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# The Effects of Bilingualism on the Intersection of Cognitive Control and Emotion Regulation

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## Dedication

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ABSTRACT OF THE DISSERTATION

The Effects of Bilingualism on the Intersection of Cognitive Control and Emotion Regulation

by

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Language serves an important role in cognition and impacts abilities such as cognitive control, memory, and emotion. Therefore, it is reasonable to assume that experience with two languages may affect individuals' abilities in these different domains. While many studies have looked at how bilingualism relates to cognition and emotion separately, this study is the first of its kind to study bilingual language use in different affective contexts and examine how spontaneous speech relates to cognitive control and emotion regulation. Studies on emotion regulation and bilingualism have often ignored heritage speakers, despite having a unique bilingual experience. This dissertation aimed to understand whether heritage speakers perceived emotional differences between their two languages, and if so, examine how differences manifest in spontaneous speech.

The first aim of this study was to examine how individual differences in cognition and emotion regulation might account for bilingual language use. The second aim was to examine the relationship between cognition and emotion regulation in a bilingual

population. This is one of few studies to specifically study heritage bilinguals, individuals who grew up speaking a home language that is not a majority language in the society at large but who typically became dominant speakers of the majority language. Fifty female heritage bilinguals from the University of California, Riverside participated in this study. Participants completed a series of emotion regulation questionnaires, cognitive control tasks (Wisconsin Card Sorting Test, Navon shape task, color/shape task), and affective conversations (positive, negative, or neutral) with a confederate. The affective conversations and self-report data replicate some previous findings, such that the heritage bilinguals revealed a preference for using English while discussing negative life events. Although many participants indicated that Spanish was perceived to be the more "emotional" language, they identified English as their preferred language for emotional expression. As for cognitive control and emotion regulation, the data suggest that domain-general flexibility might account for code-switching frequency. Performance on the Wisconsin Card Sorting Test (WCST; a task that measures cognitive flexibility) and scores from the Flexible Regulation of Emotion Expression (FREE) scale were associated with code-switching frequency. Thus, bilinguals who code-switch frequency also show evidence of flexibility in the domains of cognition and emotion regulation.

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# Chapter 1

## Introduction

Self-regulation is an important feature of adaptive human behavior that has been studied through the lenses of social, developmental, and cognitive psychology. Broadly speaking, self-regulation can be defined as the dynamic and ongoing modulation of internal states, such as cognition, emotion, and behavior (Nigg, 2017). In each of these domains, individuals must manage distractions or conflicting information in order to achieve a goal. Historically, cognitive psychologists have focused on the self-regulation of cognition, specifically executive functions, whereas social and developmental psychologists have studied self-regulation through emotion and behavior. While these different fields of psychology have studied self-regulation as separate domains, they all involve top-down and bottom-up processes. More recently, however, psychologists have made significant attempts to take an interdisciplinary approach to studying self-regulation, specifically with respect to cognition and emotion.

One phenomenon that has been proposed as a self-regulatory mechanism in the domains of cognition and emotion is code-switching. Code-switching is generally described as the alternation between two languages or linguistic varieties within the same utterance (Myers-Scotton, 1997). In the cognitive literature, it has been suggested that bilinguals may experience cognitive advantages as a result of lifelong use of their two languages (Kroll & Bialystok, 2013). Many studies have found evidence of bilinguals outperforming their monolingual counterparts on a range of non-linguistic executive function tasks (Bialystok et al., 2005; Bialystok, Craik, & Luk, 2008; Bialystok, Craik,

Klein, & Viswanathan, 2004). However, evidence of a bilingual advantage tends to appear within specific populations (e.g., young bilingual children) suggesting that different factors of the bilingual experience, such as code-switching experience, may modulate such an advantage (Emmory, Luk, Pyers, & Bialystok, 2009; Verreyt, Woumans, Vandelanotte, Szmalec, & Duyck, 2016; Hartano & Yang, 2016). Whether they are speaking to monolinguals or other bilinguals of the same languages, bilingual speakers must employ a language selection mechanism to select their intended language and avoid interference from the non-target language. Thus, there is reason to believe that the mechanisms used to monitor and manage two languages might also be involved in non-linguistic cognitive tasks as well. Previous studies have found that code-switching experience positively correlated with bilinguals' performance on non-linguistic tasks (Emmory et al., 2009; Verreyt et al., 2016; Hartano & Yang, 2016). For instance, Hartano and Yang administered a non-linguistic switching task to two groups of bilinguals, habitual code-switchers and non-code-switchers. They found that the habitual code-switchers showed smaller non-linguistic switch costs compared to the non-code-switchers.

In other domains, such as emotion and sociolinguistics, researchers have studied how bilinguals express and regulate their emotions in each of their languages. Much of the early research on bilingualism and emotion has indicated that for most bilinguals, their first language (L1) was considered the more emotional language and the one that was preferred for expressing emotion (Grosjean, 1982; Dewaele & Pavlenko, 2002; Anooshian & Hertel, 1994). The second language (L2), on the other hand, has been

reported as being the preferred language of emotional detachment. For bilinguals, code-switching has been proposed as a regulatory mechanism, allowing speakers to regulate their emotions and feelings by switching languages (Williams, Srinivasan, Liu, Lee & Zhou, 2019). For instance, if a bilingual wants to avoid feelings of embarrassment or shame, they may switch to their less emotional language that allows them to disengage from those emotions. Just as bilinguals employ cognitive control to select their target language for communicative purposes, they can also engage in a similar type of control to regulate their emotions.

Language serves an important role in cognition and impacts abilities such as cognitive control, memory, and emotion. Therefore, it is reasonable to assume that experience with two languages may affect our abilities in these different domains. While many studies have looked at how bilingualism relates to cognition and emotion separately, no studies have investigated how bilingualism may affect the relationship between cognition and emotion. The aim of my research is to understand how individual differences in emotion regulation and cognitive control account for code-switching behavior.

**Functions of Code-switching**

Code-switching broadly refers to the switching or mixing of two languages or linguistic varieties within a single utterance or conversation (Myers-Scotton, 1993). Such switches may take form within a sentence or sentence fragment (intra-sentential code-switch, see Example 1) or a switch between sentences (inter-sentential code-switch, see Example 2).

(1) Intrasentential code-switch

El professor dijo that the student had received an A.

*'The professor said that the student had received an A.'*

(Belazi, Rubin, & Toribio, 1994)

(2) Intersentential code-switch

Si, pero le hablo en español. When I don't know something, I'll talk to her in English.

*'Yes, but I talk to her in Spanish. When I don't know something, I'll talk to her in English.'*

(Zentella, 1997)

As mentioned above, code-switching serves many purposes. In what follows, I will briefly describe some of the functions of code-switching. While code-switching serves many functions, I will focus this literature review on emotion regulation, as it has been understudied in the field.

**Discursive Function.** The most common type of intrasentential code-switch occurs within the noun phrase (e.g., 'el dog', ''the$_{SPAN}$ dog$_{ENG}$") (Poplack, 1980). Bilinguals often exploit this type of code-switch to mitigate utterance planning difficulties. For example, if an individual is speaking in English but wishes to use a specific word in Spanish, they may switch to Spanish to more precisely express the intended message. In this scenario, Green and Wei (2014) suggest that code-switching allows speakers to access items that are more active and available than other competing alternatives. Another explanation is that bilinguals cannot find an appropriate word or expression in the target language, or the language simply does not have an appropriate translation. For example, for a French speaker in the United States, the word "day care"

does not have the same meaning as its French translation "crèche."

At other times, bilinguals may not have learned terms in both languages or are not equally proficient in both languages. For bilingual speakers who are less proficient in one of their languages, code-switching can serve as a tool to circumvent a lexical gap. Switching into the more proficient language serves as a "filler" to continue the flow of communication (Freeman & Freeman, 2001). For bilinguals with asymmetric proficiencies, code-switching to fill a lexical gap may also be accompanied by long pauses or dysfluencies (e.g., uh, um), indicating word search and retrieval difficulties (Hughes, Shaunessy, Brice, Ratliff, & McHatton, 2006). Code-switching not only fills a momentary linguistic need, but it is also a useful communication resource. In some instances, members of a community switch between languages to suggest a change in topic (sometimes referred to as conversational code-switching). For example, Mexican Americans in the Southwest often switch from Spanish to English when talking about money (Valdes Fallis, 1976). Valdes Fallis suggests that this is probably because most buying and selling in done in English. Blom and Gumperz (1972) illustrate another example of conversational code-switching in the Norwegian village Hemnes. The authors recall two villagers in a Social Security office using Standard Norwegian to discuss business but switching to the local dialect to discuss family and village matters. There is no physical change of setting, however the change of topic corresponds with the change of language.

