The Generalization of Inflectional and Derivational Patterns to Novel Stems by L1 Turkish Learners of L2 English*

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ABSTRACT: Studies investigating the morphological processing of affixed forms have to date focused predominantly on inflectional rather than derivational forms and have mostly tested L1 speakers. The present study investigated how high and low proficiency Turkish learners of L2 English generalize regular/irregular verbal inflection and deadjectival un-/in- derivatives to novel stems in an acceptability judgment task. The results showed that the participants generalized both the inflectional and derivational affixes to novel stems when these stems were similar to the existing stems appearing together with these affixes. However, the participants showed no preference when novel stems were dissimilar both in the case of verbal inflection and deadjectival derivatives. The proficiency level of the participants did not affect the overall response patterns. The results are discussed in terms of different models proposed for the morphological processing of complex word forms.

Keywords: inflection, derivation, morphological processing, L2 proficiency, generalization

D1 Türkçe D2 İngilizce Konuşucularının Çekimsel ve Türetimsel Örüntüleri Genelleme Biçimleri Üzerine

ÖZ: Alanyazındaki çalışmaların çoğunluğu, çekim eklerinin D1 konuşucuları tarafından biçimbilimsel olarak nasıl işlemlendiğine odaklanmıştır. Buna karşın, D2 konuşucularının işlemleme örüntülerini ve türetim eklerinin işlemlenmesini araştıran çalışmalar oldukça az sayıdadır. Bu doğrultuda, mevcut çalışmada, yüksek ve düşük seviye D1 Türkçe D2 İngilizce konuşucularının kurallı/kuralsız geçmiş zaman çekim ekini ve 'un-/in-' türetim eklerini, yeni oluşturulan sözcük köklerine nasıl genellediklerinin incelenmesi amaçlanmıştır. Çalışmadaki tüm ekler, bu ekleri alan mevcut sözcüklerin büyük ölçüde benzerlikleri korunarak değiştirilmesiyle elde edilen yeni sözcük kökleriyle birlikte sunulduğunda, anlamlı ölçüde yüksek kabul edilebilirlik oranı elde edilmiştir. Bunun yanısıra, hem çekim hem de türetim ekleri, mevcut

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sözcüklerden tamamen farklı olan yeni köklerle sunulduğunda, karşılaştırılan ekler arasında anlamlı bir tercih farkı bulunmamıştır. İki farklı yeterlik grubu arasında ise, genelleme davranışları bakımından anlamlı bir fark ortaya çıkmamıştır. Elde edilen sonuçlar, biçimbilimsel işlemleme üzerine önerilen farklı modeller ışığında tartışılmıştır.

Anahtar sözcükler: çekim, türetim, biçimbilimsel işlemleme, D2 yeterlik, genelleme

1 Introduction

How morphologically complex forms are represented in the mental lexicon and how they are processed by native (L1) and non-native (L2) speakers of a language has attracted considerable attention. Several theories have been suggested and many empirical studies have been conducted to test the validity of these theories, leading to two fundamental approaches that come in various shapes and forms: single-mechanism models and dual-mechanism models. Single mechanism models essentially suggest that a single mechanism is involved in the representation and processing of (simplex as well as complex) words. The exact natures of the proposed single mechanism models, on the other hand, vary. While associative single-mechanism accounts support the view that all complex forms, irrespective of the predictability and the productivity of the affixes, are stored as non-decomposed units (e.g. Rumelhart and McClelland, 1986), rule-based single-mechanism accounts suggest rule-driven processing only (e.g. Albright and Hayes, 2003).

Postulating rule-based as well as full-form processing, dual mechanism models assume two separate mechanisms for the representation of complex forms (e.g. Pinker, 1999). In Ullman and Pinker's (2002) dual-mechanism model, which has played a prominent role in the famous 'past-tense debate', for example, an associative memory is responsible for the processing of irregular/idiosyncratic forms whereas regular forms are generated and processed through a rule-based system that essentially functions on the basis of morphological decomposition. Similarly, the declarative-procedural model (Ullman, 2001a; 2001b; 2001c), introduced as an extension of the dual-mechanism model, also argues for the involvement of two different mechanisms in the processing of complex forms; however, this distinction is specifically attributed to two different brain memory systems. While it is argued that the declarative memory system is responsible for the representation of fully stored forms (such as irregular past tense forms in English), the procedural memory system is responsible for rule-based operations as in the case of English regular past tense forms. Moreover, this model proposes that low-proficiency L2 learners rely predominantly on the declarative memory in the processing of language; however, with increasing L2 proficiency, rule-driven processing and the use of

the procedural memory system gradually increases (Pliatsikas, Johnstone, and Marinis, 2014; Ullman, 2001a; 2001b; 2001c).

