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MEMORY OF FORMULAIC SEQUENCES IN L2 RETENTION OF CHUNKS FEATURING INCHOATIVE USES OF UNACCUSATIVE VERBS¹

This study investigates learners' processing of English unaccusative verbs in the inchoative frame (*The door opened; Oil is spilling*). Previous approaches explained L2 difficulty with the inchoative construction in terms of learners' L1 and their perception of discourse or semantic factors hypothesized to be responsible for common overpassivization errors (*The door was opened*). The purpose of the present study is to complement the extant inventory by proposing an additional factor instrumental in L2 processing. It is hypothesized that L2 use of unaccusative verbs is contingent on learners' familiarity with formulaic expressions exemplifying the inchoative construction. The study focuses on the entrenchment of frequent phrases like *My jaw dropped* in Czech and Polish learners. In a lexical decision task, their reaction times for frequent expressions were found to be faster and fewer mistakes were made than in the case of non-formulaic counterparts (*My hair dropped*).

Keywords: inchoative pattern, formulaic language, lexical decision

1. Introduction

There is increasing evidence that language users are sensitive to distinctive properties of encountered language forms such as their frequency of use (Bybee 2010: 18; Taylor 2012; Goldberg 2019). This is consistent with one of the main tenets of usage-based models of acquisition, under which a speaker's knowledge

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of language is directly based on experience with the input (Tomasello 2003). In usage-based frameworks, learners' linguistic representations are assumed to reflect the details of observed usage. According to cognitive linguistic accounts, such faithful representations are developed as learners keep track of frequencies of linguistic forms: The more frequent a form is, the more frequently it is likely to be encountered by learners and the more entrenched it then becomes in the learner's memory.

It is further assumed (e.g. Wray 2002; Arnon & Snider 2010) that frequency effects apply not only to single words but also to multiword sequences (*more or less*, *black and white* or *to answer the phone*). Frequently encountered expressions, once recorded in memory, are hypothesized to be exploited by learners to form generalizations about syntactic patterns instrumental in building sentences (Goldberg 2006) and they serve as a source of information about the semantics of their component words (Dąbrowska 2009). Language knowledge appears to be heavily dependent on formulaic storage: a memory of multiword sequences that have become larger chunks. Storing prefabricated expressions also enhances fluency of language production, especially in the face of short-term memory limitations (e.g. Wood 2015). Apart from production, benefits in terms of fluency also hold for comprehension, where instead of analyzing each individual word separately, language users are envisaged to process an entire phrase in one quick step. This conjecture has been confirmed in studies where participants were faster to recognize words in terminal positions in formulaic sequences (Schmitt & Underwood 2004). There are also benefits in terms of accuracy observed as early as in 4-year-olds (Arnon & Clark 2011).

At the same time, research findings suggest that non-native speakers do not seem to take advantage of formulaic language as readily as native speakers. Various studies (e.g. Howarth 1998; Wray 2002; Callies & Szczesniak 2008) converge on the conclusion that L2 learners tend to experience difficulty in learning and using formulaic language in a natural, native-like fashion. Indeed, deficits in formulaicity have been hypothesized to be a major reason behind foreign learners' unreliable intuitions and generally suboptimal L2 skills (e.g. Yorio 1989; Conklin & Schmitt 2012; Taylor 2012).

An ongoing question has been whether the sources of difficulty are separate factors or whether they interact (Ellis 2003; Tarone 2012), compounding their effects or perhaps canceling each other out. What happens when some formulaic expressions exemplify grammatical patterns that are different in L1 and L2? Does interference then affect their acquisition and use?

The present study looks at how L2 learners handle unaccusative verbs such as *open*, *fill* or *break* in formulaic expressions built around the inchoative (agentless) pattern (*mouth opened wide*; *eyes filled with tears*). As will be detailed below, English unaccusative verbs behave differently from their translational equivalents found in other European languages. Do the differences

cause foreign learners to experience difficulty processing the form of frequently occurring expressions or is the form observed in the input retained sufficiently strongly to override the effects of L1 interference? The ultimate significance of the present focus on formulaic expressions has to do with one question: does experience with frequently occurring expressions affect the learner's knowledge of the inchoative pattern in general? More specifically, does familiarity with instances like *His mouth opened wide* or *My jaw dropped* help learners use the inchoative pattern correctly in novel combinations?

In what follows, I will look at the differences between unaccusative verbs in English on the one hand and in Polish and Czech on the other. I will then discuss a complication to do with these verbs' presence in collocations, which affects their visibility in the input. Briefly, these verbs pose a challenge in that they are much less frequent in inchoative expressions than in transitive/causative uses (*open an account*, *open your eyes*), but as the present study shows, they nevertheless still seem to be acquired in formulaic chunks. This will be followed by the description of the study and its results, which suggest that learners are capable of retaining accurate information about frequencies of formulaic expressions.

2. Unaccusative verbs

This study focuses on the use of unaccusative verbs by foreign learners of English. As signaled above, the use of these verbs in English differs from what is found in other European languages. That is, when these verbs are used in the English intransitive construction (*The window opened*), they have the same form as in the transitive construction (*I opened the window*), whereas in most European languages, their intransitive uses are marked by reflexive pronouns accompanying the verb (*open* itself).

