and provide some suggestions for future research. The most significant limitation is that the study had a low statistical power due to small sample size (n=21 in each group) which made the difference in scores across groups difficult to detect. Therefore, the probability that we committed a Type II error is high. The study should be replicated with a larger sample size both in experimental and control groups. A priori power analysis could be conducted in order to determine how many participants were needed in each of the study's comparison groups. A priori power analysis would solve the problem of having a low statistical power and decrease the probability of committing a Type II error.

Another limitation, as noted above, is that the design of the study could have been different. The picture description task was tightly controlled and was in the same format from the baseline session to the delayed post-test session. This might have increased the possibility for participants to become accustomed to the format of the test so that they have become more successful and efficient in consciously monitoring their oral production. Thus, because of the pre-test−post-test design, a testing threat might

have existed in the study. To eliminate the threat of testing, a replication of the study should be done using the Solomon four group design[3]. This would allow the researcher to check that the pre-test did not influence the results. Other options for replications are that the pre-test should be in a different format such as spontaneous oral production, which possibly involves conscious awareness less than an elicited production task does. Spontaneous speech data could also be present in post-tests sessions to see the immediate and delayed effects of priming in a less controlled speech. Alternatively, the pre-test can be removed from the study altogether.

Future studies can also investigate the priming effects for third person singular *–s* among 'high' and 'low' proficient users (based on their *–s* accuracy scores). Such a study could reveal how L2 proficiency would influence the strength of priming regarding the third person singular *-s*. This would, in turn, contribute greatly to our understanding of learning L2 morphemes. Furthermore, more salient and transparent morpho-syntactic constructions such as past tense morphology can be investigated in future studies with L2 learners from different proficiency levels. Such investigations of morpho-syntactic priming would be revealing for the role of structural priming in L2 learning.

To conclude, the present study examined, in grammatical and ungrammatical conditions, potential priming effects in a notoriously difficult verbal inflection in L2 English, namely the third person *–s.* Although the results revealed increased accuracy in the use of the target morpheme in the L2 group that received extensive exposure to the correct uses of *–s*, these gains cannot be linked to priming effects. Because the results

[3] Solomon four group design eliminates external validity threat of testing by including two extra control groups.

revealed a similar increase in accuracy in the control group that did not receive any priming, as well as in the ungrammatical group that received ungrammatical use of the morpheme, the findings fail to indicate priming-based increase in accuracy. Future research should consider the above-mentioned suggestions for a better study design, which could potentially reveal more interpretable findings regarding priming effects in the L2.

APPENDIX A

BACKGROUND QUESTIONNAIRE FOR PARTICIPANTS

I agree to participate in this study:

Signature:_____Name (Please print):_____Date: _____

I. PERSONAL INFORMATION (Will Remain Confidential)

Last Name, First Name:_____

Telephone Number:_____E-mail address:_____

Sex: Female Male:

Date of Birth:_____Place of Birth: City:_____Country:_____

Occupation:_____

Highest Level of Schooling: Secondary____High school__University _____

II. LINGUISTIC INFORMATION

Mother Tongue: _____

Language of Education:

Primary School:_____Secondary School:_____

_____

High School:_____University:_____

Age & Place of first exposure to English: _____

How often do you use English? _____

Where do you generally use English? Home:_____Work:_____ Social:_____

_____

Have you lived in an English-speaking country before?_____If so, how long did you stay there?

Country (1) _____Age of arrival: _____ Length of stay: _____

_____

Country (2) _____Age of arrival: _____ Length of stay: _____

_____

III. ENGLISH LANGUAGE PROFICIENCY

Have you ever taken any standardized English Proficiency Test (e.g., TOEFL, IELTS)?

_____

How would you rate your linguistic ability in English in the following areas?

