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Voluntary vs Cued Language-switching in a Sentence Context

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Summary

In an increasingly multilingual world language-switching—the alternation between two or more languages within one same conversation—has become more frequent in everyday life. While multilinguals seem to perform these switches spontaneously and with little to no effort, psycholinguistic studies investigating this phenomenon persistently find a presence of switch costs (ie., a worse performance when switching between languages than when staying with the same). Up to now, the language-switching literature has focused on experiments where bilinguals are asked to switch between their two languages following a cue in the form of an auditory or a visual stimulus. These studies usually employ single-word naming paradigms that require bilinguals to name a series of unrelated objects. Such experiments have delivered strong evidence for switch costs when bilinguals switch between languages. Yet these experiments have been subject to criticism, since they do not replicate the natural circumstances under which a bilingual would normally switch languages. The few studies that have investigated the effects of a more ecologically valid setting, be it by allowing participants to either switch voluntarily (e.g., Gollan & Ferreira, 2009) or within a sentence context (e.g., Gullifer et al., 2013), have found a reduction of switch costs.

It is for this reason that the present study tested a novel combination of parameters that would more closely replicate a natural language-switching environment. Spanish-English bilinguals were asked to complete two tasks where they had to switch languages from one sentence to the next, rather than from word to word. The participants were presented with a series of networks of images connected by straight, diagonal or curved lines—very much like in the experiments by Declerck et al. (2017) and (2021). During the task, a red dot moved from one image to the next creating a path which the participants had to describe. The bilinguals were instructed to name the direction taken by the dot, the shape of the line it travelled through, and the object it approached using sentences. Since language-switching is usually a choice of the speaker that does not respond to an artificial cue, we asked participants to switch whenever they wanted to in one task, and following a color-cue in the other. In the cued language-switching task, the language the participant had to use for a specific sequence was indicated by a col-

ored frame surrounding the image. The frame would light up as the dot reached the middle point of the previous picture. Both parameters were implemented with the intention of comparing the effect of the two, and in order to have a basis of comparison with past experiments involving sentential contexts.

Switch costs were calculated based on the amount of filled pauses produced during a sequence. As in Declerck et al. (2017) and (2021), we counted a filled pause whenever the speaker produced a vocalization that did not correspond to a word (ex. *eh, um, ah,* etc.) The results from the experiment showed that while significant costs were generated by the color-cued task despite the sentence context, the costs were reduced under the voluntary parameter, as they only arose when the speakers switched to their L2.

An additional experiment was performed with a group of Arabic-English bilinguals to see if the results obtained during the first experiment would be replicated in a group of bilinguals who spoke more distinct languages. Here, only the voluntary parameter was tested. Surprisingly, the second group presented a complete elimination of switch costs regardless of the direction of the switch. Furthermore, while the Spanish bilinguals presented a reversed asymmetry (i.e., costs were bigger switching to the L2 than to the L1), the Arabic group showed a symmetrical pattern corresponding to past studies with proficient bilinguals. The asymmetrical pattern, though not a first, was less usual. Past literature presenting similar results suggests that the reversed asymmetry observed in the first group could result from a combination of two factors: the fact that in a voluntary setting bilinguals can avoid 'hard' words in their L2 (see Gollan & Ferreira, 2009), and that the higher L2 exposure reported by the participants could result in a higher relative activation of their L2 and potentially minimize the need to reactively inhibit the L1 (see Bonfieni et al., 2019).

Since the experimental setup was exactly the same in both cases, the difference in the results was assumed to stem from the groups themselves. Based on Green and Abutalebi's (2013) Adaptive Control Hypothesis, the linguistic background of a bilingual in terms of language switching could have an effect on performance during tasks as the one employed in the current study. When presented with a dense code-switching setting, where bilinguals can switch between their languages at ease, speakers who fre-

quent such environments are more likely to perform better as they are more trained in language control. We argue that while the Spanish group presented high English proficiency and reported a moderate daily switch rate, the Arabic group stemmed from a context where language-switching is a regular practice since childhood. This follows from the special status of French and English among certain Arabic speaking communities, added to the fact that Arabic speakers find themselves in a situation of diglossia due to the disparity between their local dialect and the standard language they have to master in order to be literate. Subsequently, Arabic speakers are more practiced switching between dialects and languages, and therefore could have an advantage when switching between languages.

Parting from past literature and the results garnered, we conclude that the reduction of switch costs attained in the present study was due to the combined effect of switching voluntarily and the sentence context, since, together, they recreate a more ecologically valid setup. We found evidence for Green and Abutalebi's (2013) Adaptive Control Hypothesis and confirmed Blanco-Elorrieta and Pylkkänen's (2018) claim that more ecologically valid experiments are key to obtaining a reduction of switch costs.

Word count: 988

Abstract

Though bilinguals appear to switch languages effortlessly in everyday conversations, experiments in language-switching persistently report switch costs. It has been suggested that this could be caused by the use of artificial experimental setups a bilingual would never encounter in real life. The present study investigated this claim through a network task where voluntary language-switching was investigated in the context of sentences to recreate a more ecologically valid experiment. The combination of both parameters produced an elimination of costs among Arabic-English speakers, and a reduction thereof among Spanish-English speakers, as switch costs were only absent when the latter switched into their L1. Conversely, a cued language-switching task with the Spanish-English bilinguals resulted in significant switch costs in both directions. The results evidence that switch costs can be evaded in more ecologically valid contexts and that less language control may be required under more natural circumstances.

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Key words: voluntary language-switching; cued language-switching; bilingual language production; inter-sentential language-switching

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1. Introduction

There is an infinity of possible reasons why multilinguals switch between languages, some stylistic, some based simply on convenience. In the setting of an international school where students are taught a determinate set of courses such as biology or mathematics in English, while philosophy and history are taught in Spanish, it is not strange to see that students switch to English the moment they have to talk about how a biology test went, whereas they will choose Spanish to have a philosophical conversation. Several studies (e.g., Akeel, 2016; Kite, 2001; Myers-Scotton, 1993) investigate the reasons behind language-switching and the way switches are perceived by external listeners. Some, deem the reasons to be mostly pragmatical (e.g., Akeel, 2016; Kite, 2001; Myers-Scotton, 1993), while others find a more compelling motivation in the lexical accessibility of certain lexemes (e.g., de Bruin et al., 2018; Gollan & Ferreira, 2009). A sociolinguistic study by Kite (2001) observed language-switching in an international Japanese school. The author reported that some teachers displayed a relatively negative perception of language-switching, as they considered it to be a compensatory strategy and, as such, a marker for lack of proficiency. Interviews with the students in question, as well as with teachers who had a less negative perception of the switching behavior, suggested that it was used either as a strategy to enhance communication (to create secrecy, humor or clarity), as a way to generate a more "creative repertoire" (324) and make the discourse more expressive, or as a membership marking strategy (i.e., code-switching is a membership characteristic, so individuals who do not code-switch are marked as outsiders).

In an increasingly bilingual society, language-switching has become more widely accepted, though certainly more in some communities than in others. As a guest at a dinner party in any European metropolis, it does not come as a surprise to hear people switching languages to greet one person or the other, people speaking French and their interlocutor responding in English, or switching back and forth between the two of them in a crutch-like manner, to fill in whatever knowledge they lack in one of the two languages. It is clearly a widespread phenomenon that seems natural and effortless in

everyday life (see Blanco-Elorrieta & Pylkkänen, 2018; Green & Abutalebi, 2013; Prior & Gollan 2011).

One of the reasons why scholars are so interested in finding the motivations leading multilinguals to switch languages is the fact that most psycholinguistic studies in language-switching have found this exercise to demand elevated cognitive costs from the speaker (e.g., Costa & Santesteban, 2004; de Bruin et al., 2018; Gollan et al., 2014; Declerck et al., 2017; Meuter & Allport, 1999). This worsened performance observed after switching as opposed to when staying with the same language has been termed 'switch costs' and it is assumed to be a measure of language control (Declerck & Philipp, 2015b; Green, 1998). Few studies in the field have succeeded in finding conditions under which bilinguals do not incur such costs or which result in a reduction thereof when switching languages (Blanco-Elorrieta & Pylkkänen, 2017; Kleinman & Gollan, 2016; Tarlowski et al., 2013; and Gullifer et al., 2013). Therefore it seems like language control is persistently active in multilingual conversations where switching behaviors are present. However, when looking at the different studies in language-switching, the observer will find that a majority of them test bilinguals using single word paradigms where the participant must change languages depending on an auditory or a visual cue (e.g., Costa & Santesteban, 2004; Meuter & Allport, 1999). These are situations that a multilingual speaker hardly ever finds in a natural environment, as individuals normally switch languages because they decide to do so themselves and within the context of a meaningful conversation. The few studies that have reported lessened or absent switch costs tend to employ tasks which resemble a natural conversation more closely, be it by asking participants to switch whenever they choose to (e.g., Gollan & Ferreira, 2009; Gross & Kaushanskaya, 2015), by asking them to switch within the context of a sentence (e.g., Tarlowski et al., 2013; Gullifer et al., 2013; Declerck et al. 2017), or by implementing more naturalistic switching cues (Blanco-Elorrieta & Pylkkänen, 2017). In a recent review article, Blanco-Elorrieta and Pylkkänen (2018) conclude that the replication of more ecologically valid contexts (i.e., more similar to natural conversations) is indeed a key factor leading to a reduction or even elimination of switch costs.

The present study intends to put this claim to test by examining whether language switch costs are still present if participants are allowed to switch voluntarily within a sentential context. Following Blanco-Elorrieta and Pylkkänen (2018), this more ecologically valid setup could result in a reduction of switch costs. In order to investigate this, we will make use of a network task similar to the one employed by Declerck and colleagues (2017, 2021) where, rather than listing unrelated words, participants switch from one sentence to the next (i.e., inter-sententially). Our experiment will differ from Declerck and colleagues' in that we will implement both a cued language-switching task like they did to have as a baseline for comparison, as well as a voluntary switching task, to test our hypothesis. Lastly, this study intends to help shift the focus set upon Indo-European languages and similar language pairs to more distinct ones. Admittedly, finding speakers with radically different language combinations from other language families can be a challenge for the researcher, and yet their exclusion can only reduce the validity of the results obtained from current language-switching experiments. Here, we will test the performance of a group of Spanish-English bilinguals and a group of Arabic-English bilinguals with the intention of investigating whether the same pattern obtained from the first group will be replicated in a second group targeting bilinguals of less related languages.

The upcoming sections will include a literature review accompanied by some key concepts, as well as the main research questions that will guide the study. This will be followed by a detailed account of the methodology, results, and discussion of the two experiments performed. Finally, Section 5 will include a general discussion of the results before concluding the paper.

2. Literature Review and Theoretical Framework

This section will outline the theoretical framework of the present study and introduce a series of relevant findings in the current language-switching literature. Firstly, the relevance of language control in bilingual language production will be addressed, added to the consequences this brings for research in language-switching. After this, an overview of the relevant language-switching paradigms will follow with the focus set

on cued and voluntary language-switching experiments and their overall findings. In addition, single-word picture naming studies will be contrasted with studies where sentential contexts are utilized. After rounding up the main points of the discussion, the main research questions and expectations for the study will be presented.