A number of studies have attempted to examine these competing views but have mostly focused on L1 processing and have produced largely contradictory results. Comparatively fewer studies have examined L2 processing and those that did have also arrived at results that are far from consistent. While it was predominantly the processing of the English language (and particularly the inflectional domain) that was tested in earlier studies, subsequent research has also tested the L1 and/or L2 processing of (primarily inflectional) morphology in typologically different languages like Portuguese (Veríssimo and Clahsen, 2014), Greek (Agathopolou and Papadopolou, 2009), German (Sonnenstuhl, Eisenbeiss and Clahsen, 1999), Japanese (Hagiwara, Ito, Sugioka, Kawamura and Shiota, 1999) and Spanish (Havas, Rodriguez-Fornells and Clahsen, 2012). Against this background, the aim of the present study was to investigate the L2 processing of morphologically complex English words by L2 learners of English with an L1 Turkish background. Crucially, in the present study (i) the processing of inflectional as well as derivational morphology was tested with *the same* participants, (ii) the participants were learners of L2 English who had received almost no naturalistic input in the target language but had learned the language exclusively in formal settings and (iii) L2 proficiency was included as an independent variable to be able to check for developmental differences in the processing of inflectional/derivational morphology.

Employing the same participants for the investigation of the processing of inflectional and derivational morphology (i.e., the use of a within-groups design) was actually important as such a design is known to have greater statistical power and to reduce the error variance associated with individual differences. In relation to (ii), the fact that the participants in the present study had been learning English in non-naturalistic settings, earlier studies have highlighted the impact of type of exposure and learning strategies on L2 processing. Beck (1997) and Kırkıcı (2005), for example, observed unusual patterns in the L2 processing of English irregular past tense forms, which they attributed to the fact that their participants were exposed to classroom instruction only and studied irregular past tense forms excessively through repetition and memorization. Beck (1997) and Kırkıcı (2005) argued that such classroom practices and other learning strategies typical of non-naturalistic, formal learning environments may have eliminated the natural properties (e.g., the frequency distributions) of the experimental items and lead to changes in the way they were processed. Thus, the nature of the participants tested in the present study offered the opportunity to test whether this type of non-naturalistic exposure to the L2 would lead to similar effects on the way that inflectional and derivational morphemes are processed.

1.1 Earlier Studies

In the majority of studies investigating the L1 processing of English morphology, the focus has been on the processing of inflectional morphology and particularly the English past tense. In fact, English past tense inflection can possibly be regarded as the most salient and most contested phenomenon to have been investigated as part of the efforts to shed light on the morphological processing of complex forms (often referred to as the 'past-tense debate'). The reason behind this prominence of the English past tense is the fact that it demonstrates an interesting case of a seemingly clear divide between regular and irregular inflection. It is often argued that regular inflection occurs as a result of the concatenation of the suffix *–ed* to a verb stem while irregular inflection is considered to be based upon already-inflected idiosyncratic forms (Pinker, 2001; Pinker and Ullman, 2002). Prasada and Pinker (1993), for example, investigated how L1 speakers of English generalized regular and irregular morphological patterns to artificial verb stems. Participants rated the phonological goodness of novel stems and the naturalness of the regular or irregular past tense form(s) of such stems on a 7-point judgment scale. It was found that the generalization properties of irregular patterns to novel stems were dependent on the similarity to existing forms, whereas regular patterns were generalized irrespective of resemblance to an already existing stem. For instance, the pattern in '*sing-sang*' and '*ring-rang*' was found to be generalized to novel forms like '*spling–splang*', which shared phonological and orthographic properties with already existing irregular forms (Silva, 2009). Based on their findings, Prasada and Pinker (1993) claimed that it was possible to account for the observed patterns using a dual-mechanism model of language that entails the storage of irregular forms in the associative memory based on their phonological similarity and the rule-driven formation of regular forms. In the same vein, Ullman (1999) also used a judgment task with adult native speakers of English, who rated regular and irregular past tense forms together with their stems on a 7-point scale. Ullman found that unlike regular past tense forms, the ratings provided for irregular forms displayed a significant correlation with frequency and neighborhood strength. Ullman therefore concluded that irregulars were stored in an associative memory while regulars were rule-based. Different findings, however, were reported in Albright and Hayes (2003), in which L1 speakers of English rated possible past tense forms of novel stems. When the novel stem the participants had to rate was phonologically similar to an already-existing English regular verb, they preferred the regular past tense form. Likewise, when the novel stem showed similarity to an already existing irregular verb in English, the participants opted for the irregular past tense form. Albright and Hayes (2003) suggested that these results could not be explained through separate mechanisms responsible for regular and irregular past tense formation. Instead, considering the fact that the preference of both regular and irregular past tense forms was based upon the

phonological similarity of the novel stem to an already existing one, it was suggested that a single mechanism rule-based system could account for these results.