Rigorous studies focusing on these differences have been inspired by Perlmutter's (1978) Unaccusativity Hypothesis, which divided intransitive verbs into pure activity verbs (*smile*, *laugh*, *whistle*, etc., whose subjects encode actual agents) and verbs denoting a change of state (*break*, *open*, *freeze*, etc., whose subjects do not instigate but rather undergo the processes described by the verbs). The former have been referred to as unergative verbs and the latter as unaccusative verbs. The present study will focus on unaccusative verbs available for use in two grammatical constructions:

- (1) a. The door opened. (Intransitive frame / inchoative pattern)
- b. I opened the door. (Transitive frame / causative pattern)

In (1a), the door, which undergoes the change from being closed to being open, is expressed as the subject of the verb. On the other hand, (1b) is an

example of the causative frame, because it includes an extra participant responsible for causing the process. The cause (or causer) of the process appears as the subject, while the object encodes the participant undergoing change.

These two patterns have been viewed by many authors (Pinker 1989/2013; Levin & Rappaport 1995) as being interrelated forms within the Causative Alternation, a choice between two grammatical constructions in which the verb is free to appear. The existence of alternations has been questioned by cognitive linguists (e.g. Goldberg 2002; Hilpert 2014), who treat the structures in question as two independent constructions. I will remain neutral on whether alternations are psychologically real, but for our purposes, it should be stressed that the relation between the transitive and intransitive frame is problematic from the foreign learner's point of view: While unaccusative verbs take direct objects in the transitive construction in European languages, their intransitive form in English is rather surprising, because the entity undergoing a change appears in the subject position and its non-agent status is not apparent from the form of the verb in the same way as is the case in Slavic (e.g. Malicka-Kleparska 2017; Rościńska-Frankowska 2012; Szczesniak 2008), Romance (e.g. Cançado & Gonçalves 2016) or Germanic languages (e.g. Piñón 2001). Speakers of these languages tend to signal the intransitive use (and the non-agent role of the participant in the subject position) by means of reflexive pronouns:

- (2) a. Drzwi otwarły się. (Polish)
Door opened REFL
- b. Dveře se otevřely. (Czech)
Door REFL opened
- c. A porta abriu-se. (Portuguese)
ART door opened-REFL.
- d. Die Tür öffnete sich. (German)
The door opened REFL
The door opened.'

3. The inchoative structure in L2

Given the above L1-L2 differences in terms of the form of the intransitive construction, it is to be expected that foreign learners of English may experience difficulty in using unaccusative verbs in such structures. It is a familiar observation both among researchers and language teachers that L2 English learners tend to avoid the use of unaccusative verbs in the intransitive frame. Sentences such as *The door opened* are rather rare in L2 production. When learners do topicalize the patient participant, they often resort to overpassivization (Ju 2000; Kondo 2005; Chung 2014; Cabrera 2019). Learners tend to passivize not only those unaccusative verbs that possess passive participle form

(3a), but – more seriously – those otherwise never found in passive uses in native production (3b):

- (3) a. A new branch of the bank was opened.
 b. First, the change of life-style *will be happened. (ex. 14 in Ju, 2000: 88)

This much is evident from a brief search of the *International Corpus of Learner English* (ICLE)². Table 1 below summarizes the frequencies of the verb *open* used by learners of English and by native speakers. The ICLE collection is divided into sub-corpora of writing samples by learners of various nationalities. Here samples by Czech learners are included in the row CZICLE; figures for writing by Polish learners are in the row PICLE. For additional data, the table also includes frequencies for German (GICLE) and Bulgarian (BGICLE) learners of English. The first row shows instances of *open* by American and British speakers of English as L1. Some facts are immediately clear even without a detailed statistical analysis. Both in native and non-native production, causative uses of the verb *open* predominate; they account for 70.3% - 90% of all uses. In all these samples, inchoative uses represent between 5% and 20% of all instances. The main difference is in the numbers in the column “passive uses”: the verb *open* never appears in the passive construction by native speakers, whereas passive uses do occur in all non-native samples. (Admittedly, the small sample sizes do not allow sufficient confidence to postulate statistically significant differences based on the numbers obtained. For example, in the case of the difference in passive uses between the Polish and native sample, the Fisher exact test statistic value is 0.0627, which is not significant at $p < .05$; also regarding the German and native sample, the value is 0.1465, not significant at $p < .05$.)

Table 1 Frequencies of the verb *open* in native and non-native writing samples.

	<i>open</i> total instances	causative uses	inchoative uses	passive uses	corpus size
ECLE	20	16 (80%)	4 (20%)	0 (0%)	228,000
CZICLE	20	18 (90%)	1 (5%)	1 (5%)	209,000
PICLE	27	19 (70.3%)	3 (11.11%)	5 (18.51%)	224,000
GICLE	35	28 (80%)	2 (5.71%)	5 (14.28%)	208,000
BGICLE	26	20 (76.92%)	4 (15.38%)	2 (7.69%)	202,000

² *International Corpus of Learner English* created by Sylviane Granger, Université catholique de Louvain.

It is interesting to note that the non-causative uses of the verb *open* in all the samples are similar in terms of meaning and context. They typically describe situations involving external causation; that is, present in the event are both a patient and an implicit external agent. In such externally caused scenarios, L2 learners of English tend to overpassivize more often than with internally caused ones (Ju 2000; Chung 2014). This is observed in the following examples of externally caused events.