2.1. Language-switching and bilingual language processing

In recent years multilingual speakers are becoming increasingly more common (Cenoz, 2006), and so the urgency of investigating the way they process language increases. Studies in lexical decision (Duyck et al., 2008) and semantic fluency (Gollan, Montoya & Werner, 2002; Gollan, Slattery et al., 2011) have found a disadvantage for bilingual speakers. Gollan and colleagues (2005) attribute this effect to possessing a lexicon doubled in size, added to the pervasiveness of interlinguistic interferences which are absent in a monolingual brain. Several studies (Costa et al., 2000; Grainger et al., 2010; Gullifer et al. 2013; Sánchez, 2015; Shook et al., 2015) have demonstrated that all languages spoken by a multilingual are activated to varying degrees even in single language contexts. Subsequently, access to target lexical items becomes a more cognitively demanding task for bilinguals. As a consequence of the constant co-activation of a larger number of competitors relative to those in monolinguals, bilinguals can present a delay in accessing a given lexeme.

The manifested disadvantage can be taken as evidence for access to the lexicon being non-selective, a finding also supported by studies focusing on bilingual visual word recognition in isolated and sentence contexts (for a thorough review see Van Assche et al., 2007). Cognate facilitation effects in bilingual (e.g., Caramazza & Brones, 1979; Lemhöfer & Dijkstra, 2004; Van Assche, Duyck, et al., 2009) and trilingual speakers (e.g., Lemhöfer et al., 2004) have been reported when participants were confronted with blocks of isolated words in lexical decision tasks. The cognate facilitation effect occurs when words sharing similar phonological representations across languages are more easily recognized or produced than words that do not share this phonological resemblance. In the aforementioned experiments, participants showed lower latencies in trials containing cognates. The faster reaction times indicate that cognates were being activated in the target language and in further non-targeted background languages, lead-

ing to a proportionally higher activation of cognates as opposed to non-cognates. An explanation for this effect could be derived from Gollan and Ferreira's (2009) theory that bilinguals' slower access to particular lexemes originates from a frequency issue. Since bilinguals divide their time among the languages they speak, vocabulary items in both languages are less frequently retrieved than they are for monolingual speakers. Following this line of thought, it makes sense that cognates are more highly activated, as they are accessed in both languages spoken by the bilingual and are accordingly "double" more frequent than non-cognates.

Likewise, it is logical that isolated words—whether cognates or not—would result in parallel activation, because the speaker lacks a cue providing information for the language that must be selected and, therefore, has to be prepared for any of the two. The question arises whether the effect would be replicated in sentences—as they would already provide a linguistic context that could potentially delimit access to one of the background languages. Results pertaining to the cognate facilitation effect in sentences have been mixed. Van Hell and de Groot (2008), for example, observed an elimination of the cognate facilitation effect in lexical decision tasks when Dutch-English speakers were presented with high constraint sentences (i.e., sentences where the context and the target word are strongly semantically linked), and a reduction of the effect in a translation task under the same condition. Nevertheless, the effect was still observed with low constraint sentences in the two tasks. Similarly, in an experiment where target words within a sentence had to be named aloud, Schwartz and Kroll (2006) found a reduction of the cognate facilitation effect, implying that context could reduce the need for control mechanisms. On the other hand, Van Assche, Duyck and Hartsuiker (2012) encountered a significant effect in an eye-tracking study with English-Dutch bilinguals: the closer the resemblance between the cognates, the higher the probability a word would not be fixated, meaning that it was more rapidly processed. Despite the opposing results, the authors agree on the fact that the sentence context alone cannot eradicate interlinguistic interference. Moreover, Declerck, Grainger and Hartsuiker (2021) take this lack of consistency in sentential contexts as evidence for less cross-linguistic interference being present during sentence production on the basis that during single-word production the results unanimously point towards an effect.

These studies all support the theory of simultaneous background language activation in bilinguals, and non-selective access to the lexicon. Despite being presented with language-specific cues—which would, in theory, facilitate selective processing—both the L1 and further languages appear to be activated to some degree in the multilingual brain. Parallel activation seems to be pervasive during production (e.g., Costa, 2005) and comprehension (e.g., Dijkstra T., 2005). Consequently, even in a single-language context, where a multilingual is confronted by a speaker who only has one language in common with them, items from the multilingual's background languages will be activated in parallel and may compete for selection (also see Gollan & Kroll, 2001; Poulisse, 1999). Further research has shown that factors such as the level of proficiency of the speaker and that of the interlocutor also have an effect on the level of activation of background languages (Gullifer et al., 2013; Grainger et al., 2010).

Evidence corroborates a limitation in the production of a target language following competition between elements from the target and further background languages. Additionally, accessibility to the target language is diminished when the speaker has been previously exposed to or had to make use of another language (see Hermans et al., 1998). This comes as a consequence of either lasting relative activation of the non-target language (la Heij, 2005; Philipp et al. 2007), which in turn makes lexemes from these languages into stronger candidates, or due to a lasting inhibition of the now target language from the previous trial (Green, 1998). Seeing as lexical items from different languages are in constant competition within the brain of a multilingual speaker, it is valid to question how they are able to produce the right language in the right context without another language interfering. The mechanism which ensures that, for the most part, the correct language is selected is language control (Declerck & Philipp, 2015b; Poulisse & Bongaerts, 1994) and it is highly influenced by practice (see Bialystok et al. 2004). Since multilinguals spend their lifetimes exercising control over the language they want to produce in a given situation, language intrusions are not prevalent and a continuous flow of speech is possible. Most bilingual language production models (e.g., Declerck, Koch & Philipp, 2015; Green, 1998) rely on inhibition as the principal mechanism enforcing language control. The most relevant models will be further discussed later on in this section.

Maintaining the same language in a single-language context is one thing, but switching between languages within one same conversation requires even higher levels of language control since more interference is generated and so the relative activation of the languages being spoken has to be constantly regulated (Declerck, Lemhöfer & Grainger, 2017; also see Declerck, Philipp & Koch, 2013; Ma, Li & Guo, 2016; Van Hell et al., 2015). On this account, language-switching both poses a challenge for language control and results in a task perfectly suited for doing research on it. The prevalence of language control when switching has thereby captured the attention of psycholinguists investigating control mechanisms. The coming subsection will provide an overview of some of the different language-switching paradigms in the literature and their findings.

2.2. Language-switching paradigms

Most of the studies done until now in language-switching employ cued language-switching tasks to evaluate the performance of bilingual control mechanisms during language production (e.g., Costa & Santesteban, 2004; Meuter & Allport, 1999; Prior & Gollan, 2013). Experiments usually provide stimuli in the form of ciphers or pictures, which the participants are expected to name in a designated language signaled by a visual or an auditory cue (e.g., picture-naming tasks in: Costa & Santesteban, 2004; Gollan et al., 2009 & 2015; Declerck, Stephan, et al., 2015). In Meuter and Allport's (1999) seminal paper, the authors investigated language-switching in bilinguals of various Romance and Germanic languages who had English as their first or second language. Participants were asked to name digits in their L1 or L2, depending on the colored background upon which the stimulus was displayed. The authors found that when bilinguals had to switch languages (switch trials) their reaction times were significantly slower than when they continued using the same language (repetition trials). Another example comes from Costa and Santesteban (2004), who examined the performance of Spanish-Catalan and Korean-Spanish bilinguals of different proficiency levels in a color-cued picture-naming task. Here, participants were presented with a sequence of pictures corresponding to non-cognates and they had to name them in their L1 or L2 also depending on the color background of the picture. Similarly to Meuter and Allport

(1999), a worsened performance was observed during switch trials regardless of the level of proficiency of the tested bilinguals.

An obvious point of critique for cued language-switching experiments comes from the fact that multilinguals language-switching in natural discourse do not switch under the command of others, but rather because they decide to do so. As remarked by Gollan and Ferreira (2009), the cue itself could add extra weight to cognitive processing since the speaker must monitor and respond to the external cue (also see Heikoop et al., 2016). This would require additional control mechanisms such as conflict monitoring (to detect the cue). In contrast, when the speaker is given the chance to choose themselves, they can plan the switch ahead the way they do in a real-life conversation. It was this line of reasoning that took Declerck, Philipp and Koch (2013) to test the effects of sequence-based language-switching, where bilinguals memorize a sequence for the required language and the concepts they have to produce so that a cue is not necessary. Despite the predictability of the items to be produced, switch costs, while reduced, were still found, indicating that predictability alone cannot eliminate the need for cognitive control.

However, if participants were allowed to change languages whenever they wanted to, a possible advantage could result from not being forced to produce determined words which might be more or less lexically available in a given language. Rather, they would be able to avoid words that do not come to mind in one language by using the other, which could potentially reduce costs and result in a facilitation effect. Such a theory has been tested using voluntary switching paradigms, where no visual or auditory cues are provided, and participants can decide when to switch among their two languages. This was the case in a study conducted by Gollan and Ferreira (2009). In Experiments 1 and 3 of the study, Spanish-English bilinguals with different levels of proficiency and language dominance were asked to perform a picture-naming task using the language they wanted. The participants were instructed to "name pictures as quickly as you can without making mistakes" (Gollan & Ferreira, 2009: 6). The two experiments evidenced switch costs, yet they showed a consistent mixing cost only for the participant's L1. In other words, a worse performance was observed in blocks where they were

expected to switch between the two languages (switch blocks), than in blocks where only one language was to be used (single language blocks). As for performance in the L2, learners showed a benefit in mixing languages— a better performance was delivered in a context where the speakers could use both languages freely, as opposed to a context where they were forced to maintain a single language. This is assumed to result from them being able to name 'easier' words in their dominant language and so mask costs that could arise in a cued language task.

Comparable results were obtained by de Bruin, Samuel and Duñabeitia (2020). Their study zoomed in on the effect of age on cued and voluntary language-switching by examining the performance of Basque-Spanish bilingual children, teenagers, young adults, and older adults. Switch costs were observed under the two conditions, but the voluntary switching task yielded lesser costs. The reduction of switch costs was delimited by age: young adults performed significantly better than the other groups in the voluntary switching task. Nonetheless, a mixing benefit also in the voluntary switch task was observed across all age groups, supporting findings by Gollan and Ferreira (2009). Interestingly, mixing costs during the cued language task were also greater among the older adults. Both de Bruin et al. (2018) and Jevtović et al. (2020) procured similar results when comparing the effects of voluntary switching relative to cued switching with Basque-Spanish bilinguals. Overall language-switch costs persisted, but in both cases the costs were lower than during the cued task and a mixing benefit was observed.