	Beginner	Intermediate	Advanced	Near-Native
Reading				
Writing				
Speaking				
Listening				
Overall Competence				

IV. SECOND LANGUAGE(S): (besides English) _____

	Beginner	Intermediate	Advanced	Near-Native
Reading				
Writing				
Speaking				
Listening				
Overall Competence				

APPENDIX B

TARGET VERBS AND SENTENCES

Verbs	1 million Present Simple Frequency of Dominant Part of Speech	Syllable length	Syllable form	Sentences
give	64,588	1	CVC	The father gives money to his son every week
tell	52,235	1	CVC	*The mother tells a story to her children every day*
call	41,647	1	CVC	The girl calls her mom every day
see	37,039	1	CV	*The doctor sees his patient every week*
bring	35,059	1	CCVC	The man sometimes brings flowers to his wife
leave	34,941	1	CVC	The manager usually leaves office at 6pm
show	29,863	1	CVV	*The woman usually shows her paintings to her friend*
raise	25,039	1	CVVC	*The teacher sometimes raises her voice in class*
put	23,941	1	CVC	The woman sometimes puts flowers in the vase
play	22,804	1	CCVV	The girl plays the piano every day
speak	20,902	1	CCVC	*The teacher often speaks English in class*
help	20,000	1	CVCC	*The girl sometimes helps her mother in the kitchen*
stop	19,098	1	CCVC	*A policeman often stops drivers for speeding*
ring	17,686	1	CVC	The boy always rings the door bell
ask	16,667	1	VCC	*The student always asks questions in math class*
open	16,549	2	VVCVC	The shopkeeper opens the shop at 9am everyday
begin	16,529	2	CVCVC	The teacher always begins the lesson at 9am
move	15,255	1	CVC	*A delivery man often moves heavy boxes*
win	14,588	1	CVC	The athlete wins a medal every year
pay	14,039	1	CVV	The man pays his bills every month
use	13,804	1	CVC	The woman usually uses an expensive

				perfume
hit	13,686	1	CVC	The boy often hits his friends at school
lead	13,686	1	CVC	*The businessman often leads the meeting*
break	12,980	1	CCVVC	The maid often breaks the dishes
wear	12,647	1	CVVC	A doctor usually wears a white coat
eat	12,333	1	VC	A vegetarian always eats vegetables
drive	12,078	1	CCVVC	*The actress always drives an expensive car*
send	11,451	1	CVCC	*The instructor often sends e-mails to his students*
change	11,196	1	CVVCC	The woman often changes her hair color
lose	9,529	1	CVC	The man often loses his keys
grow	9,431	1	CCVV	The lady usually grows roses in her garden
meet	9,255	1	CVC	The woman meets her friends every week
read	8,647	1	CVC	The girl reads newspapers every day
scare	8,431	1	CCVVC	The boy sometimes scares his friends
pick	8,333	1	CVC	*The man always picks the most expensive jacket in store*
write	8,255	1	CVVC	The boy sometimes writes letters
set	8,196	1	CVC	*The boy usually sets his alarm clock for 6 o'clock*
pull	7,725	1	CVC	A dentist often pulls teeth
follow	7,255	2	CVCVV	*The woman always follows the news*
sell	7,118	1	CVC	A greengrocer always sells fruits and vegetables
throw	7,059	1	CCVV	*The baby sometimes throws her toys on the ground*
close	7,000	1	CCVVC	*The girl sometimes closes the windows at night*
miss	6,549	1	CVC	The businessman sometimes misses his flight
buy	6,529	1	CVV	The woman always buys expensive clothes
carry	6,510	2	CVCV	The postman always carries a bag
drop	6,431	1	CCVC	The student sometimes drops his books on the floor
catch	6,392	1	CVCC	The man usually catches a big fish
shoot	6,216	1	CVC	The hunter usually shoots birds
serve	6,176	1	CVCC	*A waiter always serves food and drinks*
cut	6,157	1	CVC	A hairdresser usually cuts hair
fly	6,137	1	CCVV	The girl flies a kite every summer

spend	5,843	1	CCVCC	*The man usually spends a lot of money for shoes*
teach	5,216	1	CVC	The woman sometimes teaches English
drink	4,824	1	CCVCC	*The baby drinks milk every day*
save	4,667	1	CVVC	The man always saves money
kick	4,667	1	CVC	A footballer always kicks the ball
answer	4,392	2	VCCVC	A secretary usually answers phones
watch	4,275	1	CVC	The boy watches movies every week
steal	4,255	1	CCVC	A thief often steals jewelry
ride	4,059	1	CVVC	The boy rides a bike every day