- (4) a. People were allowed to purchase with private property, new banks were opened CZICLE
- b. Last year a McDonald's restaurant was opened in Moscow... PICLE
- c. I was having breakfast in the kitchen when the door was opened... GICLE
- d. ...the hero's eyes are opened to the tragic lot of his children... BGICLE

In short, the presence of an external cause increases the likelihood of overpassivization. Admittedly, this in itself is not an ungrammatical option and indeed, as one anonymous Reviewer observed, such passives are attested in native usage. However, consistently more frequent occurrences of the passive construction in place of inchoative uses in L2 production are marked as less natural and foreign-sounding. Additionally, non-native uses of unaccusative verbs are also more frequent with inanimate subjects and they are also hypothesized to be subject to L1 influence (Chung 2014; Choi 2019). L1 effects have also been reported in learners of languages other than English (e.g. Montrul 1999; Zyzik 2014).

The question pursued in the present study is whether these tendencies can be reversed. Does the likelihood of overpassivization (or of other unnatural uses of unaccusative verbs in the inchoative frame) decrease as a result of entrenchment of frequent formulaic expressions? It is a working assumption in usage-based theory that people's permanent memory representations include tokens of use of specific prefabricated expressions (Christiansen & Arnon 2017). If L2 representations are similarly sensitive to frequency effects, then memory of common expressions could be expected to affect performance. While learners may be tempted to overpassivize verbs in combinations with subjects they have not often encountered before (e.g. *restaurant + open*), L2 learners should have less difficulty handling frequent combinations such as *His mouth opened wide* or *My jaw dropped*.

This effect of formulaicity in the service of correct usage has been confirmed in various studies. Familiarity with frequent formulaic phrases like *brush your teeth* helps children produce the correct plural form *teeth* over **tooths*, which is more likely to be selected in non-formulaic frames (Arnon & Clark 2010). Similar benefits hold for L2, where learners are more likely to use the possessive *your* correctly in fixed phrases like *brush your teeth* than in less frequent phrases like *warm (your) toes* (Nap-Kolhoff & Broeder 2008).

4. Collocational asymmetry

A serious obstacle prevents learners from benefitting fully from formulaic sequences. Namely, to master the inchoative structure $\text{subject}_{(\text{patient})} + \text{verb}$, one needs sufficient exposure to collocations instantiating the pattern, but such collocations are not as numerous as $\text{verb} + \text{object}_{(\text{patient})}$ collocations exemplifying the causative pattern. There simply are not many formulaic clauses. While working definitions of a formulaic sequence do allow clause-length sequences (Wray 2002), most formulaic expressions are confined within phrase boundaries: Noun phrase, adjective phrase or verb phrase collocations are common, but clausal expressions are much less frequent. To appreciate the asymmetry, consider the following examples of unaccusative verbs available in inchoative and causative frames, shown in Table 2 below. In the right column are common VP expressions listed in most dictionaries. By contrast, there are few idiomatic expressions involving unaccusative verbs with a fixed subject, listed on the left here.

Table 2 Frequent collocations of the verbs *break*, *crack*, *drop* and *fill* in the Subject + Verb frame and the Verb + Object frame.

	SUBJECT _(patient) + VERB	VERB + OBJECT _(patient)
<i>break</i>	—	~ <i>the back</i> , ~ <i>a leg</i> , ~ <i>cover</i> , ~ <i>the ice</i> , ~ <i>new ground</i> , ~ <i>the mold</i> , ~ <i>rank</i>
<i>crack</i>	—	~ <i>heads / skulls</i> , ~ <i>a bottle</i> , ~ <i>a book</i>
<i>drop</i>	<i>sb's jaw dropped</i> , <i>the penny dropped</i>	~ <i>a brick</i> , ~ <i>the ball</i> , ~ <i>the dime</i> , ~ <i>one's guard</i> , ~ <i>a hint</i> , ~ <i>names</i>
<i>fill</i>	—	~ <i>the bill</i> , ~ <i>one's face</i> , ~ <i>the gap</i> , ~ <i>sb's shoes</i> , ~ <i>sb in on x</i>

One reason there are fewer inchoative formulaic collocations is that unaccusative verbs tend to be used predominantly in the causative frame, as is the case of the verb *open* seen earlier in Table 1. This may be the main reason why learners experience difficulty using unaccusative verbs in the inchoative frame: They may simply not have come across sufficient models of use in the input.

5. The acquisition of the inchoative pattern in L1 and L2

Attributing difficulty with L2 inchoative uses to insufficient experience with fixed inchoative expressions faces one problem. Such model inchoative uses are less frequent than causative uses both for foreign learners and children learning L1 English. How do children manage to avoid misusing the inchoative construction?

Surprisingly little research is available on how the English inchoative pattern is acquired by children, with most authors focusing on the acquisition of the causative frame. Among the most influential studies were Bowerman's (1982; 1983) analyses of her daughters' overgeneralizations of intransitive verbs in causative structures (e.g. *disappear something under the washrag*), but her list of errors did not include problems in the inchoative frame common in L2 production. In the absence of studies investigating children's use of the inchoative pattern, little beyond speculation can be offered. Perhaps the reason why children are not seen misusing unaccusative verbs in the intransitive construction is that they may not often attempt such uses in the first place. In fact, it is reasonable to suppose that children do not use verbs like *open* intransitively, given the low overall frequency of such uses in adult production.