The influence of lexical access was further corroborated by Gollan, Kleinman and Wierenga (2014) in a study evaluating cued versus voluntary switching in both a picture-naming and a non-linguistic task. The researchers noted a lack of switch costs in bilinguals who reportedly allowed the pictures they were confronted with to determine the language they would choose based on lexical accessibility. Other bilinguals who did not allow the images to guide their switching, presented significant switch costs. In the study, the authors contrasted an experiment where the same stimuli was presented only once, as opposed to an experiment where the same stimuli were presented more than once. The idea behind introducing repetitions of the same stimuli came from the suspicion that switch costs found during voluntary switching may be the result of top-down control, in the sense that rather than being voluntary, the switch is conditioned by the

lexical accessibility of a definite word. That is to say, if the speaker does not know or is less familiar with the name of an object in one language, they will rather use the word in the other language. Avoiding the naming of unknown words is possible in a voluntary switching task, but not in a cued switching one— which might explain some of the facilitation reported during voluntary switching (as in Gollan & Ferreira, 2009). However, if the lexeme is accessible in both languages, costs associated with top-down control may be suspended by eliciting more automatic responses where the subject sees the image and chooses the language based on whichever name was relatively more activated than equivalents in other languages. Experiment 1 presented switch costs both in voluntary and cued conditions with no significant differences in reaction times. Conversely, Experiment 2, where repetitions were introduced, delivered both stronger data to suggest an advantage in voluntary language-switching, as well as evidence to support the hypothesis that lexical accessibility is responsible for an advantage when switching voluntarily.

The lexical accessibility hypothesis was further tested in a later study by Kleinman and Gollan (2016). This time, English-Spanish bilinguals performed a picture naming task where they were told to pick a language for each item and continue using it whenever the item showed up again. No switch costs were observed under such conditions, presumably because the participants were fully guided by lexical accessibility. Those who did not follow the instructions did exhibit bottom-up costs. A key point to consider is that bilinguals do not automatically follow a bottom-up strategy when switching languages. In Experiment 2, when the researchers did not explicitly ask the participants to consistently name the same items in the same language, the strategy was not followed and switch costs were found. Also worthy of mention is Gollan and Ferreira's (2009) second experiment, where they instructed participants to use each language 50% of the time, which surprisingly led to an elimination of switch costs. The results obtained in Gollan and Ferreira's (2009) second experiment and Gollan, Kleinman and Wierenga (2014), imply that performance is very susceptible to the instructions provided, but that determinate conditions may result in a voluntary switching benefit.

Though there are a few other studies in voluntary switching (see Gullifer, et al., 2013; Jevtović et al., 2020), which found a better performance in voluntary contexts

over cued ones, the results are not consistent among all studies. The overall persistence of switch costs (also see Gross & Kaushanskaya, 2015) has led researchers to conclude that lexical accessibility and predictability are not the only factors steering the choice of language.

Indeed, evidence shows that bottom-up processes such as lexical access driven by the stimuli at hand does not steer language selection and switching behaviors in every circumstance. In a corpus study investigating priming in the spontaneous discourse of English-Spanish bilinguals, Fricke and Kootstra (2016) pointed out that bilinguals do not language-switch on every word during everyday life conversations. If bottom-up processes were driving language selection by themselves, bilinguals would then switch at every word to use the most available one. This is not convenient, since, in the end, speakers still have to be able to produce grammatical sentences for which purpose a syntactical structure has to be followed, and so every switched word would have to be adapted to the structure to produce an understandable utterance. Moreover, switch costs were reported by Fricke and Kootstra (2016), demonstrating that language-switching does require some form of cognitive control even in a natural environment. Nevertheless, their study does not deny the possibility of these costs being lower than the ones associated to tasks in experimental settings.

Blanco-Elorrieta and Pylkkänen's (2017) study contends that some of the costs associated with cued language-switching tasks could be induced by the lack of resemblance to a natural conversation. Thereby, the two authors designed an experiment with Arabic-English bilinguals where the neurobiology of language-switching under more ecologically valid conditions was tested and contrasted with a color-cued experiment. Blanco-Elorrieta and Pylkkänen's (2017) employed a picture-naming task framed within a bilingual-interlocutor context, which was primed through a picture of a bilingual speaker. The participants were previously familiarized with the general linguistic background of the persons in the pictures in a realistic manner. Authors found that ~~more~~ voluntary switching in the production task did not incur in switch costs, neither did it activate the prefrontal cortex, which is assumed to be linked to executive control. Meanwhile, the color-cued task resulted in switch costs and also in longer engagement of both the dorso-lateral prefrontal cortex and the anterior cingulate cortex, pointing to-

wards a higher implementation of executive control. The observed results were deemed as evidence for Green and Abutalebi's (2013) Adaptive Control Hypothesis, by which language control processes adapt to the requirements of the context of interaction. When the context demands a single language response, the background languages of the multilingual compete with one another for selection. In contrast, when the interlocutor is a known bilingual or multilingual, the common languages can work in collaboration causing a reduction of switch costs. (For a longer discussion of the Adaptive Control Hypothesis, see subsection 2.3)

Following the same reasoning that incited Blanco-Elorrieta and Pylkkänen's (2017) study, Heikoop et al. (2016) aimed to separate language switch costs from cue-switch costs. For this purpose they tested a group of German-English bilinguals in two experiments where participants named objects in pictures based on the gender of a face presented to them. Two cues were assigned to each language (e.g., two different male faces corresponded to switching to German, and two different female faces, to switching to English), to compare the effect of switching between languages and staying in the same language as a response to a different cue. The results demonstrated both "pure" language-switch costs and cue-switch costs, indicating that a substantial part of the costs observed in cued language-switching experiments could indeed be caused by switching languages, and hence be a result of language control.

2.3. Asymmetrical switch costs and language control

An interesting finding of the language-switching literature concerning bilingual language control is that of asymmetrical switch costs. Reportedly, non-balanced bilinguals perform significantly worse when switching back to their dominant language after speaking in their non-dominant one than vice-versa (Costa & Santesteban, 2004; Meuter & Allport, 1999; Philipp et al., 2007). This phenomenon can seem unintuitive at first, since performance in the dominant language would normally be assumed to be better than in a language the user is less proficient in, but it can be explained based on models of bilingual language control such as Green's (1998) Inhibitory Control model (ICM).

The ICM relies on the use of inhibitory control— a general cognitive mechanism not specific to language— to modulate the use of the appropriate language corre-

sponding to the language cue. Here, actions concerning language use are regulated by language tasks schemas. All discrete items and structures belonging to different languages are tagged with their language membership. Language schemas ensure that the correct lemma contained within its language specific lexico-semantic system will be activated in the right context, while all other competitors which do not correspond to the language cue will be inhibited. Thus the choice of the correct language is attained through inhibition of the non-target one. In a switching task, if the next trial requires a language switch, the persisting inhibition from the previous trial will have to be neutralized in order to select the new language. Assuming that the level of inhibition required to suppress one language depends on proficiency and frequency of use, the dominant language will require more inhibition to prevent it from 'slipping out' in the wrong context. This explains asymmetric switch costs in unbalanced bilinguals whose proficiency in their two languages is not equal (Costa & Santesteban, 2004; Declerck & Philipp, 2015a; Kroll, et al., 2008; Meuter & Allport, 1999)— because overcoming inhibition of the dominant language in a switch trial is more demanding than overcoming the lesser inhibition of the non-dominant language. It also explains why the costs are symmetrical in balanced bilinguals (e.g., Costa & Santesteban, 2004; Meuter & Allport, 1999), since inhibition of one or the other language should not require more cognitive costs one way or the other, given that the speaker is equally proficient in the two languages. Costa and Santesteban (2004) found that proficient bilinguals also present symmetrical switch costs when switching from their dominant language to a weaker L3 and viceversa. The authors propose that the symmetrical performance of more proficient users may be a consequence of having more practice both switching between languages and implementing language control (also see Costa et al., 2006).

Asymmetrical switch costs in unbalanced bilinguals have been widely reported, but are not universal. A series of studies has also found a lack of asymmetrical costs (e.g., Christoffels et al., 2007) or even a presence of reversed switch costs (Declerck, Stephan, et al., 2015; Bonfieni et al., 2019), where costs are higher when switching to the L2 than when going back to the L1. Studies on sentence processing, such as the self-paced reading experiments by Proverbio, et al. (2004), and Bultena et al. (2015) also provide evidence for reversed asymmetrical costs in sentences.

While Green's (1998) ICM is by far the most popular and widely accepted model of bilingual language control, there are a series of alternative models which rather than focusing on inhibition, propose that relative activation of one of the two languages is the cause for switch costs (e.g., La Heij, 2005, Phillip et al., 2007). An additional inhibition based model that has been gaining more attention lately is the Adaptive Control Hypothesis by Green and Abutalebi (2013). The theory postulates that control is adaptable to the requirements of a designated context of interaction by altering the way in which it performs a task or how it cooperates with other control mechanisms at a neural level. The authors allude to different control processes that work together to respond to the demands of three distinct interactional contexts for bilinguals: a single language context, a dual language context, and a dense code-switching context. Each of these contexts results in a different combination or exertion of control processes. A single language context refers to a situation where the bilingual divides their time speaking one language in one environment, and the other language in a different environment, so that no switching within the same situation occurs. In the dual-language context, both languages are used, but with different speakers, and while switching may occur within one conversation, it does not usually occur within a same utterance. Finally, in communities with a dense code-switching context, switching between languages, and often within the same utterance, is part of their regular everyday speech. This is the case for communities with a high percentage of bilingualism where most people dominate both languages, and thus the speaker is not restrained in their language use by the possibility of their interlocutor not being able to follow. Examples for these are Spanish speaking communities in the United States and Turkish speaking communities in Germany. Parting from Green's (1998) ICM, Abutalebi and Green (2013) advance that language task schemas compete against each other in the first two situations (the single and dual-language contexts) because the speaker has to limit their output to only one of the two languages. Dual-language environments are akin to a cued language-switching task, where various control processes are needed: conflict monitoring (needed to detect the cue), task disengagement (to cease the use of a particular language scheme), goal maintenance and interference suppression (to prevent intrusions from the non-target language and continue using the target one). On the other hand, the two language schemas are said to collaborate in a dense code-switching environment, since the speaker will not

have to suppress interferences, and can adapt them instead to the flow of speech. This does not mean that switching in a dense code-switching context is not taxing for cognitive control— the juggling between languages is simply more trained in speakers used to such contexts and, consequently, control may be more efficient than in speakers who frequent single language contexts. The model also predicts that bilinguals from dual-language contexts will be able to adapt more rapidly to a switching demand, because they are trained in switching their language schemas based on such salient stimuli such as the arrival in the conversation of a speaker with whom they normally employ a different language.

The lack of switch costs observed in Blanco-Elorrieta and Pylkkänen's (2017) task where speakers could choose to switch based on their interlocutor, supports the Adaptive Control Hypothesis, as it mimicked a dense code-switching environment. Further evidence was presented by the results of a bilingual categorization experiment by Struys et al. (2018). The study investigated how proficiency, age of acquisition and recent language exposure affected language-switching in a recognition task. The authors concluded that L2 to L1 switches were influenced by recent language exposure, yet the other two factors did not have an effect. This was taken as a confirmation for Green and Abutalebi's (2013) claim that language control is dynamic and adaptable to the requirements of a changing language environment.

2.4. Switching in Sentence Contexts

Following Blanco-Elorrieta and Pylkkänen (2018) and the Adaptive Control Hypothesis, more ecologically valid settings should result in lower switch costs. Though voluntary switching tasks are closer to a natural situation than a color-cued task, they are still asking speakers to produce lists of unrelated words, an exercise hardly imaginable in any natural situation. In order to recreate a more natural setup, a handful of studies analyzed the effect of a sentence context within a language-switching task. In an experiment akin to that of Schwartz and Kroll (2006) (discussed at the beginning of the section), Gullifer et al. (2013) asked highly proficient Spanish-English bilinguals to name a target word within a sentence, except that the language of the sentence changed

predictably after every second sentence (i.e. L1-L1-L2-L2). The induced language-switching did not result in costs.