**Social Function.** While linguistic and discursive influences can motivate code-switching, there are also social consequences and implications that affect language

choice. Language is closely related to culture and identity, so it is not surprising that social factors heavily influence a bilingual's production of code-switching. Grosjean (1982) argues that code-switching has pragmatic value and is often used to signal membership and solidarity with other members of the same bilingual community. Many scholars have noted that speakers of closed network groups share common phrases and expressions, consequently speeding up communication (Grosjean, 1982). However, speakers outside of the community may not necessarily share their communicative experience or background knowledge to interpret their speech. This concept of shared community norms can also be applied to code-switching behavior. Not all bilinguals code-switch, and those who do engage in code-switching do not switch with any and every bilingual. Bilinguals only code-switch with other bilinguals with whom they share a dual-language identity (Bullock and Toribio, 2009). Code-switching conventions and strategies are learned through experience and by observing social norms. Bilinguals tend to not code-switch with other bilinguals unless they know something about the listener's background or attitude (Gumperz, 1977), suggesting that code-switching serves as a marker of group membership and solidarity.

Just as language switching can be used to denote group membership, it can also be used to exclude others from the conversation. Di Pietro (1977) reported that Italian American parents often switched into Italian when discussing topics that they wished to keep private from their monolingual English-speaking children. Di Pietro even added that children would often develop a receptive competence of Italian, leaving their parents to either not talk in front of their children or spell words out in their native language.

As outlined above, code-switching and language choice is influenced by a plethora of sociolinguistic factors that interact or operate simultaneously. By examining code-switching through a sociolinguistic lens, rather than a purely psycholinguistic perspective, it can be recognized as a communicative phenomenon. Code-switching appears to provide some evidence of unverbalized assumptions about social categories and important insights on broader social concepts of interpersonal relations (Gumperz, 1977).

**Emotion Regulation Function.** Emotion regulation is understood as the ability to exert control over one's emotional experiences in order to meet situational and psychological demands. Similar to cognitive control, emotions are thought of as being goal oriented, such that they provide information relating to our goals and motivations (Campos, Mumme, Kermoian, & Campos, 1994). Although emotions are considered to be adaptive, one can also exert control in order to change or regulate their emotional experiences. For example, depending on one's goals, one may regulate their emotions by intensifying (up-regulation) or avoiding (down-regulation) them.

Emotion regulation is achieved through strategies that involve either engaging with or disengaging from specific emotions (Gross, 2008). In his process model of emotion regulation, Gross proposed five families of regulatory processes: situation selection, situation modification, attentional deployment, cognitive change, and response modulation, all of which affect emotional experiences at different points in the process. In his more recent extended process model, Gross (2015) discusses how emotion regulation is an extended process that is highly sensitive to the context in which it is

operating. By considering the effects of context, we may be able to better understand why people regulate their emotions in the ways they do.

When bilinguals regulate their emotions, they can engage in the emotion regulation strategies proposed by Gross (2008) by switching between their languages. Code-switching has been proposed as an emotion regulation strategy based on numerous findings that some bilinguals experience emotions differently in each of their languages (Williams et al., 2019; Pavlenko, 2005). Interest in understanding the differences in emotional resonance in bilinguals originated from sociolinguistic and cross-cultural research. Researchers have observed that different cultures value different affective states (Tsai, Knutson, & Fung, 2006). For example, Tsai and colleagues found that Asian American and Hong Kong Chinese individuals value low-arousal positive affect (e.g., calm, peaceful, relaxed) more than European American individuals. Hull (1990) investigated the possibility that some bilinguals may also be bicultural and therefore have distinct personalities related with their two languages and cultures. Following his work, psychologists and psycholinguists have taken interest in the idea of different languages and different selves. Until recently, research examining the relationship between bilingual language use and emotion has focused on how bilinguals feel and express themselves differently in their two languages. Many researchers have drawn similar conclusions that bilinguals sometimes prefer one language over the other in order to distance themselves from feelings or emotions that may feel uncomfortable or awkward (Pavlenko, 2005; Marcos, 1976**;** Dewaele, 2010; Bond & Lai, 1986). However, this idea of switching languages to distance oneself has not traditionally been framed as an emotion regulation

strategy in the bilingualism literature. In what follows, I will review some studies that have found evidence of emotional differences in bilinguals' L1 and L2. These authors did not explicitly portray code-switching as an emotion regulation strategy; however, I will interpret their findings as such.

Much of the early research on bilingual language use and emotion identified an asymmetric relationship regarding emotional resonance in the L2 compared to the L1. While working with bilinguals in psychotherapy in New York City, Marcos (1976) identified a phenomenon that he called the "detachment effect." According to him, words in the L2 carry less emotional components due to the context in which they were learned. He9iffer9eed that the L2 fulfills an intellectual function and is "devoid of emotion," whereas the L1 is the primary language in which bilinguals express emotions. This notion of switching languages to "detach" oneself from a particular emotion is a clear example of regulating one's emotions.

Other researchers have also found support for the detachment effect. Bond and Lai (1986) examined Cantonese-English bilinguals' language choice when discussing embarrassing and neutral topics. Female Chinese students were recruited in pairs in Hong Kong to interview each other in their L1 Cantonese and L2 English. The two neutral topics were about politics and economics. One of the embarrassing topics was about sexual attitudes of Chinese and Westerners, and the other was a personal experience about a recent embarrassing episode. The authors found that participants used English more frequently when discussing the two embarrassing topics compared to the neutral topics. They concluded that switching to the L2 served as a distancing function, or

regulation strategy, allowing bilinguals to distance themselves from feelings of embarrassment.

Although much of the research has been based on anecdotal accounts, some studies have examined emotional differences between the L1 and L2 using physiological and behavioral measures. Harris, Ayçiçegi, and Gleason (2003) investigated how bilingual speakers respond to taboo words and childhood reprimands in their L1 and L2. Thirty-two Turkish-English young adult bilinguals were recruited from the Boston area for the study. All participants were either students or working professionals who had acquired English after 12 years of age. The average age of arrival to the United States was 24. In their study, participants either read on a computer screen or heard a variety of words in Turkish (L1) and English (L2) while their skin conductance response (SCR) was monitored via fingertip electrodes. There were 5 categories of stimuli: neutral (e.g., *door*), positive (e.g., *bride*, *joy*), aversive (e.g., *disease*, *kill*), taboo (e.g., *asshole*, *breast*), and reprimands typically spoken to children (e.g., *Don't do that!* and *Go to your room!*). They found that the greatest reactivity was in response to taboo words, replicating previous work with monolinguals. However, SCRs to taboo words were slightly stronger in the L1, also supporting previous work suggesting that bilinguals experience more anxiety when encountering taboo words in the L1 (Javier, 1989). During their debriefing, some bilinguals even reported "feeling nothing" when hearing a taboo word in the L2. The differential SCR data suggest that these bilinguals might be experiencing bottom-up emotion regulation. In other words, when a taboo word is presented in their L1, they automatically experience increased arousal and anxiety. Because they do not feel the

same level of anxiety in their L2, one might predict that when speaking with other bilinguals, these participants might code-switch to their L2 to disengage from feelings of anxiety.

While much research supports Marcos' (1976) idea of a detachment effect, the disparity between emotion expression in the L1 and L2 is not necessarily true for all bilinguals. Just as bilinguals differ in many dimensions, such as relative proficiency and use of both languages, it makes sense that variability in emotional resonance would also exist. In order to investigate this variability among bilinguals, linguists Aneta Pavlenko and Jean-Marc Dewaele created the 'Bilingualism and emotions' web questionnaire and collected responses from 1039 bilinguals (Dewaele & Pavlenko, 2001-2003). The questionnaire contained questions asking about how bilinguals express themselves in their two languages. Pavlenko (2006) addressed one specific question from the questionnaire: 'Do you feel like a different person sometimes when you use your different languages?'

She found that 65% of participants offered an affirmative response and 26% a negative response. Four main sources of self-perception were identified: (1) linguistic and cultural differences; (2) distinct learning contexts; (3) different levels of language emotionality; (4) different levels of language proficiency. Focusing on different levels of emotionality, one major theme that emerged for affirmative responses was the idea that when speaking in their L1, bilinguals feel more "natural" and "real," whereas speaking in their L2 is more "artificial" or "fake." Some participants even described their experience speaking in their L2 as akin to wearing a mask or acting through a different persona.