A comparatively smaller number of studies has been conducted to examine the processing of derivational morphology by L1 speakers. Alegre and Gordon (1999), for example, investigated whether English derivational affixes could be generalized to novel stems. They initially conducted a distributional analysis focusing on twelve derivational affixes to see whether there were predictable environments in which these affixes appeared recurrently. The recurring environments were identified by taking into account the number of syllables, repeated stress patterns and sound sequences repeatedly occurring in the initial and final positions of the base forms. The affixes occurring in highly predictable patterns were regarded as 'gang affixes' (e.g., *–er* and *–ness*), and those occurring independent of a recurring pattern as 'non-gang affixes'(e.g., *-ion* and *–ity*). How the presence or the absence of a gang organization would affect the participants' generalizations was examined. The novel stems used in Alegre and Gordon (1999) were formed by modifying the existing stems to varying degrees (i.e., near, intermediate, and distant), depending on the overlapping phonological elements appearing in the items belonging to a gang (e.g., existing words that could take the suffix –ion). The novel stems were classified as 'near' when they were quite similar (e.g., *dissumption*), as 'intermediate' when they were partially similar (e.g., *femension*), and as 'distant' when they showed no resemblance (e.g., *mipation*) to stems within a gang. The participants had to rate on a 7-point judgment scale indicating how natural these novel stems sounded in English, and to what extent they would expect to find those stems in a derived form. For instance, when the participants were provided with the novel stem '*distar*', they were initially asked to rate how much the presented stem resembled an existing English word (1: *Poor*, 7: *Good*). Then, the derived form of the novel stem '*distart–ion*' was presented and the participants were asked to rate the possibility of encountering the novel stem in that form in English (1: *Unlikely*, 7: *Very likely*). The results revealed a gang effect for 'gang affixes' only, which indicated that the participants provided higher acceptability ratings to a novel form with a gang affix when it was similar to already existing forms appearing together with gang affixes. Non-gang affixes, however, did not show gang effects, which suggested that they are processed based on rules as in the case of regular inflection.

In contrast to the comparatively rich literature on the L1 processing of English morphologically complex word forms, the number of studies conducted with L2 learners is very low and the results are inconclusive. Murphy (2004), for example, investigated whether L2 learners of English distinguished between rule-driven processes and full-form storage. In a sentence-completion task, beginner-level L2 English students were presented with a drawing in which there

was a figure carrying out an ambiguous action. Under each drawing, the name of the figure was given first (e.g., '*This is Michael*'). This was followed by sentences describing what the figure does (e.g., '*Michael knows how to spling*' and '*He is splinging*'). In the final sentence, the participants were asked to come up with the past tense form of the verb whose infinitive and continuous forms had already been presented in the previous sentences (e.g., *Yesterday he* ___). Crucially, the verbs presented to the participants were nonce words taken from the materials used in Prasada and Pinker (1993). The results showed that the L2 participants displayed similarity effects for both regulars and irregulars, which was interpreted as indicative of a higher reliance on the full-form storage of regulars and irregulars at early levels of L2 proficiency. Silva (2009) investigated the generalization properties of regular/irregular English past-tense inflection (Experiment 1) to novel forms. These novel forms were similar to the existing regularly (e.g., *degment*, which is similar to segment) or irregularly inflected verbs (e.g., *yig*, which bears similarity to *dig*), or were dissimilar to any of the existing forms (e.g., *bletrag*, which bears no similarity to any existing English word) in English. An acceptability judgement task was administered to L1 speakers and L2 learners (L1 Chinese and L1 German) of English. The participants first had to rate the likelihood of sentence-embedded novel stems to appear in English (1: *Very unlikely*, 5: *Very likely*). Then, on a 5-point judgement scale, they rated how likely each novel stem was expected to appear in a certain regularly and irregularly inflected form. The results showed that the L2 speakers provided higher ratings for regular inflection (e.g., *degmented*) when the stem was similar to existing regularly inflected forms (e.g., *degment*) while they preferred irregular inflection (e.g., *yug*) when the stem was similar to existing irregularly inflected forms (e.g., *yig*). That is, both regular and irregular inflection showed similarity effects. However, when the stem was dissimilar to any existing English verbal stem (e.g., *bletrag*), regular inflection was the preferred option (e.g., *bletragged*). The results were interpreted as support for both single-mechanism rule-based models and dual-mechanism models since both types of models predict the generalization of regulars and irregulars based on the similarity of the novel verb to an already existing regular or irregular verb. Similarly, the preference for regular inflection for novel stems dissimilar to existing forms in English is also predicted by these models.

Silva (2009) also examined the L2 processing of English derivation. Using the same procedure as used for English past tense inflection and creating novel adjective stems similar to existing *un-* prefixed forms (e.g., *jeady* like *ready*), *in-* prefixed forms (e.g., *necure* like *secure*) and dissimilar forms (e.g., *chiog*), Silva tested the generalization properties of the English derivational prefixes *un-* and *in-*. The results were indicative of similarity effects for both affixes. That is, the participants rated *un-* forms (e.g., *unjeady*) higher upon encountering novel forms similar to existing *un-* prefixed forms (e.g., *jeady*), whereas *in-* forms (e.g.,

innecure) received higher ratings when they were presented with stems similar to existing *in-* prefixed forms (e.g., *necure*). However, when the participants were presented with an entirely novel stem, which was dissimilar to both prefixed forms (e.g., *chiog*), an L1 background effect appeared. While L1 German learners of L2 English rated the more productive prefix *un-* as more acceptable (e.g., *unchiog*), L1 Chinese learners of L2 English showed no preference in this condition (e.g., neither *unchiog* nor *inchiog*).