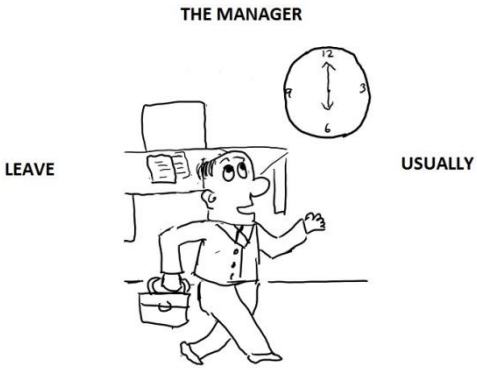
Note: Italicized sentences indicate that those sentences are used as primes.

APPENDIX C

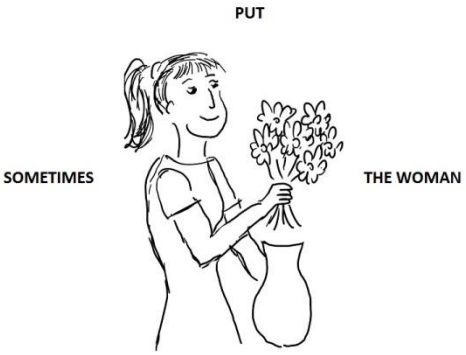
TARGET SENTENCES AND PICTURES IN THE PRE-TEST AND POST-TESTS



The father gives money to his son every week



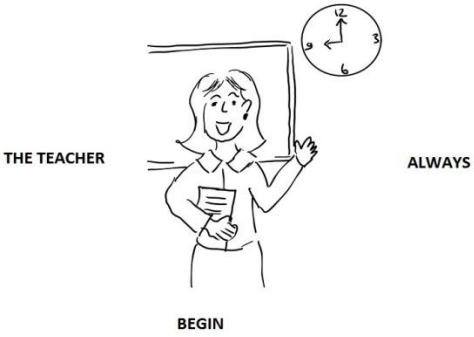
The manager usually leaves office at 6pm