However, as Pavlenko points out, just because the L1 may be perceived as more emotional, it does not imply that it is the preferred language for emotional expression. In their questionnaire responses, some participants reported a preference for expressing themselves in their L2 due to growing up in a strict environment, or simply because they currently live in a country where their L2 is the majority language. However, bilinguals do not always experience emotional detachment in their L2 – individual experiences are a great determinant in whether bilinguals will express emotion in their L2. For example, some participants reported that their low proficiency led to feelings of anxiety when speaking in the L2. On the other hand, some participants reported that being in a romantic relationship or raising children in their L2 led them to perceive the language as more emotional.

As for the negative responses, one major theme emerged: participants who did not consider themselves to be different people when speaking in their different languages reported their self-perception to be "unitary and coherent" (Pavlenko, 2006: 23). Respondents who chose to elaborate on their response noted that regardless of which languages they speak, they feel like the same person. However, they view their different languages as a strategic tool to experience different cultures, thought processes, and feelings. They are cognizant of the fact that some concepts, words, and emotions do not easily transfer between languages, therefore they can use code-switching as a communicative and emotion regulation tool.

The selected studies reviewed thus far have examined a specific population of bilinguals: sequential bilinguals. The bilinguals described in the above studies (Marcos,

1976; Bond & Lai, 1986; Harris et al., 2003; Williams et al., 2019) all learned their second language later in life after puberty and often in an academic setting. As noted by Bond and Lai, second languages are often learned and mastered in a more emotionally neutral setting, such as school. As a result, bilinguals often perceive their L2 has being less meaningful and provocative than their L1 (Marcos, 1976; Bond & Lai, 1986). Yet, this pattern of emotional processing may be specific to a certain population of bilinguals, such as late, sequential bilinguals. How, then, would a different population of bilinguals, such as early bilinguals, process emotions in two languages? One aim of the current study is to investigate how one population of early bilinguals (heritage bilinguals) express and regulate their emotions in their L1 and L2.

**Link Between Code-switching and Emotion: Two Theoretical Perspectives**

The previous section outlined three major functions of code-switching, one of which specifically concerns emotion. As previously mentioned, the emotion regulation function of code-switching appears to be overlooked in the literature, and only in the last few decades have researchers began using experimental paradigms to study bilingualism and emotional processing. In the following sections, I will outline two theoretical perspectives[1] proposed by Williams and colleagues (2019) that attempt to account for the relationship between code-switching and emotion. These two theoretical perspectives, cognitive control and emotion regulation, are both rooted in the notion of self-regulation. The purpose of introducing these theoretical perspectives is to underscore the idea that

[1] Williams et al. (2019) proposed three theoretical perspectives: cognitive control, emotion regulation, and cultural frame switching. I will only focus on the first two as they are most relevant to my hypotheses and experimental design.

code-switching may serve a self-regulation function in the domains of cognition and emotion.

**Cognitive Control Perspective.** During emotional episodes, bilinguals may switch between their languages for several reasons, including exercising cognitive control. When a bilingual speaker intends to speak in one language, there is assumed to be a certain amount of control required to inhibit the competing non-target language (Green & Abutalebi, 2013). In scenarios where both languages are available for use, less cognitive control is required, thus allowing bilinguals to switch between languages with ease. However, heightened emotion can affect a bilingual's ability to switch between languages (Williams et al., 2019). My prediction regarding the relationship between cognitive control and emotion has two potential outcomes. First, during emotional episodes involving negative affect, code-switching may occur as a result of decreased cognitive control. Heightened negative emotion may decrease cognitive control, resulting in less inhibition. Consequently, both languages would then become available in the planning schema. If this were the case, individuals exerting less cognitive control would have greater rates of code-switching. Second, depending on the bilingual and how they wish to regulate their emotions (up- or down-regulate), increased cognitive control may result in only one language being used. For example, if a bilingual is experiencing heightened negative emotion while speaking in their L2, they may default and switch into their L1 because they are able to process those feelings at a deeper affective level. In another scenario, they may want to down-regulate negative emotions by switching to

their L2. In both examples, individuals exerting greater cognitive control would have lower rates of code-switching when discussing negative affective topics.

Previous studies have provided evidence suggesting that different emotional states can directly influence cognitive control (Cohen et al., 2016; Tottenham, Hare, & Casey, 2011). Cohen and colleagues recruited healthy young adults to complete a modified emotional go/no-go task during an fMRI scan. The task was performed under three emotional state conditions: anticipating a negative event (threat), a positive event (excitement), or a no event (neutral). A different face corresponded with each event. The negative emotional state was induced by telling participants they would hear an unpredictable aversive noise paired with a picture of a megaphone. The positive emotional state was induced by telling participants they could possibly win $100. fMRI results suggested that participants used more regulation during the positive emotional state, as indicated by increased sustained BOLD activation of frontoparietal and frontostriatal circuitry. Contrary to finding improvement in cognitive control during the positive emotional state, they also found that cognitive control was diminished during the negative emotional state. Taken together, these results suggest that sustained states of heighted emotion influenced cognitive control capacity, such that negative emotional stimuli reduced top-down control.

Further evidence highlighting the interactivity between cognitive control and emotion comes from research by Sutton, Altarriba, Gianico, and Basnight-Brown (2007). They used the emotional Stroop task to study emotional processing in a Spanish-English bilingual population. In their study, Sutton and colleagues recruited early Spanish-

English bilinguals. In their responses to a language history questionnaire, participants self-reported to be slightly more dominant in their L2 English. They also reported to have begun speaking Spanish (L1) at an average age of 1.9 years old, and English (L2) at an average of 4.9 years old. In this task, participants are presented with negative emotional stimuli (e.g., *anger*, *fear*, *jealousy*) and neutral stimuli (e.g., *boat*, *car*, *train*) instead of color congruent and color incongruent stimuli. The interference effect in the emotional Stroop task is a result of the emotional content of the stimuli, such that participants experience longer naming latencies to the ink color of emotion words compared to ink colors of neutral words. The emotional Stroop effect has been found in monolingual populations (Okada, He, & Gonzales, 2019; Ben-David, Chajut, & Algom, 2012), therefore it is equally important to understand how experience with two languages affects processing of affective words. In this task, the emotion and neutral words were presented in separate blocks. In order to adapt this task to bilinguals, language was also blocked within each block, such that participants viewed emotion and neutral words in both languages.

The results of the emotional Stroop task revealed a robust phenomenon in this bilingual population: participants demonstrated equal interference effects in both their L1 and L2. These results provide evidence of the automatic activation of the emotional content in words appearing in two languages. Although the study conducted by Sutton et al. (2007) is just one selected study in this review, it provides insight into the complex relationship between bilingualism and emotion. There is mixed evidence as to whether bilinguals process emotions similarly across their two languages, and as this study

indicates, one important variable may be the context in which the two languages were learned.

Of importance is the fact that the study done by Sutton et al. (2007), like the majority of research in this interdisciplinary field, examines affective stimuli that are presented out of context. In other words, the paradigms used require participants to make judgments about isolated words, which is not how language is used in everyday life. The present study does not question the importance and validity of the existing research, but it attempts to understand how bilinguals regulate their emotions through studying their actual language behavior.

**Emotion Regulation Perspective.** Code-switching has been proposed as an emotion regulation strategy based on numerous self-reports and experimental evidence that bilinguals express emotions differently in their two languages. However, this conclusion has been based on the processing of single words (Sutton et al., 2007) and physiological evidence (Harris et al., 2003) without considering actual bilingual language production. In what follows, I will review several recent studies that have examined emotion regulation strategies in actual bilingual speech.

A recent study by Quiñones-Camacho and colleagues (2019) examined bilinguals' emotional reactivity during conversations about experienced emotional events. The authors were interested in how bilinguals use emotion regulation strategies differently depending on the language they are using, as well as how emotion regulation strategies influence physiological reactivity to an emotional event. Young adult Spanish-English bilinguals were recruited to participate in the study. Age of acquisition data was

not provided, however the majority (61%) of participants reported to be English dominant. In their study, each participant watched four video clips. Two video clips were meant to elicit sadness and two were meant to elicit fear. Two of the four clips were introduced by an experimenter speaking Spanish, and the other two were presented by an experimenter speaking English. After each video clip, participants were asked to describe the clip they had just watched and describe a similar experience from their own life. Participants were also asked to think about and describe what they had done to make themselves feel better during that experience. Cardiac psychophysiology was recorded at the beginning of the session as a baseline measure, as well as throughout the entire session. Pre-ejection period (PEP) was used as a measure of myocardial contractility that reflects sympathetic nervous system functioning.