In a similar manner, Declerck and Philipp (2015a) found circumstances under which language-switching in sentence production was not costly. They also employed an alternating language-switching paradigm where switches were predictable and always came after every second trial within a sentence (hence switches occurred intra-sententially). Three types of sentences were contrasted: language specific sentences, which were syntactically correct in one language only; language unspecific sentences, which were syntactically correct in both languages spoken by the bilinguals when translated word by word; and scrambled sentences which were syntactically incorrect in both languages. The German-English bilinguals who participated in the experiment were familiarized with a sequence of concepts, out of which they had to produce one in every trial while switching languages after every second trial. The results demonstrated no switch costs for language unspecific sentences, proving that syntactical structures do have an effect in language-switching and can contribute to reducing cognitive costs.

However, an abolition of switch costs has not been observed in every study investigating language-switching in sentences. Crucially, Tarlowski et al. (2013) conducted a study targeting inter-sentential language switching— the language switches occurred at every sentence, much like in Gullifer et al. (2013). In their study, Polish-English unbalanced bilinguals had to describe an action using a simple subject-verb phrase based on a picture. Two types of actions were tested: ongoing actions requiring the progressive, and completed actions requiring the use of perfective. An auditory cue indicated the language the participants had to employ. Contrary to Gullifer et al. (2013), significant switch costs were observed for both conditions, only that while the costs were symmetrical regarding the production of perfective phrases, they were comparatively bigger when switching to the L1 in perfective phrases. The difference in symmetry instigated by the two conditions points towards an effect of syntactic structures in the production of language switches.

Other studies have pointed towards a presence of switch costs during sentence production. Declerck et al. (2017) and (2021), for instance, performed two cued switching tasks involving sentence contexts, one with French-English bilinguals, and the other, with Dutch-French bilinguals. In both experiments, participants had to describe the path of a ball as it made is way through a network of images connected by lines of different shapes. The color frame surrounding the image signaled the participant which language they were supposed to employ for a particular sequence. Despite the more natural sentence context, both studies encountered significant switch costs. The first study by Declerck, Lemhöfer and Grainger (2017) with French-English speakers investigated bilingual error detection. The results yielded a higher rate of language intrusions in switch trials as opposed to repetition trials. A worse performance during switch trials was thus observed, according to the authors, as a result of more elevated cross-language conflict. The second study, employed the same setup, this time with Dutch-French bilinguals and a focus on language-switching. Despite the sentential setting, Declerck, Grainger and Hartsuiker (2021) also observed significant switch costs, which were greater in the L1 than in the L2.

While the studies reviewed until now in this section pertain bilingual production, language-switching has also been examined in studies focusing on language comprehension within sentential contexts. An example comes from Bultena et al. (2015), where Dutch-English participants performed a self-paced reading task with sequences of sentences alternating between the two languages. While switch costs in the shape of longer reading times were found for switches into the L2, this was not the case when the switches lead to the L1. Note that this asymmetry differs from the usual type of asymmetry, where performance of the L2 is better than that of the L1 after a switch trial. Furthermore, they found evidence suggesting cognate effects were not present, a finding which would imply that a sentence context narrows down selection and reduces interlinguistic interference (see 2.1. in this section for a more complete discussion on the cognate facilitation effect).

The findings regarding language-switching in sentences are not uniform, but evidence supporting a reduction under certain circumstances (Declerck & Philipp, 2015a) or elimination (Gullifer et al., 2013) of switch costs was still encountered. Declerck and Philipp (2015a) and Gullifer et al. (2013) examined language-switching at different levels (intra-sententially in the former vs. inter-sententially in the latter). Nevertheless, both of them offered a syntactical context for the switch and in both of them switches were predictable rather than cued. They indicate that syntactic sentence information plays a role in language-switching and that its combination with a predictable switch can reduct costs. The findings are compatible with the fact that in a natural situation, intentional language-switching usually occurs within a coherent conversation to generate a meaningful utterance and the switches can be planned in advance.

2.5. Key points

In sum, a majority of the studies done in language-switching employs tasks where switching occurs under cued conditions and involves isolated single-item naming tasks. These experiments consistently find a presence of switch costs— which are often asymmetrical, a phenomenon accounted for by Green's (1998) ICM. Experiments involving more ecologically valid conditions such as voluntary switching (e.g., Gollan & Ferreira, 2009), more "social" situations (Blanco-Elorrieta & Pylkkänen, 2017) or sentential contexts (Declerck et al., 2015; Gullifer et al., 2013) have found mixed results. While some of them find a reduction or even elimination of switch costs, others show a pervasiveness thereof. Still, research shows that language-switching can be free of cost under particular conditions (e.g., Declerck & Philipp, 2015a; Gullifer et al., 2013; Blanco-Elorrieta & Pylkkänen, 2017). Perhaps the solution to the problem lies as Blanco-Elorrieta and Pylkkänen (2018) propose: in the ecological validity of the task. This supposition corresponds to the predictions by Abutalebi and Green's (2013) Adaptive Control Hypothesis, which contends that switching in the environment of a natural conversation, where the speaker can employ any of their languages, should be without a visible cost for trained switchers.

2.6. Research Questions and Hypotheses

In the present study we set out to answer two main research questions:

1. To what extent does the more ecologically valid setup of the present language-switching task have an effect on language switch costs?
2. Is the pattern observed in Spanish-English bilinguals concerning the voluntary switching task replicated with Arabic-English bilinguals?

In order to answer the research questions, we set out to perform two experiments: one with a group of Spanish-English bilinguals and one with Arabic-English bilinguals. In both cases, we tested a combination of parameters that has not yet been reviewed in the literature, namely voluntary language-switching in a sentential context. Additionally, we performed a task which only differed in that it was color-cued with the Spanish bilingual group, in order to set a valid basis for comparison to previous literature.

Based on previous studies, switch costs are likely to be reduced or even completely eliminated by introducing this novel combination of parameters with a higher ecological validity. As previously mentioned, there is some evidence for reduced switch costs in certain instances of voluntary switching (Gollan & Ferreira, 2009; Gullifer, et al., 2013; Jevtović et al., 2020), as well as when switching in a sentence context (Declerck & Philipp, 2015a; Gullifer et al., 2013; Tarlowski et al., 2013). As for asymmetrical costs, studies on sentence processing, such as the paced-reading experiments by Proverbio, et al. (2004), and Bultena et al. (2015) provide evidence for reversed asymmetrical costs in sentences, as opposed to the asymmetrical costs observed in single-word production. Similar effects could result from the combination of parameters here proposed.

Furthermore Abutalebi and Green's (2013) Adaptive Control Hypothesis predicts that bilinguals with strong language-switching backgrounds should not present switch costs when switching willingly in a sentence context, while external cues, might be easier to modulate for bilinguals who speak distinct languages with different addressees, but will still present switch costs. Following this account, we expect to find

significant costs in the color-cued task for Spanish bilinguals, but no costs in the two voluntary switching experiments.

By comparing the results obtained from Spanish-English bilinguals with those from Arabic-English bilinguals, it will be possible to see if linguistic proximity has an effect on switch costs and if the results are replicated in genetically unrelated language pairs. Declerck and Philipp (2015a) demonstrated that when syntactical structures between English and German were identical for the targeted construction, switch costs were eliminated. As such it can be assumed that syntactical similarity influences the cognitive demands when switching languages. Such a result is to be expected, since with identical structures, adapting a switched word to the sentence would be a less demanding task, since the form would be parallel in both languages. Conversely, if word order and verbal structure are more distinct, changing structures might be more taxing. Such an effect has already been seen in Tarlowski et al.'s (2013) experiment with Polish-English bilinguals.

The two upcoming sections will describe the methodology pursued throughout the two experiments in detail and address the results obtained.

3. Experiment 1

In the first experiment we wanted to test if switch costs would be present in a voluntary switching task with a sentential context performed by unbalanced Spanish-English bilinguals. Likewise, we wanted to determine if the participants would perform differently in a voluntary versus a cued parameter of the same task. The implementation of a cued experiment also had as goal to provide a basis with which we could compare our results to past experiments employing a similar setup (e.g., Declerck, Grainger and Hartsuiker, 2021; Declerck, Lemhöfer & Grainger, 2017).

3.1. Methodology

3.1.1. Participants

The experimental group consisted of 29 native Spanish bilinguals who spoke English as a second language. Three participants were excluded due to participant error. Among the 26 resting ones, there were fifteen females and eleven males; their average age was 30.3 years old (SD=7.5). The majority of the participants (23) originated from Latin American countries— with the most represented nationality being Colombia (16 participants predominantly from the capital). The other ten participants came from diverse Latin American countries including Chile, Peru, Venezuela, Argentina and Mexico, as well as Spain. Currently, only 11 of them reside in Spanish speaking countries, the rest are mostly based in Germany or Belgium.

All bilinguals completed an English lexical decision task (LexTale by Lemhöfer & Broersma, 2012) to measure their level of proficiency. In average, they scored 80.4 (SD= 9.4) — which puts them in the "advanced/proficient users" category or in level C1-C2 of the Common European Framework (Lemhöfer & Broersma, 2012). The participants filled out a background information questionnaire where they were asked when they had started learning English and for how long they were formally taught, what other languages they spoke, their age and gender, the countries where they grew up, and the country of current residence. They also rated the frequency with which they used English and Spanish in a day to day basis currently and during their childhood (in percentages from 0-100%), as well as the frequency with which they switch languages from one (never) to five (every day). Furthermore, they were asked to rate their English and Spanish skills on a scale from 1 to 7 (1=worst) regarding their speaking and writing skills, as also done in Declerck, Grainger and Hartsuiker (2021) (see Table 1).

Table 1. Background information of participants: average responses with standard deviation in parentheses.