1.2 The Present Study

The present study aimed to investigate the L2 processing of English morphologically complex words by analyzing the L2 generalization properties of English regular/irregular past tense inflection and *un-/in-* derivational prefixes. English regular past tense forms are produced through the attachment of one of the three allomorphs (*-t,-d,-əd*) of the *–ed* past tense suffix (e.g., *stopped*, *cleaned*, *studied*) to a verbal stem (Silva, 2009). The attachment of the regular suffix is often regarded as the 'default operation' since it predictably applies to a large number of verb stems and productively applies to newly invented words (Pinker and Ullman, 2002). However, irregular inflection idiosyncratically and unpredictably (e.g., *go-went*) applies to a very small number of verbs (Pinker and Ullman, 2002), and it is generalized only when the novel stem is similar to already existing irregular forms (Prasada and Pinker, 1993). The deadjectival *un-/in-* derivatives can be attached to nominal, verbal, and adjectival stems (Adams, 2001) and give rise to a change in meaning by preserving the syntactic category of the form they merge with (e.g., *kind-unkind* and *correct-incorrect*). Even though the regular-irregular contrast observed in past tense inflection does not apply to the distinction between *un-* and *in-*, a similar contrast exists between these forms in terms of productivity, which provides us with the opportunity to compare the generalization patterns of inflectional and derivational affixes in a similar vein. The prefix *un-* is considered to be more productive (Spencer, 1991) since it is broader in scope compared to the prefix *in-*. Szymanek (1989), for example, reports that the *un-* prefix can be attached to native and foreign stems alike, whereas only foreign stems are combined with *in-*.

The present study sought to answer the following questions:

1. Will there be a significant effect of inflection type (regular vs. irregular past tense), condition (similar regular, similar irregular, dissimilar) and proficiency level (high and low) on acceptability ratings?
2. Will there be a significant effect of derivation type (un- and in- prefixed adjectives), condition (similar *un-*, similar *in-*, dissimilar) and proficiency level (high and low) on acceptability ratings?

The predictions of the present study were motivated by two major models. Both associative and rule-based Single Mechanism models would predict that the participants in the present study would display similarity effects for regular/irregular past tense forms and *un*-/*in*- derivational affixes. This would manifest itself as a preference for regular forms in the 'similar regular' condition, irregular forms in the 'similar irregular' condition, *un*- prefixed forms in the 'similar *un*-' condition, and *in*- prefixed forms in the 'similar *in*-' condition. However, these two accounts make different predictions when the novel forms presented to the participants are dissimilar to any existing forms. While the associative account would predict no preference, the rule-based account would favor a preference for regular forms for past tense inflection and *un*- prefixed forms for *un*-/*in*- derivation as the default rule. Regarding Dual-Mechanism models, Ullman's Declarative/ Procedural Model (2001c) would also predict the presence of a similarity effect for the inflectional and derivational affixes for both high and low proficiency groups, but the model would suggest different generalization patterns in the dissimilar condition depending on the proficiency level of the participants. The high proficiency group would be expected to opt for regular forms in past tense inflection and *un*- prefixed forms for *un*-/*in*- derivation as they would depend more on the rule-based procedural memory. The low proficiency group, on the other hand, would be expected to show no preference since they would depend more on the associative memory.

2 Method

2.1 Participants

The study was conducted with 26 high-proficiency (12 females, mean age= 20.5; SD= 1.4) and 26 low proficiency (18 females, mean age= 19.9; SD= 1.7) L1 Turkish speakers of L2 English. All participants were university students in Ankara or Eskişehir and stated that they had learned English exclusively through formal instruction in classroom environments. The reported mean age of the onset of L2 acquisition of English was 9.5 years (SD= 1.48) for the high-proficiency group and 10.5 years (SD= 2.06) for the low-proficiency group. While the high-proficiency group had been learning English for an average of 11 years (SD= 2.04) at the time of testing, the low-proficiency group had been learning English for an average of 9.4 years (SD= 1.96). Before the experiment, the participants self-rated their L2 English skills on a 9-point scale. A significant difference was found between the mean self-rating scores of the two groups ($t(34.98)= 8.427$, $p<.0001$).

2.2 Materials

The participants completed an offline (pen and pencil) acceptability judgment task in which each critical item contained three sentences (adapted from Silva, 2009). While the first sentence (i.e., Stem Introduction) in each item contained an underlined nonce verb, the second and third sentences contained the regularly or irregularly inflected forms of the same nonce verb in the case of inflection. For derivation, on the other hand, a nonce adjective was presented in the first sentence (Stem Introduction) and the *un-* and *in-* prefixed forms of the same nonce adjective appeared in the following two sentences (see Table 1). The nonce verbs and nonce adjectives presented in the stem introduction sentences were created either by changing the onset of the first syllable of an existing stem (in similar conditions) or by inventing a phonotactically legal nonce word not rhyming with existing stems (in dissimilar conditions).

Table 1. Sample sentence-sets (triplets) for each condition (Silva, 2009).