Bilingual speakers transcribed the interviews and coded for six engagement strategies: *problem-focused responding, cognitive reframing; breathing; calming down; accepting emotions; seeking social support.* They found that using fewer engagement strategies was associated with decreased sympathetic arousal. However, this was only the case for bilinguals who were more physiologically aroused at rest and only when they were speaking in English. These results suggest that bilinguals' physiological responses to emotional events depend on the language context they are in. Although this study did not specifically address code-switching, it is novel for two reasons. First, it is the first study that offers insight into understanding how bilinguals use emotion regulation strategies in different linguistic contexts. Second, unlike other laboratory studies, interviews were used to elicit natural speech in the two languages. Pavlenko (2005)

points out that this area of research needs to expand from surveys and laboratory studies to the examination of spontaneous speech in natural settings. Although the interviews took place in a laboratory setting, participants nonetheless produced spontaneous speech.

In another recent paper, Williams and colleagues (2019) examined the association between code-switching and facial emotion behavior. They recruited 68 Chinese American parents (L1 Chinese and L2 English) and children to complete an emotion-inducing puzzle box task. They measured the frequency and directionality of parents' code-switching and valence and intensity of their facial emotion behavior. They found that negative facial emotion behavior predicted subsequent code-switching in both language directions (L1 → L2 or L2 → L1). A stronger association was found for the L2 → L1 direction for negative facial emotion, meaning parents were more likely to switch into their L1 Chinese after exhibiting negative facial emotion. The authors' interpreted their results to suggest that L1 processing might be more automatic, whereas L2 processing is more deliberate. Like the studies described above, these results also support previous findings that emotions are associated differently with the L1 and L2, specifically that L1 is viewed as the more emotional language whereas L2 is associated with less emotional intensity (Pavlenko, 2005). With respect to emotion regulation, the parents' code-switching may have served two different functions. For instance, the parents may have code-switched into their native L1 Chinese to up-regulate anger or discipline. On the other hand, switching into their L2 English may have aided them whichn down-regulating their emotions in order to instruct their child more calmly. In this paradigm,

code-switching may have served an adaptive function, allowing the parents to regulate their emotions.

To my knowledge, the study done by Williams and colleagues (2019) is the first to use observational measures to test the moment-to-moment relationship between code-switching and emotion expression in a conversational context. Previous studies that have found evidence of differences in emotion expression in the L1 and L2 differ in two important ways. First, much research has relied on self-reports, questionnaires, interviews, and experimental tasks as their methods of data collection. While these are all useful to understand how bilinguals express themselves in their two languages, there are also limitations associated with them. For example, self-report measures that assess emotional experiences are not always reliable. Levenson (1999) notes that internal states are often difficult to describe in words, and that many individual differences exist in one's emotional awareness. Also, these types of measures do not address code-switching directly (i.e., naturalistic code-switching). Emotion regulation has been proposed as one of the functions of code-switching, yet researchers have failed to examine actual code-switches produced by bilingual speakers.

Second, and more importantly, previous studies have assessed emotion expression in bilinguals by assessing the two languages separately. While it is important to understand whether bilinguals perceive emotional differences in their two languages, these differences may not translate to how bilinguals use their two languages during spontaneous speech. If we want to understand the relationship between code-switching and emotion regulation, we need to study the two together in conversational contexts.

To my knowledge, only two studies have examined naturalistic speech to understand how bilinguals regulate their emotions through code-switching. The following studies did not address specific emotion regulation strategies like Quiñones-Camacho and colleagues (2019), however they do comment on the role of code-switching with respect to emotion regulation more generally.

Ferreira (2017) analyzed extracts from a spontaneous conversation between a mother and daughter pair who both spoke Spanish and Galician. They agreed to be recorded while talking in their home having everyday conversation. For this bilingual pair, the majority of their dialogue occurred in Spanish, which was also their dominant language. While Spanish is now the official language of Spain, Galician has historically been associated with poverty and ignorance (Del Valle, 2000). Others have also found patterns of switching into Galician to convey a particular conversational tone, such as contempt (Rodríguez Yáñez, 1993). The sociolinguistic dynamic between Spanish and Galician is important in order to understand how switching between them serves as an emotion regulation function.

The aim of Ferreira's analyses was to contextualize Spanish/Galician code-switching during emotive discourse. The selected extracts in this study included gossip and complaints about a third party. Ferreira found that, for this mother-daughter pair, Spanish served as the neutral language from the perspective of emotive involvement. The participants switched into Galician when they wanted to express an affective stance of contempt or criticism of the third party. Contrary to research emphasizing a pattern of switching into the L2 as a mean of detachment, switching into their L2 Galician served as

a means of strengthening a derogatory discourse and shifting the focus of the conversation. The social meanings associated with Galician speak to the idea that language choice serves an important role in emotional expression, and consequently emotion regulation.

The second study to investigate code-switching and emotion regulation in natural speech was done by Ladegaard (2018). In his study, he recruited Filipina and Indonesian domestic migrant workers to share their experiences of migration, the trauma they endured while working abroad, and how they have reconnected with their families after year of separation. The narratives were recorded during sharing sessions that were collected at a church shelter in Hong Kong. While the majority of sharing sessions were comprised of groups of women, some women preferred to share their stories privately with the author. The dominant sharing language was Bahasa, the official language of Indonesia, though the women frequently switched into their L2 English. In Ladegaard's discourse analyses, it was clear that these narratives were full of intense emotion. Commonalities among the women's narrative included stories of abuse, exploitation, and depression. The data demonstrate that the women switched from their L1 (Bahasa) into their L2 (English) when they described these emotionally charged experiences. However, the switch to English was often accompanied by intensive crying after telling. This suggests that even though switching to the less proficient L2 may be associated with less emotion, the narrators were still overwhelmed by emotion. In these narrations, switching to the L2 might have made their traumatic experiences easier to share and discuss. This study offers insight about how language and emotionality are interrelated to one another.

Although this study does not offer conclusive evidence as to whether the L1 is more emotional or the L2 is used for emotional detachment, it does suggest that code-switching can be used an emotion regulation tool.

**The Present Study**

The present study focused on one specific group of bilinguals: heritage speakers. Heritage speakers are individuals who grew up speaking a home language that is not a majority language in the society at large, but who typically became dominant speakers of the majority language (Vargas Fuentes, Kroll, & Torres, 2022). In the United States, heritage speakers constitute the most typical group of bilingual speakers (American Academy of Arts and Sciences, 2017), yet they are also among the least studied. This is especially true for research on emotional processing. Most of the research examining emotional resonance in bilinguals has focused on late sequential bilinguals. Little is known about how individuals who grew up with two languages perceive and express emotions in each of their languages.

There are two overarching goals of this dissertation. The first aim was to examine how individual differences in cognitive control and emotion regulation account for code-switching behavior in bilinguals. With respect to the cognitive domain, previous studies have found evidence suggesting that greater frequency of code-switching positively correlated with better performance on executive function tasks (Verreyt et al., 2016; Emmorey et al., 2009). However, given that language switching and task-switching partially share the same neurocognitive mechanisms (Abutalebi & Green, 2007; Weissberger, Gollan, Bondi, Clark, & Wierenga, 2015), researchers have wondered

whether bilinguals' language switching abilities specifically affect task-switching ability (Hartano & Yang, 2016; Monsell, 2003). Hartano and Yang administered a non-linguistic task-switching task to two groups of bilinguals, habitual code-switchers and non-code-switchers. They found that the habitual code-switchers showed smaller switch costs compared to the non-code-switchers. However, this is not a ubiquitous finding, as several studies have not found evidence of a relationship between language switching experience and task-switching performance (Paap & Greenberg, 2013; Paap & Sawi, 2014; Hernández, Martin, Barcelo, & Costa, 2013). For studies that have found null results, it is possible that researchers did not control for different types of bilingualism (e.g., simultaneous, late, heritage), which would make it difficult to find reliable effects. Although it is difficult to control for all factors related to the bilingual experience, the present study focused on recruiting Spanish-English heritage bilinguals who were early learners of both languages.