	Experiment 1		Experiment 2	
Variable	Spanish	English	Arabic	English
Age-of-acquisition	N/A	8.7 (5.3)	N/A	8.0 (3.3)
Years of instruction	N/A	9.9 (4.6)	N/A	9.3 (3.1)
Speaking	6.7 (0.5)	5.7 (1.3)	6.4 (0.8)	6 (0.9)
Writing	6.5 (0.8)	5.6 (1.4)	5.9 (1.2)	5.9 (1.0)
Currently used (%)	53.1 (29.1)	35.0 (27.0)	36.9 (21.8)	50 (21.9)
Childhood (%)	89.2 (14.1)	13.8 (13.6)	87.5 (16.5)	20 (19.3)
LexTale	N/A	80.4 (9.4)	N/A	79.2 (14.2)
Reported language-switching frequency	3.6 (1.1)		3.9 (1.3)	

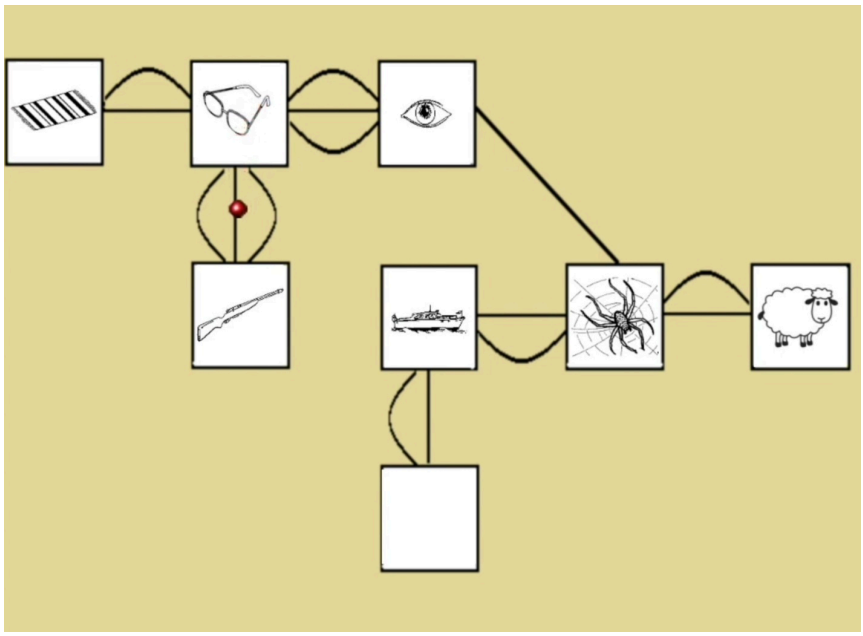
3.1.2 Materials and Task

The task employed for the experiment was based on the network description task used by Declerck et al. (2017) and (2021)— the difference being that, here, two parameters were tested: a voluntary and a color-cued one, while Declerck and colleagues focused on the color-cued one solely. There was one block per parameter, each included nine networks with seven non-repeating images in black and white. All 126 pictures corresponded to high frequent words from the Multipic corpus (Duñabeitia et al., 2017) and Severens et al.'s (2005) experiment. All Spanish-English cognates were excluded. Concepts which Spanish speakers might have trouble naming in English were picked out to lessen the effect of the participants avoiding 'hard' words in English. A full list can be found in Appendix I.

The images in the networks were connected by curved, diagonal or straight lines (see Fig 1). During the task, a red dot moved from one object to the next over the connecting lines. As in Declerck et al. (2017) and (2021), the dot started from a blank square and finished its path in 55 seconds, completing nine movements between the images. The participants were asked to narrate the dot's path switching between Spanish

and English, either depending on a color code (cued task), or whenever they wanted to (voluntary task). In the color cued task, every object was surrounded by a colored frame (green or blue) that became visible as the ball reached the center of the previous object. When the frame was blue, they had to produce the content in English, when green, in Spanish. For the voluntary parameter, the participants chose at every sentence which language they wanted to use, but they were explicitly told to use both languages (see also de Bruin et al., 2018, 2020). This was done to discourage them from staying with the same language during the duration of the whole experiment. We refrained from stating explicitly how often they should change, since Gollan and Ferreira (2009) reported that asking the participants to keep a 50-50 ratio on the languages used generated significantly different results from when they were simply asked to use whichever language they pleased. Asking the participants to balance out the language use explicitly may involve further control processes, which could have altered the results.

Figure 1: Network from the voluntary switching task



3.1.3. Procedure

The experiment had to be conducted from a distance, due to the current Covid-19 pandemic, so every participant was sent an email with an informed consent form, general instructions and a link to a YouTube playlist with the videos they had to narrate. Each video included more precise instructions for the tasks both in written and spoken form. The participants were explicitly asked to record the experiment only once and pay no mind to errors, to reduce the chances of any 'cheating' behaviors (i.e., pausing the recording to think, or re-doing it if they committed a mistake). They were also told to narrate the videos using full sentences whenever possible, and to include the direction the dot took (left/right, up/down), the shape of the line (curved, straight, diagonal) and the object (ex. "The red dot goes left over the curved line to the apple.") Finally, they were told to substitute unknown or forgotten words by saying 'x' with the idea of preventing intra-sentential language-switching or them simply getting blocked in one sentence.

Bilinguals were tested using two tasks: a voluntary switching task and a color-cued switching task. The order of the two was counterbalanced across participants. Each task was preceded by a prerecorded example network to explicitly show the participants what they were expected to do. This was then followed by two practice networks to acquaint them with the exercise. The practice networks contained only five pictures instead of seven, all of which did not occur again in the experiment.

For the color-cued task, the color code was repeated before and after both the example and the practice networks, and visible through the two of them, to ensure the participants would not forget the code during the real task. Following similar switch rates observed in other voluntary language-switching studies (e.g., de Bruin et al., 2020; Gollan & Ferreira, 2009), the switch rate was set at 37% in the color-cued task and 50% of the trials had to be produced in English. This resulted in approximately 30 switches in every cued block.

3.1.4. Analysis

The speech was recorded by each of the participants using diverse mobile phone applications and sent via email. The language intrusions, filled pauses, and substitutions with 'x' rather than a word were coded after the data collection. As in Declerck, Grainger and Hartsuiker (2021), a language intrusion was understood as "selecting the correct concept, but in the wrong language" (7)— ex. the participant says *la bola* instead of *the ball* when they are supposed to say it in English, or *derecha* instead of *right,* or use the article *la* instead of *the.* Filled pauses were coded whenever the participant produced "vocalizations during speech that do not represent words" (Declerck, Grainger and Hartsuiker, 2021: 8), such as "*eh, um, ah"*. Though not included in the final analysis, instances of "x" as a substitution for an unknown or forgotten word were also initially coded, as they can be interpreted as an indication of a tip of the tongue effect resulting from competition between the two languages (Gollan, Ferreira, Cera & Flett, 2014).

The following sentences were excluded from the analysis: sentences with a language intrusion in the cued language-switching block, sentences with intra-sentential switches, and missed trials. The reasoning behind excluding sentences with intra-sentential switching, was that it was hard to determine whether the switch had been intentional or not, and that the matrix language became difficult to identify. Since the first sentence of every network did not correspond to either a switch or a repetition, they were also excluded. In all, 5.3% of the data was not included in the final analysis.

A generalized linear mixed model was employed to analyze the binomial data using the 'lme4' package in R statistical software. Participants and items with a maximal likelihood structure (Barr et al., 2013) constituted the random effects, while Language (L1 = −0.5; L2 = +0.5), Trial type (repetition trials = −0.5; switch trials = +0.5), Language-switching variant (cued language-switching = −0.5; voluntary language-switching = +0.5), as well as their interactions, amounted to the fixed effects.

z-Values were considered significant when they were either larger or equal to 1.96 (Baayen, 2008).

3.2. Results

This section will provide an overview of the results of the first experiment by looking at the switch rate and the filled pauses observed in the two tested conditions.

Switch rate in voluntary language-switching

In the voluntary switch block, we observed an overall switch rate which was higher (47.3%) than the one set in the cued language-switching block (37%). Additionally, the participants evidenced a preference towards switching into their L1 (52.2%) as opposed to their L2 (43.1%).

Filled pauses

In general, we observed a smaller occurrence of filled pauses in the participant's L1 (11.7%) than in their L2 (20.1%) respective to the number of trials per language. As described in Table 2, the Language effect proved to be significant. Switch trials resulted in significantly more filled pauses (18.5%) than repetition trials (14.3%) as well, which indicates a presence of switch costs. Lastly, a three way interaction was found: the difference in switch costs according to language was significantly bigger in the voluntary language-switching block than in the cued block. Costs incurred in the voluntary block were higher in the speakers' L2 than in their L1.

The interaction of the three variables was broken down by applying separate analyses on both cued and voluntary language-switching variants with the factors Language and Trial type. In the data obtained from voluntary language-switching blocks the factor Language (b = 0.389, SE = 0.229, z = 1.697) was almost significant, and Trial type (b = 0.399, SE = 0.148, z = 2.703) was deemed significant. Likewise, the interaction between the two factors was significant. A higher frequency of filled pauses was exhibited in L2 sentences (18.5%) than in L1 sentences (12.1%) and there were more filled pauses when switches occurred (18.2% in the L2, 13.2%, in

the L1) than when the speakers did not change languages. Moreover, the interaction of Language and Trial type was statistically significant (b = 0.583, SE = 0.293, z = 1.990)— as switch costs were notably higher in sentences produced in English (10.3%) than in sentences produced in Spanish (0.1%).

Table 2. b-values, standard errors and z-values of main analysis.

Factors	b-value	SE	z-value	signifi-cance
Language (Spanish/English)	0.677	0.103	6.571	*
Trial type (Switch/ Repetition)	0.403	0.104	3.892	*
Language-switching variant (Voluntary/ Cued)	0.190	0.990	-1.931	.
Language x Trial type	0.046	0.205	0.227	
Language x Language-switching variant	-0.084	0.206	-0.410	
Trial type x Language-switching variant	-0.018	0.207	-0.086	
Language x Trial type x Language-switch-ing variant	1.13	0.414	2.729	*

Though the trend was similar in the cued language-switching block, the pattern was not fully replicated. Here, both the main effect of Language (b = 0.619, SE = 0.175, z = 3.539) and Trial type were significant (b = 0.431, SE = 0.148, z = 2.920). More filled pauses were found in L2 trials (21.9%) than in L1 trials (11.2%). Nevertheless, the interaction between the two effects, Language and Trial, was not significant (b = -0.442, SE = 0.295, z = -1.490). As indicated in Table 3, switch costs were present in both languages. While the difference was not significant, they were slightly higher in the L1 than in the L2.

Table 3. Overall mean filled pauses in percentages (SE in parenthesis) as a function of Language (Spanish; English), Trial type (repetition trials; switch trials), and Language-switching variant (Cued language-switching; Voluntary language-switching).

	Cued language-switching		Voluntary language-switching	
Trial type	L1	L2	L1	L2
Switch	14.1 (2.0)	23.7 (3.8)	12.1 (2.5)	24.4 (4.6)
Repetition	9.6 (3.0)	20.8 (4.4)	12.0 (2.6)	14.1 (3.2)
Switch costs	4.5	2.9	0.1	10.3

3.3. Discussion

In Experiment 1, we wanted to investigate if switch costs would be present in a more ecologically valid setting where participants could switch languages voluntarily in the context of sentence production. Secondly, we intended to investigate if there was a difference in switch costs when compared to a cued language-switching task that also required the participants to switch between sentences. The analysis of the data shows that in the voluntary task switch costs were still observed, but these were limited to sentences where the participants switched to their L2. As for the cued language-switching task, switch costs were present both in the L1 and in the L2. Furthermore a difference in the switch cost asymmetry was observed across the two parameters: during the voluntary task, switching into the L2 was notably costlier than switching into the L1, and so asymmetrical switch costs were evidenced, whereas the costs were similar in both directions during the cued task (symmetrical costs).

Switch Costs

The significant switch costs observed in Spanish-English bilinguals during the cued language-switching task are in line with several other studies employing color-cued switching parameters in picture-naming tasks (e.g., color cued task in Blanco-Elorrieta & Pylkkänen, 2017; Costa & Santesteban, 2004; Costa, Santesteban & Ivanova, 2006; Meuter & Allport, 1999). The findings are also parallel to those yielded in the studies conducted by Declerck et al. 2017 and 2021, where cued language-switching was investigated also using a very similar network task in French-English and Dutch-French bilinguals respectively. This confirms our prediction based on Abutalebi and Green's (2013) Adaptive Control Hypothesis: language switch costs are to be expected in cued experiments even in bilinguals who are highly trained in language-switching.