However, errors in the inchoative frame are common in L2 before learners develop proficiency. The question is how more advanced learners do eventually eliminate them in their production. In keeping with usage based approaches, it is fair to assume that to develop the target representations of the English inchoative construction, foreign learners need to encounter specific tokens of use. The usage-based view of proficiency through exposure further assumes that learners' representations retain concrete tokens of unaccusative verbs (e.g. *the forest is burning*), some of which are fixed expressions (e.g. *my jaw dropped*). If this assumption is correct, learners should demonstrate familiarity with common inchoative uses of unaccusative verbs. The present study is an attempt to measure the strength of memory of such uses in L2 learners.

6. Study

The purpose of this study was to time people's reactions to phrases by means of a phrasal decision task, a modification of the standard lexical decision task. The main question under investigation here is whether people's processing latencies for common formulaic phrases are shorter than when faced with relatively free phrases. The latter can be assumed to require more time to process given that their comprehension involves looking up separate component words one by one, whereas common fixed phrases can be retrieved as wholes. If language learners are like native users in their sensitivity to phrase-frequency, they can be predicted to respond faster to high frequency phrases. To detect these expected differences in reaction times, the design involved sentence pairs whose members differed only in terms of phrase frequency, but were matched for substring frequency. That is, the frequencies of the individual words were comparable, to rule out the possibility of any differences in processing latencies resulting from the differences in the lexical search of component words.

6.1. Participants

48 subjects participated in the experiment, which was carried out at the University of Silesia in Poland (26 subjects; 19 females and 7 males) and at Palacký University in the Czech Republic (22 subjects; 17 females and 5 males). All subjects were second-year students of English at the two universities, native speakers of Polish and Czech, respectively. The students were 19 - 23 years old, with 11 - 14 years of English language study.

6.2. Materials

Materials used in this study included sentence pairs whose members contained the same verb used in Subj + V bigrams of different frequencies, such as in the example below.

- (5) a. My jaw dropped. (Member with a formulaic, frequent Subj + V sequence)
- b. My hair dropped. (Member with a non-formulaic, infrequent Subj + V sequence)

Examples like (5a-b) used in the experiment were all constructed sentences featuring authentic Subj + V bigrams extracted from the *Corpus of Contemporary American English* (COCA). The sentence in (5a) features a fairly common bigram [*jaw + dropped*], which is more common than what can be considered a non-formulaic free sequence [*hair + dropped*]. Pairing formulaic and non-formulaic uses made it possible to compare their processing latencies, which could be assumed to depend on their relative entrenchment in language learners; if non-native speakers' processing is comparable to that of non-native speakers, the more formulaic member can be predicted to be processed faster than its non-formulaic counterpart. 21 such pairs of short sentences were constructed.

Apart from pairs of sentences, the selection contained filler sentences scattered between targeted sentences. These included sentences such as **She wented on feets*, clearly and unambiguously ungrammatical examples, whose purpose was to prevent the subjects from discovering a pattern. (A pattern would allow them to start marking all sentences as grammatical in an effort to accelerate reaction times, which would in turn cause the subjects to rush through the examples without really processing the sentences.) Table 3 includes some examples of the sentence pairs and fillers used (see the Appendix for the complete selection).

All the 21 sentence pairs were divided into two batches: in the high-frequency batch, the cutoff point was set at 100 per billion words (the size of COCA in 2020) and in the low-frequency batch, the sentences were based on

Table 3 Sentence pairs and filler sentences used in the experiment.

Formulaic or near-formulaic sentences	Non-formulaic counterparts	Filler sentences
<i>My jaw dropped.</i> <i>Her eyes filled with tears.</i> <i>Oil is spilling.</i> <i>School starts today.</i> <i>The ship drifted away.</i> <i>The beards grayed.</i> <i>His mouth opened wide.</i> <i>The stone rolled down.</i>	<i>My hair dropped.</i> <i>Her glass filled with wine.</i> <i>Juice is spilling.</i> <i>The month starts today.</i> <i>The bottle drifted away.</i> <i>The clouds grayed.</i> <i>The bag opened wide.</i> <i>The pencil rolled down.</i>	* <i>The boss informed which.</i> * <i>Sit through the table.</i> * <i>She wented on feets.</i> * <i>The hour sold.</i> * <i>The song will review.</i> * <i>She laughed the baby.</i>

Subj + V combinations whose frequency was below the cutoff point of 100 per billion. The rationale was that if learners are sensitive to frequency differences between phrases, these should be reflected in reaction times more strongly where the differences are considerable (i.e. in the high-frequency batch) than in the case of those pairs whose members are both rather infrequent. In both these batches, the choice of the sentences in each pair was dictated by the following criteria.

Sentence length

First, the sentences were kept short, on average four words each. (The shortest sentence contained three words and the longest one was seven words long.) This was intended to limit processing latencies and obtain reaction measurements that could be considered approximate for formulaic phrases alone, something that would not be possible if the sentences contained additional material beyond the phrases under consideration.