As for emotion regulation, I assessed how two different variables relate to code-switching behavior. First, I assessed whether speaking about different affective topics predicts frequency of code-switching. Many studies have found that bilinguals prefer to express certain emotions in one language over the other, particularly with respect to negative affect. I examined whether bilinguals have a language preference when speaking about different affective topics (negative, neutral, positive), and whether the affective topics affect the frequency of their code-switching. Second, I used a questionnaire to assess the strength of emotional expressiveness that bilinguals feel in each of their languages. As Pavlenko (2005) has suggested, some bilinguals feel differently when

speaking in each of their languages, whereas other bilinguals do not report emotional differences. How bilinguals report emotional closeness in each language may affect the frequency and direction of their code-switching behavior while they are talking about different affective topics, as well as in which affective contexts they code-switch. Finally, as an exploratory research question, I asked if flexible use of emotion regulation strategies, as indicated by the FREE Scale (Burton & Bonanno, 2015), predicts code-switching frequency during the affective narrative task. Code-switching has been proposed to be a linguistic skill that makes use of executive control processes such as inhibition and cognitive flexibility (Barac, Bialystok, Castro, & Sanchez, 2014). Bilinguals who regularly switch between languages receive frequent practice managing and resolving linguistic conflict, as well as activating language sets within working memory (Wiseheart, Viswanathan, & Bialystok, 2016). Therefore, it is possible that language switching practice could lead to enhanced flexibility in other domains, such as emotion regulation.

The second major aim was to demonstrate that a relationship exists between cognitive control abilities and use of emotion regulation strategies in a bilingual population. Much of what we know about bilingualism and cognitive control has not considered the role that emotion regulation might play in individual differences. The same can also be said regarding the role that cognitive control abilities might play in the relationship between bilingualism and emotion regulation. Because both cognitive control and emotion regulation involve exerting control to achieve a goal, there is reason to believe that experience in one domain might be related to experience or performance in

the other. Many studies have found a positive relationship between use of emotion regulation strategies and executive functioning such that greater use of reappraisal strategies was associated with higher working memory capacity (Lantrip, Isquith, Koven, Welsh, & Roth, 2016; Marceau, Kelly, & Solowij, 2018; Schmeichel, Volokhov, & Demaree, 2008; Schmeichel & Demaree, 2010; McRae et al., 2012). Other studies have found that difficulties with emotion regulation (e.g., impulse control difficulties, lack of emotional awareness) were associated with better performance on switching tasks (Marceau, Kelly, & Solowij, 2018). However, the relationship between emotion regulation and executive functioning has not been examined with respect to bilingualism. There is mixed evidence as to whether bilinguals experience enhanced executive functioning as a result of possessing two languages (Paap & Greenberg, 2013), and it is possible that individual differences in use of emotion regulation strategies may account for some of that variability. My goal was to take an integrated approach by examining the relationship between the cognitive and affective domains with respect to bilingualism.

To address these questions, a combination of behavioral measures, questionnaires, and conversational data were used. In order to study individuals' language use, participants completed three conversation tasks. The first two tasks (rapport building conversation and code-switching map task) were used to establish a relationship between the participant and the research assistant (RA) confederate. The goal was to make the participant feel comfortable using both languages, and potentially code-switching. The third conversation task asked participants to describe three life events (one negative, one neutral, and one positive event). By asking them to reflect on the emotions they felt

during those events, I expected their narratives to be full of emotional language, and consequently, affect which language(s) they use to describe those events.

To assess individual differences in cognition, participants completed three switching tasks (Navon shape task, Wisconsin Card Sorting Test, and color/shape switching task). A switch cost was calculated as the dependent variable, and a composite measure across the three tasks was planned for use in correlational analyses. Because every cognitive task involves multiple cognitive processes, I used a composite score to represent a better construct of switching ability. To assess emotion regulation behavior, I used two self-report questionnaires. The first questionnaire, Emotion Regulation Questionnaire (ERQ; Gross & John, 2003), asked about use of two specific emotion regulation strategies, cognitive reappraisal and expressive suppression. The second questionnaire, the Flexible Regulation of Emotional Expression Scale (FREE Scale; Burton & Bonanno, 2015), asked about self-perceived abilities to flexibly use different emotion regulation strategies. I used the scores from both questionnaires in correlational analyses as well.

Previous literature has found that some bilinguals express emotions differently in each of their languages. One major finding is that the L1 tends to be the more emotional language, whereas the L2 can be strategically used to distance oneself from emotions they wish to avoid. Although these findings are consistent across many studies, there are several limitations associated with them. For example, most studies have relied on self-reports or experimental paradigms that examine bilinguals' reaction to single, isolated words. With the exception of a few studies (Williams et al., 2019; Ferreira, 2017;

Ladegaard, 2021), researchers have not examined emotion regulation using actual bilingual speech. Additionally, these studies have not directly examined the relationship between cognitive control and emotion regulation abilities in a bilingual population, and how these abilities relate to actual code-switching. My study aimed to fill in these gaps by measuring cognitive control and emotion regulation abilities and by asking how individual differences in these abilities can account for code-switching behavior.

Hypotheses for Aim #1

1. Participants will show greater rates of code-switching while discussing the negative affective topic compared to the positive and neutral topics. I predict that code-switching will be used as a regulatory mechanism, aiding participants to regulate their emotions while discussing a negative life event.
2. I predicted that there will be an inverse relationship between code-switching frequency and task-switching performance. Participants who show greater rates of code-switching during the affective narrative task will also experience smaller switch costs in the switching tasks.
3. I hypothesize that the language participants indicate as their preferred language of emotional expression will be the language they use the majority of the time when discussing the negative and positive topics. For example, if a participant indicates that Spanish is their preferred language for emotional expression, I predict that the majority of their speech while discussing the negative and positive topics will be in Spanish.

4. *Exploratory hypothesis*: Given previous findings that demonstrate the positive relationship between language switching and task-switching (Hartano & Yang, 2016), I predict that overall code-switching frequency in the affective narrative task will correlate with flexibility in use of emotion regulation strategies. In other words, participants who show greater rates of code-switching will also have a higher score on the FREE Scale, suggesting they are able to flexibly regulate their emotions.

Hypotheses for Aim #2

5. Participants who experience smaller switch costs (as measured by the composite switch cost score) in the switching tasks will also show a greater tendency to rely on cognitive reappraisal strategies as opposed to expressive suppression (consistent with prior studies such as McRae et al., 2012).

Because both cognitive control and emotion regulation involve exerting control to achieve a goal, there is reason to believe that experience in one domain might be related to experience or performance in the other.

# Chapter 2

# Method

## Participants

Fifty participants were recruited from introductory psychology courses at the University of California, Riverside between the ages of 18 and 27 ($M$ = 19.6, $SD$ = 1.83). A screening questionnaire was given to participants via an online research portal to identify bilinguals who meet the inclusion criteria. Only bilinguals who met all the inclusion criteria were included in the study. Participants were required to identify as female, to have spoken Spanish since childhood, and to self-report to have native-like proficiency in both Spanish and English. I recruited only individuals who identified as female because previous research has suggested that women tend to share more intimate information in conversation with other women, compared to male dyads (Jansz, 2000). Forty-three participants reported English as their dominant language.

## Materials and Procedure

Three Spanish-English bilingual research assistants (RA) were trained to be confederates in this study. The confederates were all native speakers of both languages and frequently code-switch in their everyday lives. During the training period, they completed the three conversation tasks with four different speakers (two speakers were the other RAs and the other two speakers were pilot participants). They were instructed to code-switch as much as possible during the three conversations. They were not instructed how to code-switch, but instead asked to code-switch as they normally do in everyday

life. At the end of each training session, the RAs listened to all three conversations and transcribed the affective narrative conversation.

Upon arrival, participants were consented and then asked to complete cognitive tasks, conversation tasks, and one questionnaire in the order in which they are listed below. The session lasted approximately two hours. The confederate was introduced as if she were another participant in the session. She was the participant's partner for the three conversation tasks at the end of the session.

**Questionnaires.** Prior to the in-person testing session, participants completed the three online questionnaires (Emotion Regulation Questionnaire, Flexible Regulation of Emotional Expression Scale, and Language History Questionnaire). The final questionnaire, the Emotional Closeness Questionnaire, was completed at the end of the session after the affective narrative conversation.

***Emotion Regulation Questionnaire (ERQ).*** The ERQ (Gross & John, 2003) is a 10-item self-report questionnaire based on Gross's (1998) process model of emotion regulation that measures the use of two emotion regulation strategies: cognitive reappraisal and expressive suppression. Cognitive reappraisal is an antecedent-focused strategy, where a person attempts to change how they think about a situation in order to change its emotional impact. Expressive suppression, on the other hand, is a response-focused strategy, where a person attempts to inhibit the behavioral expression of their emotions. The items use a 7-point Likert scale with responses ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Separate scores were derived for the two strategies, with higher scores indicating higher usage of that strategy (Gross & John, 2003).