The woman sometimes puts flowers in the vase



The shopkeeper opens the shop at 9am everyday



The teacher always begins the lesson at 9am



The woman usually uses an expensive perfume

OFTEN



HIT

THE BOY

The boy often hits his friends at school

WEAR

A DOCTOR



USUALLY

A doctor usually wears a white coat

CHANGE

THE WOMAN



OFTEN

The woman often changes her hair color

THE GIRL



READ

EVERY DAY

The girl reads newspapers every day

A DENTIST

OFTEN



PULL

A dentist often pulls teeth

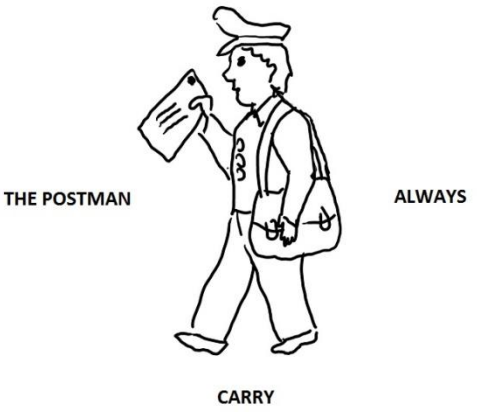
A GREENGROCER

SELL

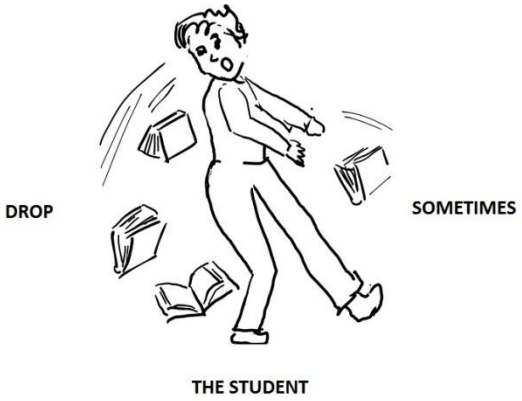


ALWAYS

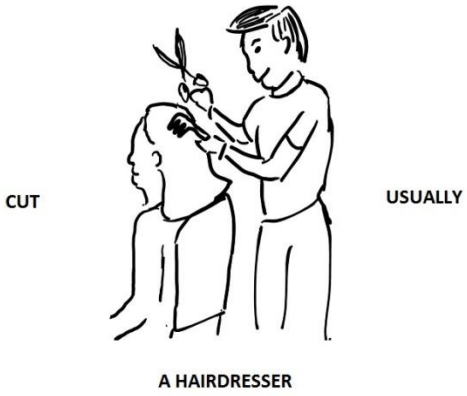
A greengrocer always sells fruits and vegetables



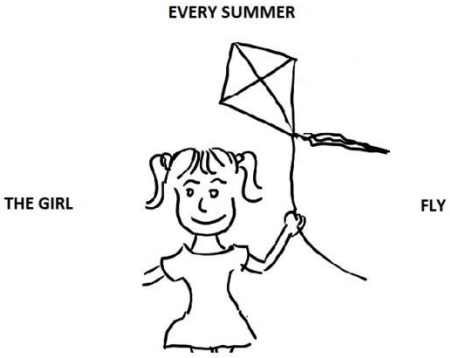
A postman always carries a bag



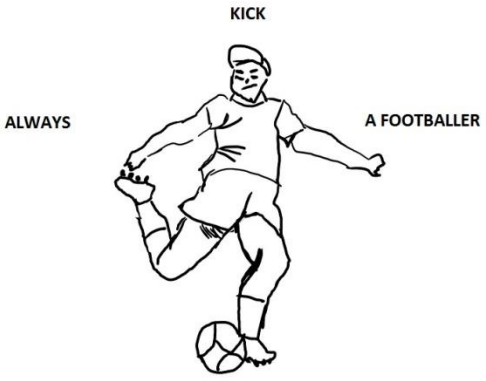
The student sometimes drops his books on the floor