Past Tense Inflection	
Similar Regular Condition	
Stem Introduction	Did she bomment as well as last time?
Regular Form	No, she bommented better last time.
Irregular Form	No, she bommaint better last time.
Similar Irregular Condition	
Stem Introduction	We need to voose slowly.
Regular Form	Just like we voosed it last time.
Irregular Form	Just like we vose it last time.
Dissimilar Condition	
Stem Introduction	I would never bletrag.
Regular Form	But Sheri bletragged last night.
Irregular Form	But Sheri bletrug last night.
Un-/In- Derivation	
Similar un– Condition	
Stem Introduction	That should be more tamportant.
Un– From	Why can't it be untamportant.
In– Form	Why can't it be intamportant.
Similar in– Condition	
Stem Introduction	That was the last kifferent utag.
Un– Form	All the others are unkifferent.
In– Form	All the others are inkifferent.
Dissimilar Condition	
Stem Introduction	That wasn't kespreg.
Un– Form	It was unkespreg.
In– Form	It was inkespreg.

The items in the past tense inflection set consisted of 20 regular and 20 irregular stems whose frequencies were matched pairwise based on the Francis and Kucera corpus (Francis and Kucera, 1982). The mean frequency was 38 per million (SD= 21.87), and there was no frequency difference between regular and irregular pairs. All stems were one or two syllables long. As shown in Table 1, there were 3 conditions in the Past Tense item set, which were 'similar regular' (e.g., *clean-plean*), 'similar irregular' (e.g., *choose-voose*), and 'dissimilar' (e.g., *bletrag*). The mean numbers of syllables for the three conditions were 1.4 (SD= 0.5), 1 (SD= 0), and 1.75 (SD= 0.44), respectively.

As for derivational forms, 20 *un–* and 20 *in–* adjective stems were used to create novel forms. The mean frequency was 93.25 per million (SD= 104.03) for *un–* forms and 79.1 per million (SD= 97.86) for *in-* forms. The mean syllable length of the novel stems similar to existing adjectives was 2.3 (SD= 0.47) whereas the average syllable length of dissimilar stems was 1.9 (SD= 0.79). Adjectives starting with a vowel were altered in such a way that they were initially attached to an onset and then their nucleus was changed (e.g., *equal-doqual*). No novel stem requiring an allomorph of the prefix *in-* (e.g., *il-/im-*) was included in the experiment to avoid possible confounding factors. The three conditions related to *un-/in-* prefixes were 'similar *un-*' (e.g., *happy–vappy*), 'similar *in-*' (e.g., *correct–dorrect*) and 'dissimilar' (e.g. *laquev*). All triplets were pseudo-randomized using a Latin Square design in order not to present triplets from the same affix type and the same condition successively.

2.3 Procedure

The participants were tested individually in a quiet room. They read and signed an informed consent form and completed a language background questionnaire. Before the actual experiment, they were given instructions along with 3 practice triplets. For the low-proficiency group, the instructions were also provided in Turkish. During the experiment, which was administered in the form of a paper–and–pencil task, the participants were presented with the sentence triplets together with a judgment scale next to them. For the first sentence of each triplet, the participants were instructed to rate how good the underlined nonce stem sounded to them in English. For the following two sentences, they were instructed to rate on a 5-point scale the likelihood of regular/irregular forms or *un-/in-* prefixed forms of that stem to appear in English, where 1 stood for 'very unlikely' and 5 stood for 'very likely'. The participants were also reminded that there were no correct or incorrect answers and that they were expected to rate the items as quickly as possible. 40 distractor triplets were included for both the inflection and the derivation experiment. After the experiment, the participants took a vocabulary test in which they were asked to translate into Turkish the words that had been used to create the novel forms tested (e.g., *comment*,

important). The aim of this translation test was to detect unknown words and to discard these. It took the high proficiency group approximately 30 minutes and the low proficiency group around 45 minutes to complete the whole session. All participants were naïve with regard to the aim of the study.

2.4 Data Analysis

Three–way mixed–design ANOVAs were used for data analyses. For the analysis of the responses provided in the past tense condition, *L2 Proficiency Group* (high, low) was a between-subjects factor whereas *Condition* (similar regular, similar irregular, dissimilar) and *Inflection Type* (regular, irregular) were within-subjects factors. For the analysis of derivational affixes, the *L2 Proficiency Group* was a between-subjects factor while within-subject factors were *Condition* (similar *un-*, similar *in-*, dissimilar) and *Derivation Type* (*un-*/*in-*).

Based on the participants' vocabulary test scores, all novel items (e.g., *yig*) whose underlying existing forms (e.g., *dig*) in English were unfamiliar to a participant were excluded from the analysis for that particular participant. As a result, a substantive amount of data had to be discarded. Overall, 16% of the high proficiency group's data and 26% of the low proficiency group's data were trimmed in the inflection experiment whereas 20% of the data drawn from high proficiency group and 28% of data from low proficiency group were discarded in the derivation experiment.

3 Results

3.1 Past Tense Inflection

The descriptive statistics are presented in Table 2. The results of a 2x3x2 mixed between-within Repeated Measures ANOVA indicated that there was a significant main effect of Condition ($F(1.61, 80.24)= 71.417$, $p<.0001$) and of Inflection Type ($F(1, 50)= 8.630$, $p=.005$). There was no significant main effect of Proficiency Group ($p>.05$), indicating that the 'high proficiency' and the 'low proficiency' groups displayed comparable rating patterns. Lastly, the interaction between the Condition and Inflection Type was statistically significant ($F(1.76, 87.96)= 44.044$, $p<.0001$). No further significant main effects or interactions were obtained.