Frequency of unaccusative verbs

The unaccusative verbs selected were all relatively frequent. They included unaccusative verbs like *break*, *clear* or *fill*, but crucially the selection did not feature items such as *sear*, *steep* or *taper*, as these are not found in any common formulaic expressions of the Subj + V type.

Choice of formulaic phrases

The selection of formulaic Subj + V combinations followed the criterion of familiarity. Those combinations were included that could be expected to be familiar to second-year students of English. Bigrams like *school starts* or *shop closes* can safely be taken to be present in the kind of input that learners of English as a foreign language are exposed to in their coursebooks. Additionally, many of them can be assumed to have come across N-V bigrams like *jaw dropped*, fairly frequent in the language of social media.

Phrase frequency and substring frequency

The sentences in each pair differed in terms of phrase frequency, but they were matched for substring frequency. That is, sentences containing formulaic or near-formulaic phrases (e.g. *His mouth opened wide* or *My jaw dropped*) were higher frequency than their non-formulaic counterparts (*His bag opened wide* or *My hair dropped*). However, the substring frequencies were kept relatively equal in each case, where the sentences *His mouth opened wide* and *His bag opened wide* each contained words of comparable frequencies: the noun *mouth* and *bag* are listed as the 1077th and 1045th most frequent words in Davies & Gardner's (2010) *Frequency Dictionary of Contemporary American English*. Thus, each pair was designed by first finding a common Subj + V bigram featuring a given verb preceded by a subject noun #1. Then the other sentence was built around the same verb preceded by a subject noun #2 selected from the frequency list, where that noun would be as near as possible to noun #1.

Plausibility

The non-formulaic Subj + V bigram had to constitute a plausible combination. For example, to match the subject in the sentence *Their hair greyed*, the noun *clouds* was selected because it is a natural subject of the verb *grey*, attested in actual use, albeit less often than the noun *hair*. Each low-frequency non-formulaic combination was based on authentic uses such as the examples below. (This was especially important when a bigram was not attested in the COCA, such as [*mood* + *dim*] or [*apples* + *reddden*].)

- (6) a. As they neared the bank, they saw that the *island was shaking* violently. (Norma Hayes Bagnall, *On Shaky Ground*)
- b. the berries ripened on the bush and *the apples reddened* in the orchard. (*The Modern Pickwick Papers*)
- c. *Bridle Path closes early* due to inclement weather, the Extended School Care Program closes two hours after dismissal time. (www.npenn.org)
- d. And *mountains will shrink* down to hills as we travel onward to greater heights of motherhood. (www.beautythroughimperfection.com)

6.3. Procedure

The experiment was conducted by means of DmDX Display Software (developed by Jonathan Forster, <http://www.u.arizona.edu/~kforster/dmdx/dmdx.htm>). The procedure involved a phrasal decision task to time the subjects' processing of short sentences. Participants were seated in a quiet room in front of a computer, where they were shown sentences displayed in their entirety, flashing one after another on the screen. The participants' task was decide

whether or not the sentences were grammatically correct sequences possible in English. They were instructed to indicate their decision by means of the Left Shift key (“no, incorrect”) or the Right Shift key (“yes, correct”). Following each decision, the sentence disappeared, the screen went blank for one second and the next sentence was presented. Participants were instructed to react to sentences as quickly as possible and not to look for typos in any of the sentences. Additionally, they were told not to dwell on their misreactions (such as pressing Left Shift for a “yes, correct” decision). Before each participant began the task proper, he or she first went through six warm-up sentences to get familiarized with the procedure.

To avoid cross-priming, the formulaic and non-formulaic uses were separated into two blocks, each of which contained both formulaic and non-formulaic sentences, but only one of any sentence pair. Both blocks were presented consecutively to all participants, half of whom were shown block 1 first. The order was reversed for the remaining subjects, who saw block 2 first.

6.4. Results

When a subject took longer to react to some sentences, likely as a result of inattention or failure to press a key (and having to press it again), that increased these sentences’ average times for the wrong reasons. To avoid such distortions, reaction times of over 4 seconds were excluded. The average times for each sentence was then calculated and the results were gathered separately for Czech and Polish subjects. The average times for some sample sentences are shown in Tables 4 and 5 (and the remaining figures are shown in the Appendix).

Table 4 Some reaction times to sentence pairs in ms (Czech group)

My jaw dropped.	1554.624	My hair dropped.	1890.1845
The earth was shaking.	1754.374	The island was shaking.	2043.8838
Bubbles burst.	1828.775	Stars burst.	2004.0859
The stone rolled down.	1852.484	The pencil rolled down.	1847.4895
His face reddened.	1776.780	Our apples reddened.	2321.3786
School starts today.	1555.203	The month starts today.	2256.1245

Table 5 Some reaction times to sentence pairs in ms (Polish group)

My jaw dropped.	1416.604	My hair dropped.	1570.364
The earth was shaking.	1510.652	The island was shaking.	1934.723
Bubbles burst.	1727.571	Stars burst.	2050.194
The stone rolled down.	1482.504	The pencil rolled down.	1632.491
His face reddened.	1639.922	Our apples reddened.	2179.159
School starts today.	1582.716	The month starts today.	1927.208