Altogether, switch costs were equally present in the voluntary task, but these were only significant when switching into the L2, as switching into the L1 remained free of cost. According to de Bruin et al. (2020) switch costs in voluntary settings can

be attributed to a reactive cost resulting from having to reconfigure the language set with each switch, be it through inhibition of the non-target language (Green, 1998) or activation of the target language (see la Heij, 2005; Philipp et al., 2007). Parting from the premise that switch costs are a measure of language control (Green, 1998), the lack of significant costs observed in the voluntary task when switching into the L1 suggests that either the voluntary parameter (as opposed to cued experiments), or the use of sentences rather than single picture naming, contributed to reducing the need for language control. The effect observed in the voluntary task was not replicated in the cued task, which would insinuate that the voluntary parameter was the crucial factor resulting in a reduction of costs. However, previous literature has repeatedly shown that voluntary picture-naming tasks result in significant switch costs both in the L1 and in the L2 (see de Bruin et al., 2018, 2020; Gollan, Kleinman & Wierenga, 2014; Grunden et al., 2020). Similar results have been observed in cued tasks with sentential contexts (see Declerck et al., 2017, 2021). It seems rather, that the combination of the two factors is key for the eradication of switch costs, because together, they create a more ecologically valid context. This assumption would be in line with the central claim of Blanco-Elorrieta and Pylkkänen's (2018) review article: that while artificial cues generate additional costs, the use of more natural conditions present a reduction of switch costs.

Asymmetrical Costs

The cued switching task delivered parallel switch costs across both languages. This symmetrical cost pattern has been observed in other studies pertaining both highly proficient bilinguals (e.g., Calabria et al., 2012; Costa & Santesteban, 2004; Costa, Santesteban & Ivanova, 2006) and lower proficient ones (Christoffels et al. 2007; Gollan & Ferreira, 2009; Prior & Gollan, 2011). Nevertheless, the pattern of asymmetrical switch costs perceived within the voluntary switching task in this experiment is less usual. Normally, in studies reporting asymmetrical switch costs (e.g., Costa & Santesteban, 2004; Meuter & Allport, 1999; Costa, Santesteban & Ivanova, 2006), the asymmetry is observed the other way around (i.e., language switch costs

are higher when switching into the L1). Parting from Green's (1998) ICM, this follows from the inhibition upon the L1 being higher than the inhibition placed upon the L2, due to inhibition being relative to the level of resting activation of the language in question. Proficiency and use ordinarily contribute to the L1 having a higher resting activation. When switching back to the L1, the level of inhibition from the previous trial persists and needs to be overcome. As a consequence of the higher inhibition on the L1, higher switch costs are created. Asymmetric switch costs can also be a marker of the relative activation of the L1 and the L2 (Bonfieni et al., 2019; Philipp et al., 2007). In a study with Italian-English and Italian-Sardinian speakers, Bonfieni et al. (2019) found reversed asymmetrical switch costs in both groups, not unlike the ones found in the experiment at hand. The authors argued that a higher L2 exposure, as observed in more highly proficient speakers, could potentially minimize the need to reactively inhibit the L1. Reportedly, higher exposure to the L2 results in easier access to items of both languages and also reduces the dominance of the L1. By reducing the dominance, less inhibition would need to be placed upon the word, and so, the lexemes would be more accessible. Seeing as a subset of the bilinguals performing the task currently resides in non-Spanish speaking countries, it is possible that the relative activation of their L2 is also higher.

Besides, level of proficiency is known to crucially affect the relative level of activation (Declerck, Thoma, Koch & Phillip, 2015; Bonfieni et al., 2019). Considering that the present group of bilinguals showed to be "advanced" users based on their LexTale, and also reported a high L2 exposure (see Table 1), it is plausible that their L2 was relatively more highly activated during the voluntary switch task. Though this results are less common, this is not the first study to observe a reversed asymmetry, Bonfieni et al. (2019), Declerck and Philipp (2015c), Declerck, Stephan, et al., (2015) and Zheng, et al. (2020) also observed such a pattern, and it was mostly attributed to overall L2 activation. In addition, both Proverbio, et al. (2004), and Bultena et al. (2014) observed asymmetrical switch costs in paced reading comprehension tasks involving sentences, and so the result corresponds with our initial predictions based on past literature.

Regarding the color-cued switching trials, the asymmetrical pattern was not replicated. On the contrary, the trend was the opposite, English sentences resulted in slightly lower switch costs (2.9) than when switching to Spanish (4.5). Being minimal, the difference was not deemed statistically significant and so the cost is considered to be symmetrical. An interpretation, which could also be taken as an alternative or complementary explanation to the relative higher L2 activation during the voluntary task, comes from the voluntary language-switching experiments by Gollan ans Ferreira (2009). The authors observed a facilitation effect for the L2 in language mixed blocks as opposed to single language bocks, which they attributed to the fact that participants could choose to name less lexically available items in their L1, and the 'easier' ones in their non-dominant language. The hypothesis was then supported by their second experiment, suggesting that costs were partially masked due to this item selection effect (also see Gollan et al., 2014 and 2016 for similar patterns). The same principle could be applied to explain the difference between the cued versus the voluntary condition of the current experiment. The voluntary task would have allowed the participants to select English for the 'easier' responses, which would result in a relative higher activation of the L2 for the set of words in the voluntary task. Since English was then more activated in the block, the relative inhibition placed upon it should also be higher and accordingly harder to overcome when switching back to English from Spanish. This would then result in a facilitation effect when selecting their less inhibited L1.

To summarize, though switch costs arose in both the cued and the voluntary tasks, these were absent when switching into the L1 during the voluntary task. A second relevant finding comes from the symmetry of the switch costs: while costs were symmetrical in the cued switching task, a reversed asymmetry effect was observed in the voluntary switching task.

4. Experiment 2

The second experiment was conducted in an attempt to see if the results observed in the voluntary switch task of the previous experiment would be replicated by a group of bilinguals with a more distinct language combination: Arabic and English.

4.1. Methodology

4.1.1. Participants

The set of bilinguals consisted of 16 Arabic speakers who had English as their second or third language. Their average age was 28.25 (SD=2.7)— 11 of them were males, and five, females. The participants originate from several Arabic speaking countries: Egypt (4), Syria (4), Lebanon (3), Tunisia (2), Jordan (2), Palestine (1), though some also report having lived in Saudi Arabia and the United Arab Emirates. Note that unlike with Spanish, where dialectal differences are highly mutually intelligible and there is not a "Standard Spanish", the status of the Arabic language is radically different. Though all participants learned and are able to speak Standard Arabic, this variety differs considerably from the dialectal variants which they speak in everyday life. For this reason, participants were asked to complete the task using the variant that was easiest for them (all chose dialect), since it would not be fair to compare switches between two L2s with the switches between an L1 and an L2 in the previous experiment. All speakers currently reside in non-Arabic speaking countries (62.6 % in Belgium, the rest, in Germany)— the majority of the participants (14 out of 16) speak a further language, with French, German, and Dutch being the most prominent ones.

Speakers were classified as "upper-intermediate users" or in the B2 CEF level (Lemhöfer & Broersma, 2012), based on an average score of 79.2 % (SD=14.2) in the English LexTale (Lemhöfer & Broersma, 2012). As with the Spanish group, they completed a background information questionnaire (refer to Table 1 in the previous section).

4.1.2. Material and Task

The task employed for the experiment was exactly the same as the one in Experiment 1, with the difference that only the voluntary block was tested. Additionally, Arabic-English cognates were excluded, as well as French-Arabic cognates, since French is, historically speaking, a major language in Arabic speaking countries due to the colonial past. As in the previous experiment, speakers could choose what language to use for each stimulus, and they were explicitly asked to use both English and their L1, be it Standard Arabic or their regional variant. The list of concepts for the Arabic-English bilinguals is based on the same concepts proposed in the MultiPic corpus (Duñabeitia et al., 2017).

4.1.3. Procedure

The procedure was identical to that of Experiment 1, with the only difference being that participants only completed the voluntary language-switching part and as such, all participants received the same task with the same instructions.

4.1.4. Analysis

The analysis was conducted in the same way as in Experiment 1. The exclusion criteria was also identical, which resulted in 21.6% of the data being excluded. 8.9% of the excluded data originated from the exclusion of trials featuring intra-sentential switches. Since the cued language-switching task was not performed, the fixed effects consisted solely of Language (L1 = −0.5; L2 = +0.5), Trial type (repetition trials = −0.5; switch trials = +0.5) and their interactions.

4.2. Results

In the second experiment we observed a trend towards a better performance when employing the L2, except that it was not significant (see Table 5). Furthermore, there was no significant difference between switch and repetition trials, implying that switch costs were not present, both when switching into the L1 as when switching into the L2. This section will present an overview of the results by looking at the switch rate and the filled pauses in the voluntary switching task.

Switch rate

The overall switch rate was of 38.8%, with a higher tendency to switch into the L1 (44.3%) than to the L2 (35.0%). The general lower switch rate compared to the Spanish bilinguals (47.3%) could be explained by the fact that Arabic bilinguals produced a crucially higher amount of intra-sentential language switches (8.9%), and all of these were excluded from the final analysis.

Filled pauses

The amount of filled pauses in the L1 trials (26.8%) was higher than in L2 ones (19.4%), and switch costs were also slightly higher in the L1 (see Table 4) which would suggest asymmetrical switch costs. However, the difference, as seen in Table 5, was not deemed significant. Table 4 shows an overview of the overall mean filled pauses in percentages. The figures show a slightly better performance in repetition trials in Arabic than in switch trials, but the lack of significance suggests an absence of switch costs. As for the English trials, the difference in performance between switch and repetition trials is even smaller, which, once again, points towards a lack of switch costs. Finally, the interaction between language and trial type was insignificant (Table 5).

Table 4. Overall mean filled pauses in percentages (SE in parenthesis) as a function of Language (Arabic; English) and Trial type (repetition trials; switch trials).

Trial type	L1	L2
Switch	29.1 (6.5)	19.3 (4.7)
Repetition	27.8 (6.7)	19.7 (4.6)
Switch costs	1.3	-0.4

Table 5. *b*-values, standard errors and *z*-values of the analysis.

Factors	*b*-value	SE	*z*-value	significance
Language (Arabic/English)	-0.343	0.295	-1.160	
Trial type (Switch/ Repetition)	0.080	0.160	0.497	
Language x Trial type	0.025	0.319	0.078	

4.3. Discussion

In Experiment 2, we intended to investigate whether the pattern observed in Experiment 1 regarding the voluntary switching task would be replicated in a group of speakers whose L1 and L2 were more distinct. The pattern was only partly replicated, as switch costs in the Arabic-English sample were symmetrical and absent both when switching into the L1, as well as when switching into the L2. The symmetry of the costs also differs from the pattern displayed by the Spanish-English group and contradict our prediction of reversed asymmetrical costs being possible due to the sentence context. Gollan and Ferreira (2009) has already observed symmetrical switch costs in a voluntary picture-naming task with unbalanced bilinguals. The authors put forward that the most efficient way to mix languages is to achieve an equal and steady inhibition of the dominant language in repetition and switch trials. Such a behavior is only possible for balanced bilinguals in cued language-switching task, but the voluntary paradigm allows non-balanced bilinguals to attain the same effect and reflect symmetrical switch costs.