***Flexible Regulation of Emotional Expression Scale (FREE scale).*** The FREE scale, created by Burton and Bonnano (2016), is a 16-item self-report and scenario-based questionnaire that assess an individual's perceived ability to express and suppress emotions given specific positive and negative contexts. The measure identifies two second-order factors (Enhance and Suppress) and four first-order factors (Enhance Positive, Enhance Negative, Suppress Positive, and Suppress Negative). All items are rated on a 6-point Likert scale with responses ranging from 1 (*unable*) to 6 (*very able*). A FREE flexibility score was calculated based on participants' overall sum of enhancement and suppression scores. Higher FREE scores are associated with greater flexibility in emotion regulation.

***Language History Questionnaire (LHQ).*** This in-house questionnaire (based upon the LHQ created by Li, Zhang, Tsai, & Puls, 2014) assessed several self-reported factors associated with the bilingual experience, such as age of acquisition of each language, proficiency (reading, writing, speaking, and understanding) in each language, frequency of use of each language, and frequency of code-switching. Proficiency scores were rated on a scale from 1-7 (1 = "Very Poor", 7 = "Native-like"). Frequency of use was rated on a scale from 1-10 (1 = "Never", 10 = "Always"). Frequency of code-switching was rated on a scale from 1-5 (1 = "Never", 5 = "Always").

***Emotional Closeness Questionnaire (ECQ)***. This final questionnaire was an adapted version of the Bilingualism and Emotions Questionnaire (Dewaele & Pavlenko, 2001-2003). The questionnaire consisted of questions that used a 5-point Likert scale and open-ended questions inquiring about how participants express emotions in each of their

languages. The rating scale questions asked about the expression of anger and feelings to different interlocutors, as well as language choice for swearing and perceived emotional weight of swear words. The open questions asked about the emotional significance of each language, as well as their preferred language for recalling bad or difficult memories. Participants were also asked whether it was easier or more difficult to talk about emotions in the different languages.

The purpose of this questionnaire was to provide a qualitative assessment of how bilinguals use their two languages in different emotional contexts and with different interlocutors.

**Cognitive Tasks.** The following three switching tasks were administered on a Dell Precision 3420 computer running Windows 7 Professional. Stimuli for the Navon shape task and Wisconsin Card Sorting Test were presented online using the PsyToolkit platform (Stoet, 2010, 2017). The color/shape task was presented via E-Prime 2.0 (Psychology Software Tools, Pittsburgh, PA). I collected both accuracy and reaction time (RT) data for all three tasks.

***Navon Shape Task.*** A modified version of the Navon task (Navon, 1977) from PsyToolkit (Stoet, 2010, 2017) was used to assess task-switching. Since the available version of the Navon task on this platform uses letters, I replaced the letter stimuli with shape stimuli created using Adobe InDesign (Adobe Inc., 2019) to ensure that the cognitive task was void of linguistic information. In this switching task, attentional flexibility was tested by manipulating switching between global and local levels of a visual stimulus. Participants were presented with a compound stimulus, consisting of a

large global shape made of smaller local shapes (squares, circles, diamonds, and triangles). The larger shape contained approximately 18 smaller shapes. Stimuli appeared as white shapes on a black background. On each trial, participants indicated whether a square or circle was present, which could be at the global (larger shape) or local (smaller shapes) level. For each stimulus, the global shape and the local elements were different (incongruent displays, such as a large square made up of smaller diamonds). Squares and circles were never paired together. In other words, participants never saw a large square made of small circles, or a large circle made of small squares. Participants responded with the A key if a square was present or the L key if a circle was presented. All stimuli appeared for 300 ms per trial with an inter-trial period of 600 ms. Participants were given feedback after each trial with a colored fixation cross. The task began with eight practice trials followed by 128 experimental trials. The experimental trials were divided into two blocks that were pseudorandomized, such that participants never saw more than four consecutive trials of global or local stimuli.

To assess attentional flexibility in this task, the switch cost was calculated as the difference in RTs between correct responses on switch trials (change in categorization/focus compared to previous trial) and correct responses on non-switch trials (same categorization/focus as in previous trial) (Navon, 1977).

***Wisconsin Card Sorting Task (WCST).*** The PsyToolkit (Stoet, 2010, 2017) computerized version of the WCST (Berg, 1948) was used to assess set-shifting. In this task, participants were asked to classify cards on a computer screen according to different criteria. The WCST consisted of two identical sets of 60 response cards whose elements

differed on three sorting dimensions: color (red, blue, yellow, or green), form (crosses, circles, triangles, or stars), and number of figures (one, two, three, or four). Four target cards represented the range of dimensions and participants matched a separate card to one of the four targets. Participants were informed as to whether each response was correct or incorrect, but at no point were they explicitly told how the cards would be sorted. Once the participant correctly sorted 10 consecutive cards, the classification rule changed without warning. Once the rule changed, participants typically made at least one or more errors in an attempt to discern the new rule. The procedure continued until the participant completed each of the three sorting categories twice.

Number of perseverative errors were used as the switch cost for this task. Perseverative errors occur when the participant continues with the same response strategy following a rule switch, committing the same error repeatedly. Because this task does not alert participants of a rule change, all participants made some mistakes in order to figure out the new sorting rule.

***Color/shape Switching Task.*** In this task-switching paradigm, participants made color and shape judgments on visually presented stimuli. This task followed the same procedure as Prior and Gollan (2011). The stimuli consisted of two possible shapes (circle or triangle), in one of two possible colors (red or green). Participants responded to stimuli by pressing two keys on a keyboard (keys A or L). At the beginning of each trial, a fixation cross was presented for 350 ms, followed by a 150-ms blank screen. An instructional task cue then appeared above the fixation cross for 250 ms. The cue for the color task was a picture of a color gradient, and the cue for the shape task was a row of

small squares. Cues were always valid predictors. The cue remained on the screen until the target appeared. Both the cue and target remained on the screen until the participant responded, or for a maximum of four seconds. Participants only received feedback for incorrect responses, which consisted of a 100-ms beep. An 850-ms inter-trial blank screen was presented before the start of the next trial.

The task consisted of three parts, comprising a sandwich design. First, participants completed two single-task blocks (color and shape; order counterbalanced across participants). Each block began with eight practice trials, followed by 36 experimental trials. Second, participants completed 16 mixed-task practice trials, followed by three blocks of mixed-task experimental trials. Each mixed-task block had 48 trials. In each mixed block, half of the trials were switch trials and the other half were non-switch trials (of both color and shape tasks). The trials were randomly ordered with a maximum of four consecutive trials of the same type. Two dummy trials were added at the beginning of each block and were not included in the analysis. Finally, in part three, participants completed the same two single-task blocks, however the blocks were presented in the opposite order from the first part. The sandwich design of this task enabled comparisons of 72 switch trials, 72 non-switch trials, and 144 single-task trials (72 color and 72 shape).

The dependent measure of switching for this task was calculated as 36ifferrence in RTs between switch and non-switch (repeat) trials within the mixed-task block (Prior & Gollan, 2011).

**Conversation Tasks.** The following two conversation tasks were used to create a relationship and establish a connection between the confederate and participant. Participants completed the rapport building conversation and then the code-switching map task. The goal of the rapport building conversation was to establish a connection between the two based on commonalities they share. For example, they were both students and Spanish-English bilinguals. However, because they are not necessarily from the same linguistic communities, it was important that they know some background information about each other, to the point where they would feel comfortable using both of their languages with each other. If successful rapport was established between the pair, it is likely that the participant would feel comfortable code-switching with the confederate during the subsequent code-switching map task and affective narrative task. The code-switching map task was included in this study because it has shown to be an effective task for eliciting code-switching (Beatty-Martinez & Dussias, 2017). Although the rapport building conversation and code-switching map task are not central to my hypotheses, they are critical for inducing an environment where both languages are used by the participant. Data from the rapport building conversation and code-switching map task will not be included in this study.

***Rapport Building Conversation.*** In this conversation task, the participant and confederate received a list of conversation topics to discuss. Because both the confederate and participant were students, some conversation topics were about what they are studying, what organizations they are involved with on campus, where their families are from, and how they learned both of their languages. All of the topics were written in

Spanish to encourage participants to use Spanish. Given that most participants were English-dominant, I expected that they would primarily use English otherwise. The participant and confederate alternated reading the topics. Importantly, they were told that they were free to use both of their languages. There was not a specified time limit to discuss each topic. The main objective of this task was to build a relationship between the participant and the confederate so that the participant would feel comfortable code-switching during the map task and affective narrative task. Previous research has shown that bilinguals may produce four times as many code-switches in informal contexts when they are paired with an in-group interlocutor (Poplack, 1983). If the participant feels comfortable interacting with the confederate, there is a greater chance they will naturally engage in code-switching during the other tasks.