The results of pairwise comparisons examining the main effect of Condition showed that the difference between the 'similar regular', and the 'similar irregular' ($p=.001$) the difference between the 'similar regular' and the 'dissimilar' ($p<.0001$), as well as the difference between the 'similar irregular' and the 'dissimilar' ($p<.0001$) conditions were significant. To investigate the significant interaction between Condition and Inflection Type further, paired-

samples t-tests were conducted. The results showed that there was a significant mean difference between 'regular' and 'irregular' ratings in the 'similar regular' condition ($t(51)= 6.158$, $p<.0001$). Similarly, there was also a significant mean difference between 'regular' and 'irregular' ratings in the 'similar irregular' condition ($t(51)= 3.300$, $p=.002$). However, there was no significant mean difference between 'regular' and 'irregular' ratings in the 'dissimilar' condition ($t(51)= 1.818$, $p=.075$). Hence, the significant interaction resulted from the different rating directions in the 'similar regular' and 'similar irregular' conditions. While regularly inflected items were rated higher than irregulars in the 'similar regular' condition, irregularly inflected items received higher ratings than regulars in the 'similar irregular' condition. For the 'dissimilar' condition, no preference was found.

Table 2. Mean Rating Scores (out of 5) for Past Tense Inflection and un-/in-Derivations across Groups and Conditions (standard deviations in parentheses).

Group	Similar Regular		Similar Irregular		Dissimilar	
	Regular	Irregular	Regular	Irregular	Regular	Irregular
High Proficiency	3.35 (.85)	2.42 (.77)	2.90 (.69)	3.22 (.68)	2.24 (.75)	2.10 (.78)
Low Proficiency	3.25 (.79)	2.55 (.78)	2.96 (.56)	3.19 (.62)	2.39 (.77)	2.18 (.61)
	Similar Un-		Similar In-		Dissimilar	
	Un-	In-	Un-	In-	Un-	In-
High Proficiency	2.82 (.79)	2.26 (.70)	2.60 (.82)	2.93 (.79)	2.27 (.71)	2.08 (.71)
Low Proficiency	2.74 (.80)	2.40 (.75)	2.63 (.67)	2.88 (.76)	2.27 (.58)	2.24 (.59)

3.2.1 Un-/In- Derivation

The descriptive statistics are presented in Table 2. A 2x3x2 mixed-design ANOVA was conducted to see whether the effects of Condition, Derivation Type and Proficiency Level on acceptability ratings were significant. The results revealed a significant main effect of Condition ($F(2,100)= 43,242$, $p<.0001$) and a significant interaction between Condition and Derivation Type ($F(1.72, 86.04)= 20,916$, $p<.0001$). The analysis revealed no further statistically significant main effects or interactions ($p>.05$ in all cases).

Pairwise comparisons investigating the main effect of Condition yielded a significant mean difference between 'similar *un*-' and 'similar *in*-' (p=.008), 'similar *un*-' and 'dissimilar' (p<.0001), and 'similar *in*-' and 'dissimilar' conditions (p<.0001). Furthermore, follow-up paired samples t-tests were conducted to uncover the source of the significant interaction between Condition and Derivation Type. The results showed that *un*- forms were rated significantly higher than *in*- forms in the 'similar *un*-' condition (t(51)= 4.273, p<.0001). The mean acceptability rating for *in*- forms, on the other hand, was significantly higher than *un*- forms in the 'similar *in*-' condition (t(51)= 2,146, p=.037). Finally, there were no significant mean difference in the 'dissimilar' condition (t(51)= 1.852, p=.070). Consequently, the *un*- form was found more acceptable than the *in*- form in the 'similar *un*-' condition, but *in*- form received significantly higher ratings than *un*- form in the 'similar *in*-' condition. No preference was observed in the 'dissimilar' condition.

4 Discussion

This study investigated how L1 Turkish speakers of L2 English at different L2 proficiency levels generalize regular and irregular inflections to novel stems which vary in their similarity to existing stems. Moreover, it was examined whether the generalization patterns of inflectional and derivational operations are comparable by focusing on deadjectival *un*– and *in*– derivatives in English.