The results support the theory that more ecologically valid experimental setups can lead to a reduction of language switch costs. This is not the first experiment to find a lack of switch costs in a voluntary setting (see Blanco-Elorrieta & Pylkkänen, 2017; Experiments 1 and 3 by Gollan & Ferreira, 2009), neither the first one to encounter an absence of switch costs when switching occurs inter-sententially (e.g., Gullifer et al., 2013). Nonetheless, based on the results found in Experiment 1, it is plausible to believe that the absence of switch costs results from the combination of

the two parameters, since the literature shows that voluntary switching in single-word production and cued switching in sentences have also yielded language switch costs.

Such a theory is supported by the fact that Blanco-Elorrieta and Pylkkänen (2017)'s study—one of the few which has found an absence of switch costs in a single word naming experiment— also involved conditions which made the switching behavior more natural in the shape of "social" priming (i.e. the participants switched languages based on the linguistic knowledge of an imagined interlocutor). The authors substantiated their findings with Green and Abutalebi's (2013) Adaptive Control Hypothesis, a theory which is also compatible with the results garnered from the present experiment. The more natural dense code-switching context provided by the combination of voluntary switching with a sentential context, allows for their knowledge of Arabic and English to collaborate rather than compete with one another.

But parting from Green and Abutalebi's (2013) hypothesis, such a setting would reduce cognitive costs only if the participants are 'practiced switchers'. Indeed, the participants from the present sample can be considered as members stemming from "dense code-switching" contexts. As stated by Blanco-Elorrieta and Pylkkänen (2018), such contexts are created within bilingual communities, where two languages are spoken by the whole group, allowing for regular code-switching behaviors. Sociolinguistic studies by to Elsayed (2016), Akeel (2016) and Fatima (2017) highlight code-switching behaviors among learned individuals in Arabic speaking countries. As an example, Fatima (2017) identifies English code-switching in young people in Lebanon as an identity marker, while Elsayed (2016) examines the use of English in Whatsapp messages of Arabic native students from Kuwaiti, who use switching as a marker of cultural identity. In addition, 68.8% of the participants in the Arabic speaking sample admitted to switching between languages every day or almost every day, a factor which has been proven to affect performance in language-switching tasks (see Prior & Gollan, 2011; Hartanto & Yang, 2016 for the effect of frequent bilingual language-switchers in task-switching). Hence, Language-switching can be assumed to constitute to a frequent behavior among Arabic speak-

ers, and parting from the self reported switch rates and self-perceived language usage of the participants, we can assume that they do come from a dense code-switching environment. Additionally, the participants were all proficient speakers of at least two L2's including English for all of them, and French, for more than half. All this to say, that a possible reason behind the lack of switch costs would result from the fact that Arabic speakers are more trained in switching between languages.

5. General discussion

The principal aim of this paper was to provide an answer to the following question: would language switch costs arise in a more ecologically valid language-switching task where a voluntary parameter is combined with a sentential context? Secondly, we wanted to compare the performance of Spanish-English bilinguals with that of Arabic-English bilinguals. The answers to these two questions are mixed. Switch costs were present, but eliminated under certain conditions. Moreover, the pattern observed with the Spanish native speakers was not fully replicated in the Arabic ones. The sections below will compare the results obtained through the two experiments and provide answers to both research questions by focusing on the switch costs observed and the differences that surfaced between the two groups.

5.1. Switch costs

In Experiment 1 we evaluated whether the combination of a voluntary switching task with a sentential context would result in a reduction of language switch costs in unbalanced Spanish-English bilinguals. In addition, we intended to compare the results obtained from the voluntary block with the bilinguals' performance in the cued switching block. In that way, we would create a basis of comparison with previous experiments that had a similar setup. Overall while switch costs were encountered, they were limited to two settings: the cued language-switching task, and switches into the L2 during the voluntary task. Meanwhile, switching to the L1 voluntarily resulted in an absence of switch costs. The most plausible explanation for a lack of switch costs under those precise conditions is the effect of the voluntary

switching task added to the sentence setting, which together create a context more similar to that of a natural conversation (Blanco-Elorrieta & Pylkkänen, 2018; Green & Abutalebi, 2013). Moreover, the asymmetrical switch cost observed could be tentatively explained by a relative increase of the L2 activation during the voluntary block (Bonfieni et al., 2019; Philipp et al., 2007), combined with naming 'easier' or more accessible words in the less dominant language (Gollan & Ferreira, 2009). The costs observed in the cued switching task were in line with our predictions and corresponded to the results by Declerck et al. (2017) and (2021), who employed a very similar cued switching task.

In the second experiment, we replicated the voluntary switching task performed in Experiment 1, this time with Arabic-English bilinguals. Surprisingly, the second group of participants presented a complete lack of switch costs. The asymmetrical pattern from the first experiment was also not replicated.

The general reduction in switch costs observed across both experiments, is equally compatible with Green and Abutalebi's (2013) Adaptive Control Hypothesis. The two authors proposed that multilinguals who are used to switching between languages, both those who come from dual-language contexts, as well as those who come from dense code-switching environments will need to engage control to a higher extent when in a single language context. As a reminder, in dual-language contexts, individuals usually speak different languages with different speakers, but intra-sentential switching is less frequent, while individuals from dense code-switching environments belong to communities with a high bilingual population, where switching inter-sententially and intra-sententially is part of everyday discourses. This heightened engagement of control in speakers from both contexts follows from the need to stay in one language requiring them to suppress other competing stimuli from background languages. On the other hand, in a dense code-switching context, where speakers are allowed to make use of whichever language they want at any time, control mechanisms are less engaged, because having the freedom to select whatever structure comes easier and fastest, eliminates the need for inhibition. The Adaptive Control Hypothesis contends that switch costs while producing sentences would not be expected for trained speakers in a dense code-switching context, which would correspond to the voluntary condition of the ex-

periment here performed. The lack of costs observed in Arabic speakers supports this theory, as do the reduced costs observed in the Spanish sample. Green and Abutalebi (2013) point out, nevertheless, that as soon as the speaker has to produce one or the other language in response to a cue, their language schemes will find themselves once again in competition with one another, implying that switch costs in such a situation are to be expected. Though speakers from a dual-language context will have an advantage in a cued task over speakers of a dense code-switching context, costs will not be fully eliminated. The switch costs observed in the color cued task with Spanish bilinguals in Experiment 1, also fall in line with this prediction.

5.2. Differences between the two groups

The effects observed in the two groups are hereby accounted for. Now it is time to address our second research question: is the pattern observed in the Spanish-English bilingual group during the more ecologically valid switch task replicated in the Arabic-English bilingual group? The answer to that would be: to some degree. Put simply, the elimination of switch costs was complete among the Arabic bilinguals and only partial in the Spanish bilingual group— since switch costs were still present when switching into the L2. Furthermore, the switching asymmetry in the Spanish group was not observed in the Arabic one. The conditions and instructions given to the two groups were exactly the same, so the inevitable question emerges as to why the two groups presented differences. If not the experimental conditions, then it logically follows that the explanation must lie within a difference between the groups of participants themselves.

When we compare the linguistic environments of the two communities of speakers, a crucial difference becomes evident, and that is the fact that Arabic speaking countries offer dense language-switching contexts (see Akeel, 2016; Elsaed, 2016; Fatima, 2017). French, due to the colonial past, has a privileged position in these countries, but English also appears to have been gaining territory in the last decades, since, as Akeel (2016) reports, the use of English in Arabic countries is now often regarded as a marker of education and belonging to a higher social class. As mentioned in the introduction, one of the possible reasons why multilinguals switch between their languages is to mark

group membership, a pattern which has been reported in sociolinguistic studies observing code-switching in Arabic (see Fatima, 2017; Elsayed, 2016). While this is also the case in some Spanish speaking communities, and dense code-switching is not unusual in areas such as the United States and Mexico, they are not as prominent in the countries of origin of the current Spanish speaking sample. The Spanish-English bilinguals who contributed to the study proved to be highly proficient in English, but 50% of them reported using English less than 30% of the time in their everyday lives, probably owing to the fact that part of the sample still resides in Spanish speaking countries. Meanwhile only 25% of the Arabic speakers reported a similar behavior, and they all reside in non-Arabic speaking countries (note, however, that these are not countries where English is an official language). A recent study by Bonfieni et al. (2019) found evidence that not only proficiency has an effect on language-switching but also daily exposure. They tested two groups of bilinguals, a group of highly proficient Italian-English speakers and one of Italian-Sardinian speakers. Through a cued language-switching task authors found that active language proficiency correlated with a reduction of switch costs, which would explain why Arabic speakers showed even fewer costs than the Spanish speaking group did. Perhaps it would have been interesting to perform a cued switching task with the Arabic sample to verify if the costs were comparable under such parameters.

An additional factor to take into account is the importance of practice when it comes to control mechanisms (see Bialystok, 2004). Out of 16 Arabic speakers, 15 reported speaking a further language other than their native language or English. As for the Spanish speaking sample, this was the case for 15 out of 26 speakers. Arabic speakers who actively manage multiple languages in their everyday lives could potentially be more trained in managing relative activation and inhibition levels of their background languages to produce the right output in the appropriate situation.

That being said, one could argue that speaking more languages does not directly imply that cognitive control is more exercised, it could be that the multilingual mostly uses only two of their languages, and acts much like an active bilingual. Nonetheless,

there is still one more factor to consider: literate speakers of Arabic already master two different variants of the same language, namely Standard Arabic and their own regional dialect, and these are two varieties which, at the very least during school years, had to be constantly modulated by the speaker. Even though the Spanish speakers we tested also speak different variants of the same language, there is no official standard Spanish known to all Spanish speakers without which reading a newspaper becomes impossible, and though the different variants do have grammatical and lexical differences, these rarely impede intelligibility from one country to another.

That is not the case for Arabic. Speakers of this language find themselves in a situation of diglossia, where the written standard language presents a crucial linguistic distance from the spoken dialects (Shendy, 2019). The disparity between the two variants was clear in the comments of a number of the participants, who while responding to the background questionnaire, mentioned mastering their local dialect but not the standard language to the same level and consequently were not sure how to rate their knowledge of their native language. This puts Arabic speakers already in a position where they are constantly obliged to switch between varieties when reading the newspaper, attending university or writing an email, as opposed to when they speak informally with friends, family and generally, in everyday life. Learned Arabic speakers are then highly proficient in modulating their employment of the Standard Arabic and their regional dialect and adapting their use to the correct environment. Kirk et al. (2018) already presented evidence showing that comparable switch costs to those seen in bilinguals switching between two languages are also found in dialect speakers switching between the standard language and a dialect. In their case, they observed that both native English speakers switching to Dundonian Scots dialect and German speakers switching to the Öcher Platt dialect incurred switch costs, that the costs were symmetrical, and lower for cognates. If switching between a dialect and the standard language is akin to switching between languages, then learned Arabic speakers as the ones in the present sample could present an advantage over the Spanish speakers in terms of practice managing language control. Green and Abutalebi (2013) point out that skills in cognitive control can be magnified through a persistence of heavier cognitive demands linked to

language control in bilinguals. Though the Spanish bilinguals of the sample are trained in this respect, it is possible that the fact that Arabic speakers have been training this mechanism since early school years further enhances the effect. This could very well explain why switch costs were completely absent in the Arabic speaking group in the second experiment, while their elimination was only selective among the Spanish bilinguals in the first experiment.