***Code-switching Map Task.*** The goal of this corpus elicitation task was to examine participants' language use, specifically with respect to code-switching. To assess language use, a map task adapted from Beatty-Martinez, Navarro-Torres, and Dussias (2020) was employed in which pairs of director-matcher speakers work together to reproduce the director's map. The participant and confederate each sat with their own computers opposite of each other and took turns playing the role of the director and matcher. The director-matcher pairs took turns describing visual scenes (i.e., maps) to one another within a specific time frame. There were six maps and the pair had two minutes to complete each map (see Figure 1). For each map, the director gave instructions to the matcher instructing her where to move the objects on the screen using the mouse. Director and matcher maps differed only in terms of the way objects were

arranged on the computer screen. Each map contained background objects that are fixed, as well as moveable objects that the matcher had to move based on the director's instructions. All objects were presented in color in order to elicit more detailed descriptions.

Although the confederate's utterances were not scripted, she used both Spanish and English and actively engaged in code-switching, with the goal of priming the participant to also code-switch.

*Figure 1*. Example of map with moveable objects.

***Affective Narrative Task.*** In this narrative task, the confederate asked the participant to describe three different life experiences. Each life experience corresponded

with three affective topics: positive, neutral, and negative, and all participants responded to the topics in that order. I did not counterbalance the order of the topics because I was interested in examining individual differences across the three topics. There was not a time limit for any topic, and participants were told they could use both of their languages. The experimenter told the pair that the participant will complete all three narratives first, followed by the confederate. However, because the aim of this task was to elicit speech from the participant, the experimenter revealed the identity of the confederate after the participant completed all three topics and ended the task.

The goal of this narrative task was to examine participants' language use while discussing three affective topics. For the neutral topic, participants described a typical weekday and weekend in their life. Participants also described, in detail, one low and one high point of their life for the negative and positive topic, respectively. For the negative and positive topics, participants were specifically asked to describe how they felt during those periods in their life.

Spanish-English bilingual research assistants transcribed both the participant's and confederate's speech using Excel. The R package tidytext was used to calculate word count (Silge & Robinson, 2016).

# Chapter 3

## Results

In this section, I will first characterize this sample of bilinguals by examining demographic information from the Language History Questionnaire (LHQ), language production behaviors from the affective narrative conversation, performance on cognitive control tasks, and responses to emotion regulation questionnaires. I will then report the correlations and multiple regressions I conducted to address my hypotheses.

### Sample Characteristics

**Language History Questionnaire.** As part of the Language History Questionnaire (LHQ), participants were asked to self-report their current proficiency in English and Spanish, the age at which they learned each language (AoA), how frequently they are exposed to and use English and Spanish, and how frequently they code-switch (see Tables 1 and 2). Code-switching frequency was further broken down into four sub-categories: intrasentential switching, intersentential switching, situation switching, and topic switching (see Table 2).

Table 1.
*Means and (SDs) characterizing the self-reported language proficiency for English and Spanish from the LHQ.*

| | English | Spanish |
|---|---|---|
| Proficiency | | |
| Speaking | 6.73 (0.53) | 6.20 (0.79) |
| Reading | 6.73 (0.57) | 5.95 (0.87) |
| Writing | 6.54 (0.71) | 5.56 (1.01) |
| Understanding | 6.83 (0.38) | 6.56 (0.68) |
| Current exposure | 9.63 (1.18) | 9.22 (2.57) |
| Current use | 8.04 (1.65) | 7.55 (2.52) |
| AoA (years) | 3.53 (1.87) | 1.89 (1.68) |

On average, participants were highly proficient in both English ($M$ = 6.71, $SD$ = 0.57) and Spanish ($M$ = 6.01, $SD$ = 0.91). There were no statistical differences between languages in any of the self-report proficiency measures, $t$s < 1. The results verify that the sample was comprised of early, balanced bilinguals who reported using both languages equally in their daily lives.

Table 2.
*Means (SDs) and Pearson correlation matrix (n=49) for code-switching sub-categories from the LHQ.*

| | Mean | SD | 1 | 2 | 3 |
|---|---|---|---|---|---|
| 1. Intrasentential switching | 2.88 | 1.15 | - | | |
| 2. Intersentential switching | 2.61 | 1.09 | **.68**[a] | - | |
| 3. Situation switching | 4.04 | 0.91 | **.40**[a] | .13 | - |
| 4. Topic switching | 3.14 | 1.17 | **.54**[a] | **.44**[a] | **.34**[b] |

[a]p < .01
[b]p < .05

With respect to code-switching frequency, there were statistically significant differences between self-reported code-switching sub-categories ($F(3,192) = 15.97$, $p < .001$, see Table 2). Tukey's HSD Test for multiple comparisons found that participants engaged more frequently in situation switching compared to intrasentential switching ($p < .001$), intersentential switching ($p < .001$), and topic switching ($p < .001$). The difference between situation switching and topic switching was trending toward a significant difference ($p = .07$). However, there was no statistical difference between intrasentential and intersentential switching ($p = .62$). All code-switching sub-categories were intercorrelated except for intersentential switching and situation switching ($p = .39$) – see Table 2, right panel.

**Affective Narrative.** Across all three narrative conditions, the word counts indicated that participants spoke significantly more English than Spanish, $t(49) = 12.76$, $p < .001$ (Figure 2). A one-way ANOVA revealed a significant difference in word count

among the three topics, $F(3, 135) = 9.53$, $p < .001$ (Figure 2). Tukey's HSD Test for multiple comparisons revealed that participants spoke significantly more in the negative topic compared to the positive ($p = .013$) and the neutral topics ($p < .001$). There was no significant difference in word count between the positive and neutral topics.

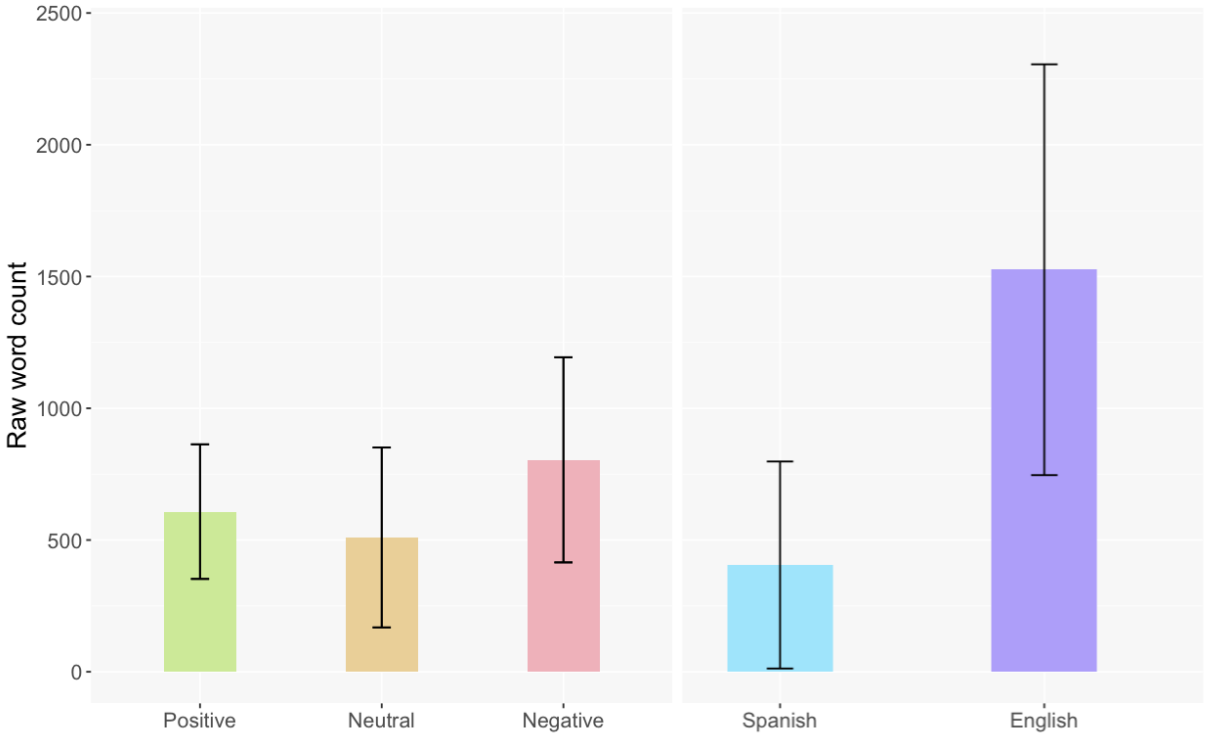


*Figure 2*. Raw word counts for the affective narrative broken down by topic and language.