6.4.1. Inverse correlation: reaction times

As predicted, the reaction times observed in both the Polish and Czech groups were found to be inversely correlated with the frequencies of the sentences in question. The more frequent member in each pair tended to elicit faster responses than its lower-frequency counterpart. In the Polish group, the average difference in reaction times was 168.19 ms (1706.33 ms for more frequent members and 1874.52 for their low-frequency counterparts; $p = .014$), and the average in the Czech group was 175.57 ms (1885.43 ms for higher-frequency members and 2061 ms for low-frequency counterparts; $p = .069$). In some pairs, the differences were especially pronounced, as was the case of the bigrams [*school* + *starts*] and [*month* + *starts*], which were found to obtain reaction times differing at 344 ms ($p = .046$) and 701 ($p = .0008$), in the Polish and Czech groups, respectively. In other pairs, the differences were also clear, but not always statistically significant at $p > .05$ in both groups, as in the bigrams [*eyes* + *filled*] and [*glass* + *filled*], which elicited reaction time differences of 340.79 ms ($p = .002$) in the Polish group and 314.54 ms ($p = .052$) in the Czech group.

As a general rule, the differences in reaction times were greater in the case of those pairs whose members were separated by higher degrees of frequency difference (most often in the high-frequency batch). Table 6 shows differences in reaction times obtained in each pair. Where a sentence based on the less frequent bigram obtained faster reaction times (contra predictions), this is reflected in negative results. For example, in the bigrams [*beards* + *greyed*] and [*clouds* + *greyed*] (of the low-frequency batch), where Polish subjects recognized the latter bigram faster by 34 ms.

Thus frequencies and reaction times were found to be inversely correlated, as can be seen Figures 1 and 2. While the pattern of correlation is far from perfectly regular, both groups of subjects exhibit a similar tendency illustrated by the trend direction (broken line).

Table 6 Increasing differences in frequencies and differing reaction times (in ms)

Bigrams	Diff in frequency b/n bigrams	Diff in reaction time (CZ)	Diff in reaction time (PL)
<i>beards/clouds greyed</i>	3	1	-34
<i>shirt/mountains shrink</i>	3	-208	254
<i>ship/bottle drifted</i>	20	278	-36
<i>stone/pencil rolled</i>	41	-5	149
<i>ears/balloons pop</i>	43	51	-454
<i>earth/island shaking</i>	73	290	425
<i>check/file bounced</i>	82	146	159
<i>shop/path closes</i>	88	-203	240
<i>sky/forest cleared</i>	130	286	532
<i>face/apples reddened</i>	216	544	539
<i>water/milk boiling</i>	234	292	-319
<i>light/mood dimmed</i>	373	141	-129
<i>oil/juice is spilling</i>	419	164	2
<i>car/cup broke</i>	477	315	467
<i>fire/wood burned</i>	529	-258	-111
<i>bubbles/stars burst</i>	531	175	322
<i>school/month starts</i>	669	701	344
<i>eyes/glass filled</i>	715	460	341
<i>jaw/hair dropped</i>	742	335	153
<i>year/person passed</i>	1272	277	249
<i>mouth/bags opened</i>	1629	-95	438

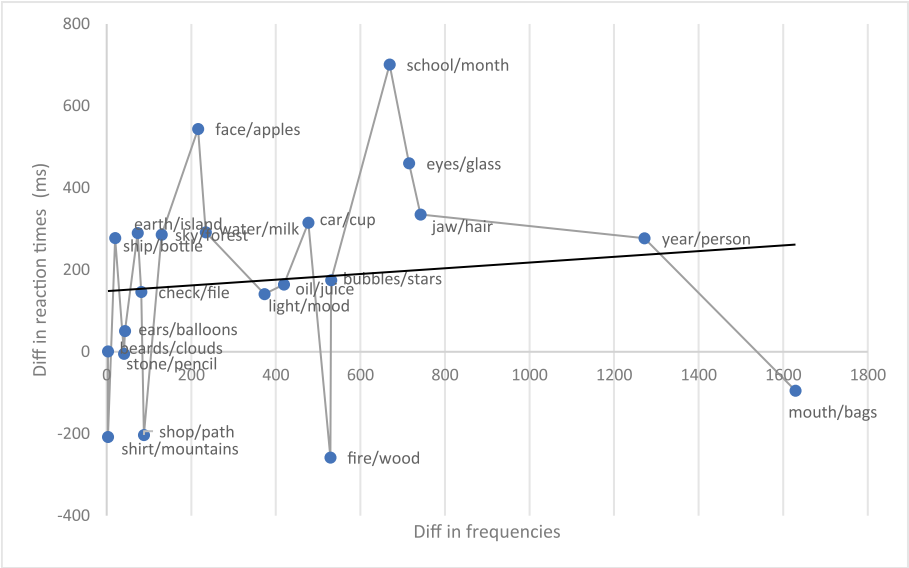


Figure 1 Correlations: diff in frequencies to reaction times (CZ)