As mentioned in the discussion for the Arabic experiment, the frequency of daily switching has been proved to affect performance in language-switching tasks. A study by Prior and Gollan (2011) found that the frequency with which bilinguals change between languages in everyday life has an impact on their executive control mechanisms. They compared the performance of a group of Spanish-English bilinguals with that of a group of Mandarin-English bilinguals in a cued switching task. The first group, which had reported switching frequently in everyday life evidenced lower switch costs than Mandarin-English speakers, whose reported daily switching frequency was lower. Their results provide evidence to sustain the claim that practice is indeed a central factor when it comes to performance in language-switching. In both groups of bilinguals examined in the present study, over half of the participants reported switching languages every day or almost every day, which adds to the reasons why conditions under which switch costs were absent were found in both experiments.

Lastly, one of the aims of this paper was to directly compare the performance of two groups of very distinct bilinguals with crucially different native languages and backgrounds. Though the focus of the paper was to observe patterns regarding the presence or absence of switch costs, another interesting behavior surged while reviewing the data. Despite the fact that both groups received the exact same instructions for the voluntary switching task, we found that the rate of intra-sentential language-switching among Arabic speakers was much more elevated than that of Spanish native speakers. Since the focus of the experiment was inter-sentential language-switching all such trials were eliminated. Participants were not explicitly told to avoid intra-sentential language-switching, as such an explicit instruction would limit the extent to which the condition

was voluntary (see Experiment 2 in Gollan & Ferreira, 2009). According to comments by the Arabic participants, this switching behavior reflects the way they implement switching in everyday life, which corresponds to the fact that Arabic speaking communities present dense code-switching contexts.

5.3. Limitations of the study

While the experimental procedure was as rigorous as the context allowed, there are still a few limitations in the present study that should be addressed and kept in mind for future research. The first point to consider is the choice of vocabulary for the task involving Arabic speakers. Due to the lasting influence of the French language in Arabic speaking countries, we decided to exclude not only Arabic-English cognates but also Arabic-French ones. The problem with this was that we did not expect cognates to differ from one dialect to the other. Determinate varieties of Arabic, such as that spoken in Tunisia possess more or simply different loan words from French than the Lebanese dialect, for example. While there were only a few instances of participants naming cognates (21 in total) and hence are too small to alter the data significantly, it is a factor that should be taken into account in future experiments. Then again, cognate facilitation effects have been shown to be less consistent in sentential contexts (see Van Hell & de Groot, 2008; and Schwartz & Kroll, 2006), so the expected effect would be minimal.

Another point to address is the fact that while all speakers of the Arabic sample lived in non-Arabic speaking countries, in the Spanish sample, this was the case for roughly half of them. Admittedly, the countries of residence of the Arabic and Spanish bilinguals do not have English as their official language, but rather German, Dutch or French, so English is not necessarily more activated than it would be if they were in a country where their native language is spoken. Additionally, reports from several sociolinguistic studies imply that English is often introduced in conversations between Arabic speakers in Arabic speaking countries (Elsayed, 2016; Akeel, 2016; Fatima, 2017), so the level of activation could be the same in their country of origin. Still a study comparing the performance of Arabic speakers in their home country, relative to that of Arabic speakers in a foreign country could be an interesting endeavor.

6. Conclusion

The current study tested a novel combination of parameters in a language-switching task to create a more ecologically valid experimental setting. The motivation for the study came from the fact that when comparing cued language-switching experiments to voluntary ones, the latter have generally yielded smaller switch costs and mixing effects (e.g., Gollan, Kleinman, & Wierenga, 2014; Jevtović et al., 2020), and even mixing benefits (e.g., Bruin, Samuel, & Duñabeitia, 2018; Gollan & Ferreira, 2009). Instead, cued language-switching experiments consistently produced switch costs in unbalanced bilinguals (e.g., Costa & Santesteban, 2004; Meuter & Allport, 1999). Experiments employing sentential contexts (e.g., Declerck & Philipp, 2015b; Gullifer et al., 2013) have also resulted in less consistent switch costs. We theorized that a combination of the two parameters would contribute to creating a task more akin to a natural setting, and so eliminate possible cognitive costs incurred by the experimental setup itself (see Blanco-Elorrieta & Pylkkänen, 2018).

Our results show that language switch costs still persist in language-switching tasks involving sentences when participants base their responses on an external cue (see Experiment 1). Yet switch costs can be reduced and even completely eliminated when switching is voluntary in a sentential context. While native Spanish speaking bilinguals showed switch costs during the voluntary task, these were abolished when switching into their L1. Surprisingly, in the Arabic-English group, switch costs did not arise during the voluntary task. The findings thus confirm that language-switching can occur without a cost under particular conditions. We take this as evidence for the Adaptive Control Hypothesis by Green and Abutalebi (2013) and as a corroboration of Blanco-Elorrieta and Pylkkänen's (2018) suggestion of more ecologically valid experiments being the key to avoiding switch costs. Differences in performance by the two groups imply that their distinct linguistic backgrounds could have an effect on their level of cognitive control. Further research should investigate such differences and take them into account when analyzing their data.

Word count: 15.206

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Appendix I: Word List

Spanish	English	Arabic
abrigo	coat	miATaf
aguja	needle	ibra
ala	wing	Hallaaq
alfombra	carpet	sajjaada
anillo	ring	khaatim
araña	spider	Aankaboot
árbol	tree	shajara
ballena	whale	Hoot
bandera	flag	Aalam
barco	ship	al-baakhira
bombero	fireman	rajul al-iTfaa'
brazo	arm	dhiraaA
bruja	witch	sahira
búho	owl	booma
burro	donkey	Himaar
caballo	horse	HiSaan
cabeza	head	ra’s
cabra	goat	maAza
calabaza	pumpkin	qarA Aasalee
calzoncillos	pants	sirwal
cama	bed	sareer
camión	truck	shaaHina
camisa	shirt	qameeS
campana	bell	jaras
candado	lock	qufl

Spanish	English	Arabic
carta	letter	khiTaab
casa	house	al-manzil
casco	helmet	khoodha
cebolla	onion	baSal
cerdo	pig	khinzeer
cerebro	brain	mukhkh
ciervo	deer	ghazzaal
cinturón	belt	Hizaam
clavo	nail	musmar
cohete	rocket	sarukh
collar	necklace	Aiqd
conejo	rabbit	arnab
copa	glass	ka’s
corazón	heart	qalb
corbata	tie	ribaaT Aunuq
cuchara	spoon	milAaqat
cuchillo	knife	sikkeen
cuello	neck	Aunuq
dedo	finger	iibae
destornillador	screwdriver	mifakk
enfermera	nurse	mumarriDa
espada	sword	sayf
falda	skirt	tannoora
fantasma	ghost	sahbh
fresa	strawberry	faraawla

Spanish	English	Arabic
habitación	bedroom	ghurfat an-nawm
hoja	leaf	waraqa
hombre	man	rajul
horno	oven	furn
hueso	bone	AaZma
huevo	egg	bayDa
iglesia	church	kaneesa
libro	book	kitaab
llave	key	miftaaH
lobo	wolf	dhi'b
luna	moon	al-qamr
maíz	corn	dhurra
maleta	suitcase	kays
mano	hand	yad
manzana	apple	tuffaaH
mariposa	butterfly	faraasha
martillo	hammer	yaduqq
mesa	table	maa'ida
mosca	fly	yatir
mujer	woman	imra’a
muñeca	doll	dumya
muro	wall	jidaar
niña	girl	bint
niño	boy	walad
nube	cloud	saHaab
ojo	eye	Aayn
olla	pot	wiea’

Spanish	English	Arabic
oreja	ear	udhun
oso	bear	dubb
oveja	sheep	kharoof
pájaro	bird	aT-Tuyoor
pala	shovel	mijrafa
pan	bread	khubz
pato	duck	baTTa
pavo	turkey	deek roomee
payaso	clown	mahraj
peinilla	comb	mishT
pelo	hair	ash-shaAr
pelota	ball	kura
perro	dog	kalb
pez	fish	samak
pierna	leg	saaq
pistola	gun	musaddas
pluma	feather	reesha
pollo	chicken	dajjaaja
puente	bridge	jisr
puerta	door	baab
pulgar	thumb	ibhaam
ratón	mouse	fa’r
rayo	lightning	barq
red	net	shibaak
reina	queen	wazeer/ malika
reloj	watch	saaAa
rey	king	malik

Spanish	English	Arabic
sello	stamp	TaabiA
silla	chair	kursee
sobre	envelope	maZroof
sombrero	hat	qubbaAa
tambor	drum	Tabla
taza	mug	qadaH
tenedor	fork	shawka
tiburón	shark	qirsh
tijeras	scissors	miqaSS
timbre	bell	jaras al-baab
timón	wheel	Aajalat qiyaada
uña	nail	Zifr
vaca	cow	baqara
vaso	glass	fanajaan
vela	candle	shamAa
ventana	window	naafidha
ventilador	fan	mirwaHa
vestido	dress	fustaan
zanahoria	carrot	jazar
zanahoria	carrot	jazar
zapato	shoe	Hidhaa’

Appendix II: Background Questionnaire

Name:

Age

-Gender: Female Male N/A:

-Languages you speak (it can be more than one):

-Schools/Universities attended:

-At what age did you start learning English? __

-How many years did you have English in school? __

-How good is your spoken Spanish/Arabic?

(very bad) 1 2 3 4 5 6 7 (very good)

-How good is your written Spanish/Arabic?

(very bad) 1 2 3 4 5 6 7 (very good)

-How good is your Spanish/Arabic reading?

(very bad) 1 2 3 4 5 6 7 (very good)

-How good is your spoken English?

(very bad) 1 2 3 4 5 6 7 (very good)

-How good is your written English?

(very bad) 1 2 3 4 5 6 7 (very good)

-How good is your English reading?

(very bad) 1 2 3 4 5 6 7 (very good)

-Percentage of time currently using Spanish/Arabic (on a day to day basis)

0 10 20 30 40 50 60 70 80 90 100

-Percentage of time currently using English (on a day to day basis)

0 10 20 30 40 50 60 70 80 90 100

Any other language you currently use?

———————————————————-

-Percentage of time currently using other language. (On a day to day basis)

0 10 20 30 40 50 60 70 80 90 100

-Percentage of time using Spanish/Arabic during childhood

0 10 20 30 40 50 60 70 80 90 100

-Percentage of time using English during childhood

0 10 20 30 40 50 60 70 80 90 100

Any other language you used during childhood?

———————————————————-

-Percentage of time using other language during childhood

0 10 20 30 40 50 60 70 80 90 100

Country/countries where you grew up:

Country of current residence:

Other countries where you have lived. For how long?

-Do you ever switch between Spanish/Arabic and English in a conversation? (Or maybe between other languages?)

(Never) 1 2 3 4 5 (Every day)