A hairdresser usually cuts hair



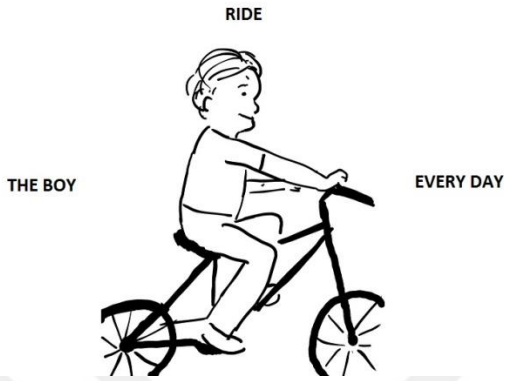
The girl flies a kite every summer



A footballer always kicks the ball



A secretary usually answers phones



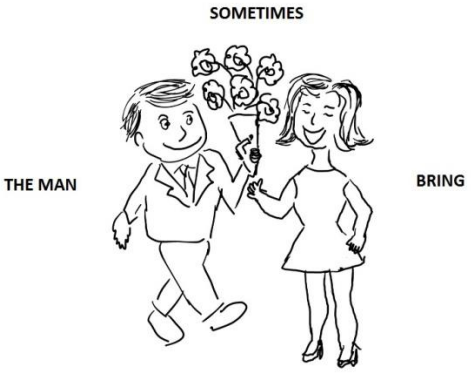
The boy rides a bike every day

APPENDIX D

TARGET SENTENCES AND PICTURES IN THE TREATMENT SESSIONS



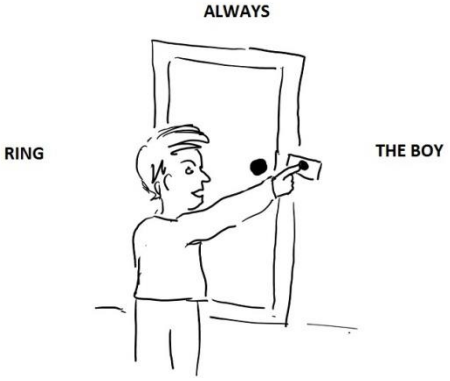
The girl calls her mom every day



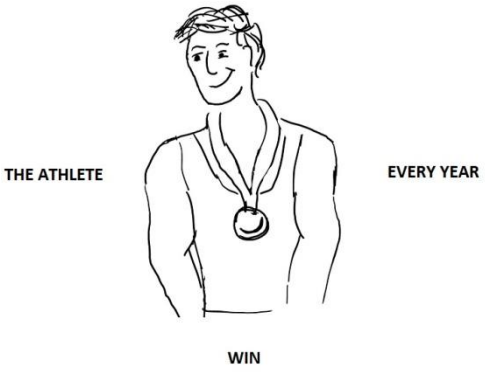
The man sometimes brings flowers to his wife