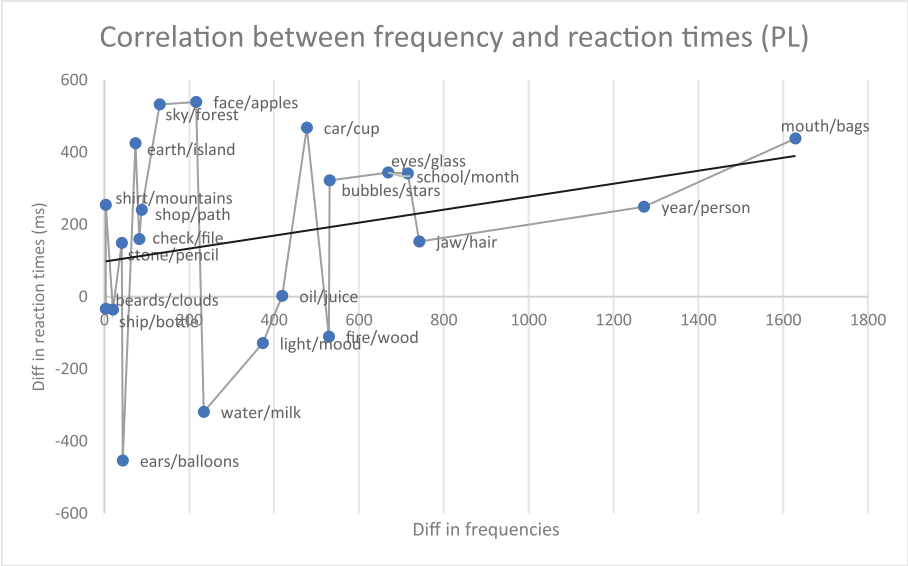


Figure 2 Correlations: diff in frequencies to reaction times (PL)

6.4.2. Direct correlation: accuracy

Apart from bigram frequencies correlating with their reaction times, there is a direct correlation between frequencies and accuracy rates of the subjects' responses. Generally, in most pairs, sentences featuring higher-frequency bigrams received more accurate responses than their counterparts with lower-frequency bigrams. This effect was especially strong in the case of bigrams from the high-frequency batch (whose frequencies ran in the hundreds of instances in the one-billion *Corpus of Contemporary American English*). For instance, in the pair *The month starts today* (lower-frequency member) and *School starts today* (higher-frequency), all subjects identified the latter as a correct sentence, while the former was rejected by 5 subjects (22.72 % of all responses) in the Czech group ($p = .048$, significant at $p < .05$) and by 10 (38.46 %) in the Polish group ($p = .0007$). Similarly, the sentence *Her glass filled with wine* (low-frequency member) was rejected by 17 and 14 subjects in the Czech and Polish groups respectively, while *Her eyes filled with tears* (high-frequency member) was rejected by 4 and 3. These are shown in Table 7 (see the Appendix for the remaining data).

Table 7 Numbers of sentences mistakenly recognized as incorrect by Czech and Polish subjects

	CZ			PL		
	Mistakes	%	Fisher exact	Mistakes	%	Fisher exact
<i>The month starts today.</i>	5	22.72	0.0485	10	38.46	0.0007
<i>School starts today.</i>	0	0		0	0	
<i>Her glass filled with wine.</i>	17	77.27	0.0002	14	53.84	0.0025
<i>Her eyes filled with tears.</i>	4	18.18		3	11.53	
<i>My hair dropped.</i>	11	50	0.0002	11	42.30	0.002
<i>My jaw dropped.</i>	0	0		1	3.84	

7. Discussion

The status of verb alternations is a contentious issue. While some authors (e.g. Levin 1993; Pinker 1989/2013) assume that alternations are a prominent component of language knowledge (and can therefore be thought of as being psychologically real), cognitive linguists, such as Goldberg (2002) or Gries (2003), argue that any two alternating patterns display sufficient semantic differences to be treated as separate, independent constructions. The issue is of more than just purely theoretical significance. The rationale for postulating a mental link between alternating syntactic patterns is that such links may be the vehicle of productivity: Once the learner witnesses sentences like *James Bond burned the letter* and perceives the verb *burn* as a verb of change of state, he or she can automatically conclude that the verb is also available to appear in the inchoative frame, *The letter burned*. The main question is whether the existence of a pattern is indeed recognized and exploited by language users:

“Do you keep accumulating these pairs of verbs, filing them away pair by pair? Or do you make a leap of faith and assume that any verb that appears in one of these constructions can appear in the other one?” (Pinker 2007: 35)

In the case of foreign language study, the answer to this question seems to be that learners are careful not to generalize too soon. Rather than make a generalizing leap of faith for the whole pattern, they seem to be conservative in filing away pairs of verbs. That is, having seen a verb in the causative pattern does not justify, in the learner’s eyes, using it in the inchoative pattern. To move

beyond it and allow a verb in the inchoative pattern, the learner needs evidence of that verb witnessed in the inchoative pattern. More cautiously still, learners do not even seem to generalize beyond very limited combinations of verbs with specific subjects. For instance, while the data show that the participants are familiar with the verb *fill* in inchoative uses like *Her eyes filled with tears*, they do not treat that as sufficient grounds for using the same verb with a subject like *glass* in *Her glass filled with wine*. In the present study, such less frequent uses not only took longer to process, but more seriously, they also caused our subjects to make more mistakes.