Considering the results of past tense inflection, L2 proficiency was not found to affect the overall acceptability rating patterns. Similar to Murphy's (2004) findings obtained from both L1 and L2 groups and contrary to what was found by Prasada and Pinker (1993) with L1 speakers, in the present study the participants' responses yielded similarity effects for both irregulars and regulars. That is, when a novel stem presented to the participants was similar to an existing regularly-inflected stem (e.g., *bomment*), its regularly inflected form (*bommented*) received a higher rating than its irregularly inflected form (*bommaint*). Similarly, when a novel stem was similar to an irregularly-inflected stem (e.g., *voose*), its irregularly-inflected form (*vose*) was preferred over the regularly-inflected form (*voosed*). On the other hand, when the novel stem presented to the participants was dissimilar to any existing stem (e.g., *bletrag*), the participants displayed no significant preference for either the regularly or the irregularly inflected past-tense form. These similarity effects in the 'similar regular' and 'similar irregular' conditions replicate the findings of Silva (2009). However, the results of the 'dissimilar' condition are not in accord with the findings of Silva (2009), who found that both L1 and proficient L2 speakers rated regularly-inflected nonce stems more acceptable when the novel stem was dissimilar, which was interpreted as evidence in favor of a dual-mechanism account. Considering the fact that the proficient L2 speakers in Silva (2009)

displayed generalization patterns very similar to L1 English speakers, and that those L2 speakers were comparable to the highly proficient L2 speakers in the present study, it was predicted at the outset of the present study that the high proficiency L2 participants would also display similarity effects in the 'similar regular' and 'similar irregular' conditions. In addition, they were also expected to depend more on rule-driven processing and choose the default form (i.e., regular inflection) when they encountered a nonce stem dissimilar to any existing stems (Pliatsikas et al., 2014; Ullman, 2001a; 2001b; 2001c). Although the results lend support to the existence of a similarity effect, the prediction regarding the dissimilar condition was not validated since the high proficiency group showed no preference in this condition as in the low proficiency group.

However, it should be noted that although no statistically significant preference was obtained in the 'dissimilar' condition, the response patterns nevertheless displayed a response trend in the expected direction. Both high and low proficiency groups opted for regularly inflected forms when the novel stem did not bear any similarity to the existing regularly or irregularly inflected stems (see Table 2). Considering the fact that a substantive amount of data had to be removed prior to the statistical analyses, it appears important to point out this non-significant, yet non-trivial, trend in the responses. Based on the predictions of Ullman (2001a; 2001b; 2001c), a higher reliance on the associative memory, and thus no preference in the 'dissimilar' condition, is exactly what would be expected for the low proficiency group. However, both proficiency groups in this study seemed to show a tendency to choose regular inflection in the absence of similarity. Thus, in contrast to Ullman's predictions, the two proficiency groups behaved similarly in that they appeared to make generalizations based on rule-driven processing in the 'dissimilar' condition. Earlier studies (e.g., Beck, 1997; Kırkıcı, 2005) have highlighted the potential role of a number of factors such as excessive exposure to linguistic structures, memorization and explicit language teaching methodologies in accounting for such unexpected results obtained with L2 learners who have been exposed to the target language in predominantly non-naturalistic classroom environments. Given the fact that the participants in the present study reported to have been exposed to English in classroom settings only, it could be speculated that the 'natural/typical' processing differences between high and low proficiency L2 learners reported in many studies was eliminated because of this type of exposure.

Independent of the explanations offered above, the existence of a similarity-effect for both regulars and irregulars can be interpreted as supportive evidence for both single-mechanism accounts (Rumelhart and McClelland, 1986; Albright and Hayes, 2003) and the declarative/procedural model (Ullman, 2001a; 2001b; 2001c) since in all these accounts it is predicted that a novel affixed form is found more acceptable when its stems are similar to an existing stem appearing together with the same affix. In the same vein, the lack of a clear preference in the

'dissimilar' condition is also in line with the tenets of single mechanism associative accounts and the predictions of the declarative/procedural model for low proficiency L2 learners. Looking from the viewpoint of single mechanism associative accounts, since all forms are regarded to be lexically stored, one would not expect any preference between regular and irregular forms in the 'dissimilar' condition. From the perspective of the declarative/procedural model, on the other hand, the absence of such a preference is explained by the fact that low-proficiency L2 learners depend more on the declarative memory and process all forms as a whole unit (see, for example, Silva and Clahsen, 2008; Neubauer and Clahsen, 2009 for further supportive evidence). However, it would be difficult for the declarative/procedural model to explain the results obtained with the high proficiency group in the present study, who did not show any preference in the 'dissimilar' condition in contrast to Ullman's (2001a; 2001b; 2001c) predictions for high proficiency L2 learners.

Regarding the results obtained for *un-/in-* derivational prefixes, the participants' proficiency level, again, did not significantly affect the overall response patterns. A similarity effect was obtained for both *un-* and *in-* forms. That is, *un-* forms received significantly higher acceptability ratings when the novel stems were similar to the existing *un-* prefixed forms. In the same vein, the *in-* forms received higher acceptability ratings when the novel stems were similar to the existing *in-* prefixed forms. However, the participants showed no preference for either type of derivation in the 'dissimilar' condition. The similarity effect found for *un-* and *in-* forms was inconsistent with the findings of Alegre and Gordon (1999), who did not observe a similarity effect for affixes without a 'gang' organization like the prefix *un-*. They did, however, observe a similarity effect with affixes having a 'gang' organization like the prefix *in-*. On the other hand, the similarity effect we observed for *un-* and *in-* replicated the findings of Silva (2009), who focused on the same affixes as in the present study and found similarity effects for all the three groups that were examined: L1 English and L2 English speakers (i.e., L1 German and L1 Chinese). In contrast to the preference for *un-* prefixed forms in the 'dissimilar' condition observed by Silva (2009) for L1 English speakers and L1 German learners of L2 English, no such preference was obtained in the 'dissimilar' condition in the present study. However, this rating pattern was similar to the ratings of the L1 Chinese learners of L2 English in Silva (2009) in that they also showed no preference in the 'dissimilar' condition. Considering that the L2 groups tested by Silva were both highly proficient in English, such rating differences were rather unexpected. Silva attributed this discrepancy to the fact that German is morphologically closer to English and claimed that the German group therefore benefited from a transfer effect. Keeping in mind that the present study was methodologically similar to Silva (2009), finding no statistically significant preference in the 'dissimilar' condition for the high proficiency group was unexpected as the high