The girl plays the piano everyday



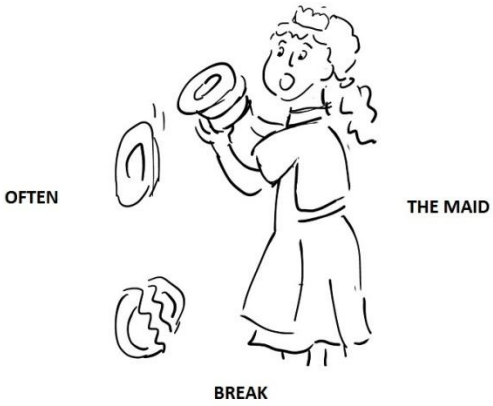
The boy always rings the door bell



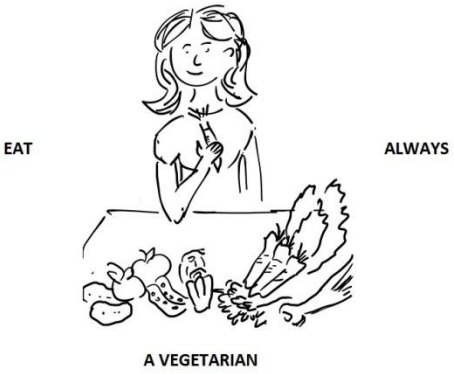
The athlete wins a medal every year



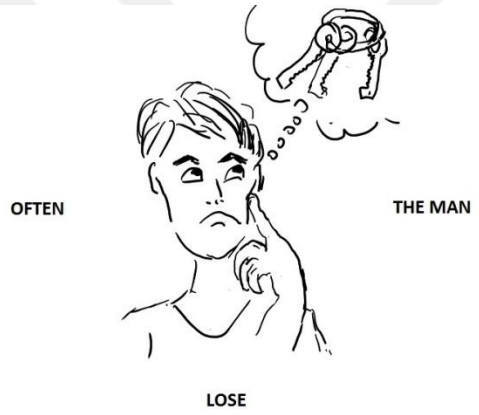
The man pays his bills every month



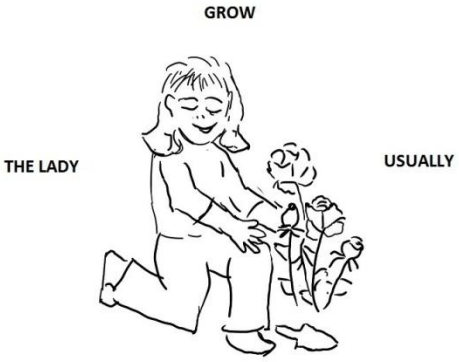
The maid often breaks the dishes



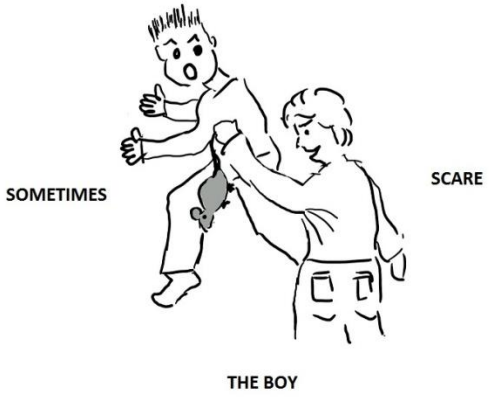
A vegetarian always eats vegetables



The man often loses his keys



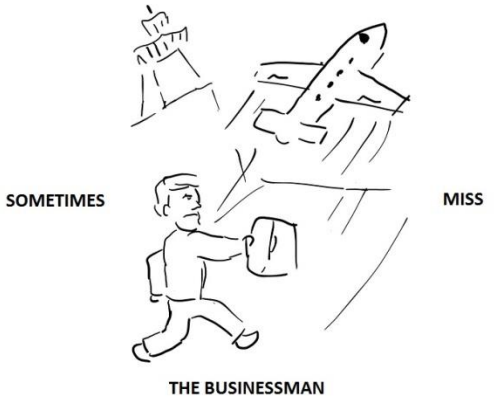
The lady usually grows roses in her garden



The boy sometimes scares his friends



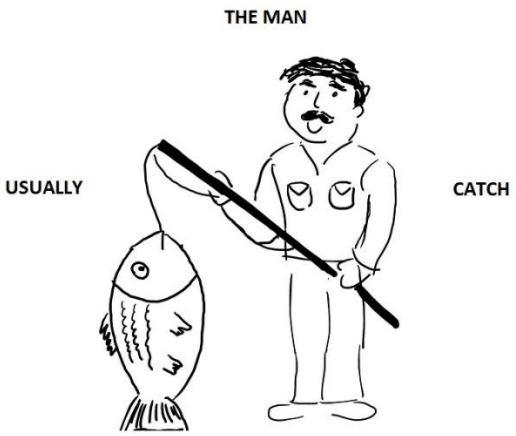
The boy sometimes writes letters



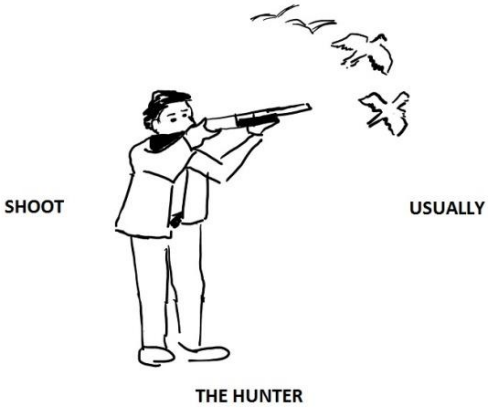
The businessman sometimes misses his flight