While the Czech and Polish participants were found to react to most sentences in comparable ways (more frequent bigrams elicited faster reaction times), there were some discrepancies, which may at first glance appear puzzling. For example, in the Polish group the sentence pair *The shirt will shrink* / *The mountains will shrink* elicited reaction times of 1737.134 and 1991.041 respectively, and the corresponding times were not only considerably much higher in the Czech group, but they were also reversed, with the *shirt* sentence taking longer to recognize, 2641.9711 against 2434.9705 for the *mountains* sentence. However, it is important to note that such discrepancies occurred only in the case of examples in the low-frequency batch. It is justified to suppose that they may be due to differences in the amounts of exposure to selected phrases that learners of different nationalities have received. That is, while high frequency bigrams (e.g. *jaw dropped*) are likely to be encountered equally frequently by all advanced learners, there may be considerable variation in the case of rare bigrams: some learners are likely to have witnessed inchoative uses of [article of clothing + *shrink*] as rarely as [*mountains* + *shrink*], and may therefore take about as long to process both types of subject-verb combinations.

Whatever discrepancies or degrees of randomness were observed, what the present study does show clearly enough is that learners' performance is a reflection of usage they are exposed to in input. Like native speakers, foreign learners are sensitive to frequencies of use (revealed through corpus analysis). Although language users may not have any clear recollections of seeing uses like *poss mouth opened* or *poss eyes filled with tears*, familiarity with such specific tokens is testified to by the reaction times obtained in our study. The clear differences in reaction times make it possible to hypothesize that each phrase is characterized by its own degree of entrenchment in the learner's lexical representations.

Further, the above can be taken as a strong indication of redundant storage: Language users retain not only idiomatic phrases but also transparent, perfectly predictable ones in their mental lexicons. The fact that they are stored redundantly as whole chunks also shows that their enhanced swifter processing is one accompanying result. It is implausible to suppose that these facts

should have no effect on learners' capabilities. The deeper significance of formulaic storage is that it is precisely through phrases retained this way that generalizations can be attempted.

Thus, the present study suggests that L2 use of the inchoative pattern should be treated as a product of the size of the learner's formulaic storage. While there is no denying the importance of rules or the many interesting semantic intricacies underlying the inchoative predicate, these are assumed to follow from frequently observed patterns instantiated through concrete expressions encountered in input and stored in the lexicon. Indeed, the learner can form no rules or semantic regularities unless and until sufficient numbers of tokens exemplifying them have been amassed in memory. Of course, it is perfectly possible to identify factors behind correct uses of the inchoative pattern in L2 production (and those that cause learners to overpassivize), but the main determiner of how learners handle inchoative uses is ultimately not so much a matter of underlying rules or semantic factors but of familiarity with model uses like *poss jaw dropped* or *poss face reddened*. It is over these uses, once enough of them have been accumulated, that any successful native-like generalizations can be reached. It is through such concrete collocations (memorized despite their transparency and predictability) that learners overcome L1 influence and the temptation to overpassivize or to use reflexive pronouns in the inchoative pattern.

8. Conclusions

Dąbrowska (2016) warns against making strong inferences about mental representations based on usage patterns from corpus data. It is impossible to know exactly how a speaker's knowledge of language forms is organized without experimental evidence (p. 487). The challenge is even more complicated when using corpus data as a source of hypotheses about foreign learners' knowledge. Although it stands to reason that exposure to input affects learners' mental representations, these representations remain a black box, inscrutable without our hypotheses being corroborated experimentally.

It is for this reason that the present study combines corpus-based data and experimental evidence. It focused on formulaic instances of the inchoative pattern frequently occurring in the input (e.g. *My jaw dropped*; *His mouth opened wide*). Because most advanced learners of L2 English can be assumed to have come across such formulaic uses, it was hypothesized that their experience would be observable in their improved performance processing those specific uses, relative to less frequent uses. Indeed, it was found that when it comes to unaccusative verbs in inchoative expressions, corpus evidence does serve to predict learners' performance. That is, learners benefit from familiarity with frequently occurring exemplars. This is true of unaccusative verbs that are often

found to occur with specific subjects and tend to be better consolidated in learners' memory. However, it is not the frequencies of verbs alone that determines performance, but the frequencies of concrete subject-verb bigrams. While the frequent occurrence of *jaw* and *dropped* can contribute to learners' familiarity and enhanced performance in processing uses like *My jaw dropped*, it does not automatically translate into more ease with inchoative uses of *drop* with other subjects (*My hair dropped*). In the present study, both Czech and Polish learners of English showed significant differences in how they approach uses of the same verbs with different subjects. They made fewer mistakes and took less time, on average, to recognize sentences featuring frequent subject-verb bigrams than they did processing uses with less common bigrams. This pattern was found to be consistent (independently of the learners' first language) and hold especially strongly for high-frequency bigrams.

The present study does not offer a definitive answer to the question of when (or whether at all) learners are ready to generalize accurately, the way children have been observed to learn rules by abstracting over stored chunks in L1 (e.g. Bannard & Lieven 2012). One possibility is that having encountered sufficient uses of a verb with different subjects (e.g. *penny dropped*, *prices dropped*), learners may recognize a pattern and apply it productively, breaking free from the influence of transfer. Unfortunately, it is difficult to indicate how many such formulaic combinations would have to be witnessed as a tipping point past which learners should be able to handle the inchoative construction without overreflexivization or overpassivization errors. Still, the potential of L2 learners exploiting observed instances to generalize cannot be ruled out: This study does demonstrate that learners are sensitive to the frequencies of formulaic phrases. Since learners are capable of amassing specific usage exemplars, there are no reasons why they should not eventually reach a critical mass of model uses revealing the correct, native-like inchoative pattern.

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