proficiency group was anticipated to rely more on rule-driven processing and choose the more productive affix *un-* (Ullman, 2001a; 2001b; 2001c).

It should be noted, however, that the participant groups in the present study showed a clear, albeit statistically non-significant, rating pattern in the 'dissimilar' condition. The high proficiency group tended to rate *un-* prefixed forms as more acceptable when the novel stems were dissimilar. The low proficiency group, on the other hand, seemed to display no preference (see Table 2). Considering the notable amount of data loss, and hence the decrease in statistical power, it seems plausible to claim that the rating difference in favor of *un-* prefixed forms in the 'dissimilar' condition for the high-proficiency group might have reached statistical significance if the data loss could have been kept at a lower level.

Looking at the results of earlier studies investigating affixes comparable to *un-* and *in-* cross-linguistically (Hagiwara et al., 1999; Havas et al., 2012), it can be seen that the existence of a similarity effect is not limited to inflectional affixes. For instance, Hagiwara et al. (1999) found a similarity effect for the affixed *-sa* and *-mi* in Japanese, which were comparable to *un-* and *in-* in terms of morphological productivity. Further, Havas et al. (2012) also obtained a similarity effect with the Spanish affixes *-ez(a)* and *-ura*, which were again comparable to *un-* and *in-* in their productivity. All in all, the results obtained for the derivational affixes are very similar to those obtained for the past tense, as the similarity effects found for *un-* and *in-* were also in line with single mechanism accounts (Rumelhart and McClelland, 1986; Albright and Hayes, 2003) and the declarative/procedural model (Ullman, 2001a; 2001b; 2001c). As highlighted above, these accounts predict higher acceptability ratings for an affixed novel stem when this stem is similar to an existing stem attaching to that exact affix. Additionally, observing no preference for either *un-* or *in-* in the 'dissimilar' condition was also compatible with the predictions of a single mechanism associative account, suggesting full-form storage of each and every form, and therefore favoring neither *un-* nor *in-* while generalizing in the absence of similarity. Further, this finding obtained from the derivational affixes appeared to support the predictions of the declarative/procedural model for low proficiency L2 learners in that the participants might be relying more on the associative memory and probably process morphologically complex forms as unanalyzed units. The results of the high proficiency group, on the other hand, was hard to reconcile with Ullman's claims (2001a; 2001b; 2001c) due to the fact that they would be expected to opt for the more productive affix as a consequence of the dominant use of rule-driven processing according to declarative/procedural model, but they did not show any preference for either one of the derivational affixes.

5 Conclusion

Focusing on the generalization properties of English regular/irregular past tense inflection and *un-*/*in-* derivational prefixes, this study investigated the processing of morphologically complex words in English by high and low proficiency L1 Turkish learners of L2 English. Overall, the results revealed similarity effects for both inflectional and derivational affixes but no statistically significant preference for either type of inflection or derivation in the absence of similarity. In this sense, the findings suggest the full-form storage of each and every word form as predicted by single mechanism associative accounts (Rumelhart and McClelland, 1986) but are also in line with the predictions of the declarative/procedural model, which claims greater dependence on the associative memory and less use of rule-driven mechanism particularly at the initial stages of L2 proficiency (Ullman, 2001a; 2001b; 2001c). These findings are in contradiction to the claim that more productive affixes are generalized irrespective of how similar the novel stem is to an existing word (cf. Veríssimo and Clahsen, 2014).

Making use of masked or overt priming paradigms, Clahsen and Ikemoto (2012), Fiorentino, Naito-Billen, and Minai (2016), and Silva and Clahsen (2008) have shown that the effect of productivity might not be a good predictor of decomposability for derivational affixes. It should be noted, however, that the above studies focused on the very early processing of morphologically complex word forms and that their results should not be taken as directly relevant to the findings of the present study and other studies that have relied on off-line measures. Surprisingly, the high proficiency group in the present study displayed response patterns similar to those of the low proficiency group, which was unexpected considering the claim that there should be less dependence on the associative memory and increasingly more rule-driven processing should start to emerge as L2 speakers become more proficient (e.g., Pliatsikas et al., 2014). It is crucial to note that this pattern of results might be the result of the division of L2 proficiency groups on the basis of the self-ratings of the participants. Although self-ratings have become a standard procedure in psycholinguistic experiments, in our case the self-ratings might not have been successful in establishing two distinct L2 proficiency groups, which is a point that requires closer scrutiny in further studies.

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