The woman always buys expensive clothes



The man usually catches a big fish



The hunter usually shoots birds



The woman sometimes teaches English



The man always saves money

EVERY WEEK

WATCH



THE BOY

The boy watches movies every week

A THIEF



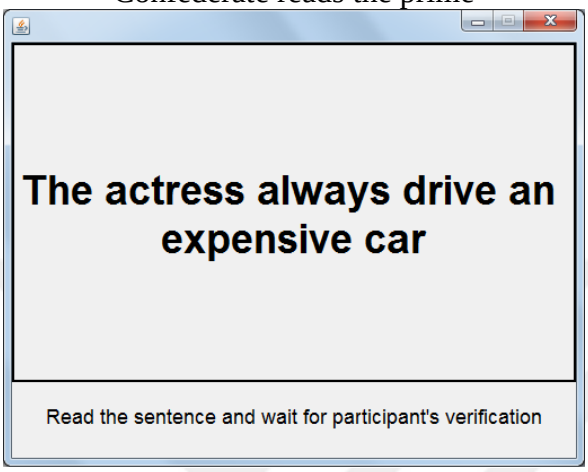
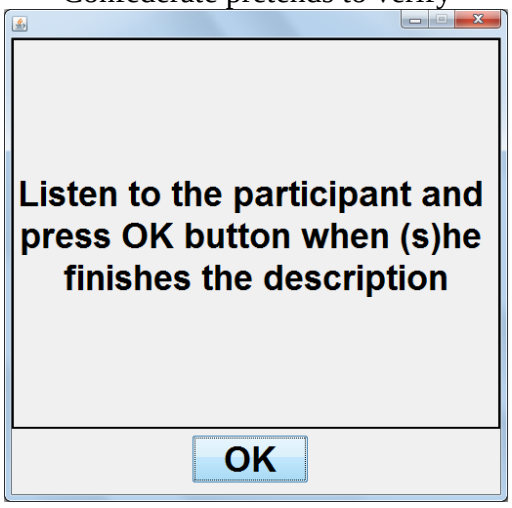
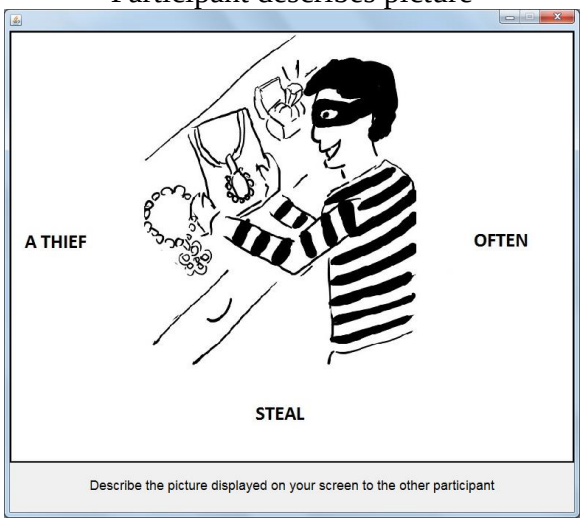
OFTEN

STEAL

A thief often steals jewelry

APPENDIX E

SCREENSHOTS OF AN EXPERIMENTAL TRIAL

CONFEDERATE	PARTICIPANT
Confederate reads the prime	Participant verifies description
	
Confederate pretends to verify	Participant describes picture
	

APPENDIX F

THE PRIME-TARGET PAIRS USED IN THE TREATMENT/PRIMING SESSIONS

Primes	Targets
The mother tells a story to her children every day	The girl calls her mom every day
The woman usually shows her paintings to her friend	The man sometimes brings flowers to his wife
The teacher sometimes raises her voice in class	The girl plays the piano every day
The teacher often speaks English in class	The boy always rings the door bell
The police often stops drivers for speeding	The athlete wins a medal every year
The doctor sees his patient every week	The man pays his bills every month
A delivery man often moves heavy boxes	The maid often breaks the dishes
The businessman often leads the meeting	A vegetarian always eats vegetables
The actress always drives an expensive car	The man often loses his keys
The man always picks the most expensive jacket in store	The lady usually grows roses in her garden
The boy usually sets his alarm clock for 6 o'clock	The boy sometimes scares his friends
The woman always follows the news	The boy sometimes writes letters
The baby sometimes throws her toys on the ground	The businessman sometimes misses his flight
The girl sometimes closes the windows at night	The woman always buys expensive clothes
A waiter always serves food and drinks	The man usually catches a big fish
The girl sometimes helps her mother in the kitchen	The hunter usually shoots birds
The student always asks questions in math class	The woman sometimes teaches English
The instructor often sends e-mails to his students	The man always saves money
The man usually spends a lot of money for shoes	The boy watches movies every week
The baby drinks milk every day	A thief often steals jewelry

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