A one-way ANOVA was conducted that analyzed the effect of topic on proportion of Spanish words produced (Figure 3). The proportion was calculated by

dividing the Spanish word count by the total word count for each topic[2]. There was a significant difference in the proportion of Spanish words produced among the three topics, $F(3, 132) = 5.44$, $p = .005$. Tukey's HSD Test for multiple comparisons revealed that participants produced significantly more Spanish in the positive ($p = .007$) and neutral topics ($p = .03$) compared to the negative topic. There was no significance difference between the positive and neutral topics.

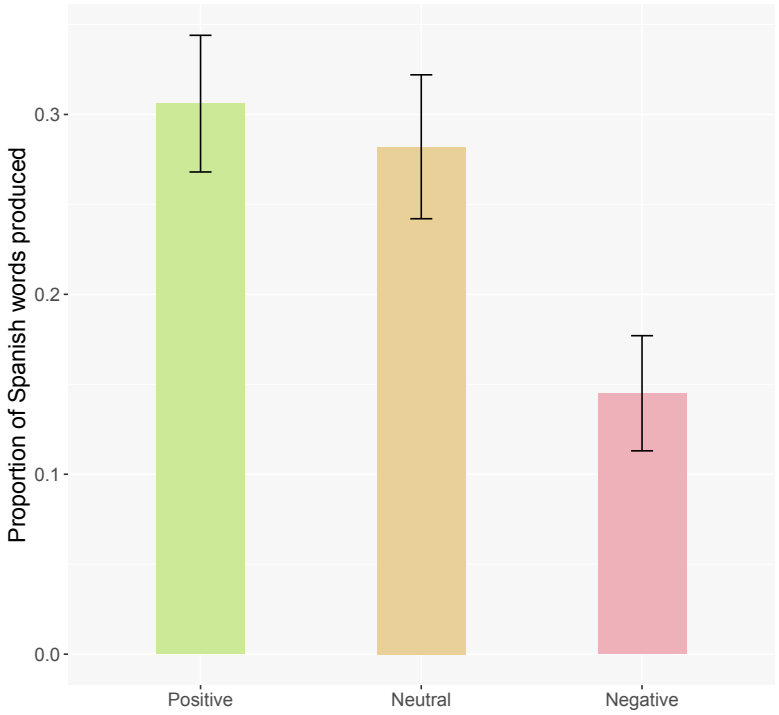


*Figure 3*. Proportion of Spanish words produced for each affective narrative topic.

Next, I examined individual differences in the amount of code-switching that participants produced in each topic and overall. To calculate code-switching frequency

[2] The proportions of Spanish and English produced summed to the overall word count. The English proportion is the complement of the Spanish proportion and will not be reported.

for each topic, I divided the number of code-switches by the total word count for that category for each participant. While not a true percentage of code-switching frequency, this method standardizes code-switching frequency based on how much each participant speaks. There was a statistically significant effect of topic on code-switching frequency, $F(2, 135) = 3.08$, $p = .049$. Post-hoc comparisons using Tukey's HSD test indicated that participants code-switched significantly more frequently during the positive topic than the negative, $p = .038$ (see Figure 4). There was no significant difference between the negative and neutral, nor the positive and neutral, topics.

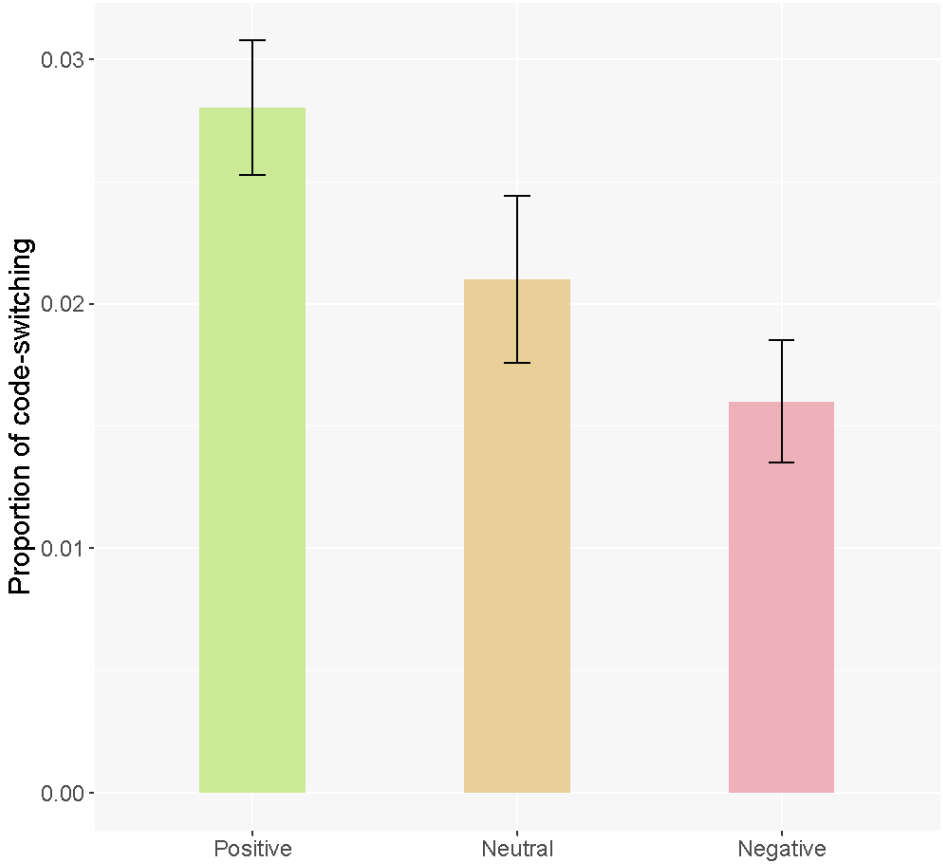


*Figure 4*. Proportion of code-switching across for each affective narrative topic.

Finally, I examined the three confederates' speech. There was not a significant difference in the average number of words spoken by each RA ($p = .07$). On average, confederate #1 spoke 462 words, confederate #2 spoke 642 words, and confederate #3 spoke 831 words. However, there was a significant difference in code-switching frequency, $F(2, 43) = 11.21$, $p < .001$. Confederate #3 code-switched more frequently than confederate #1 ($p < .001$) and confederate #2 ($p = .03$). There was not a significant difference in the amount of Spanish and English used by the confederates ($p > .05$).

Across all three confederates, confederates' code-switching frequency did not predict participants' code-switching frequency, $r(49) = .12$, $p = .45$. Separately for each confederate, I correlated the amount of code-switching of the confederate when speaking to a given participant with that participant's amount of code-switching. The separate correlations for each of the confederates were not significant either.

To summarize the affective narrative results thus far, participants spoke significantly more English than Spanish across the three topics. They also spoke significantly more in the negative topic compared to the positive and neutral topics. When broken down by language and topic, participants used significantly more Spanish in the positive topic compared to the negative topic. Finally, one of the RAs code-switched significantly more frequently than the other two, but there was no relation between the frequency of code-switching for confederates and participants.

**Cognitive Control**. The switch cost for the Navon shape task and color/shape task was calculated using RT, whereas number of perseverance scores was used for the WCST. First, a correlation matrix was calculated to determine whether the three tasks

were correlated with one another (see Table 3). Only the Navon shape and color/shape tasks were significantly correlated with one another.

Table 3.
*Correlation matrix for WCST, Navon shape task, and color/shape task.*

| | WCST | Navon shape |
|---|---|---|
| WCST | - | |
| Navon shape | .007 | - |
| Color/shape | .12 | .36* |

*p < .05

I originally planned to use a composite switch cost by converting the three measures to *z* scores and then averaging the three scores to measure cognitive control. However, because the WCST did not correlate with the other two tasks, I ran separate analyses using two different scores: the 2-composite switch cost and the raw WCST perseverance scores.

**Emotion Regulation (ER) Questionnaire Data**. For the FREE Scale, the overall FREE score was calculated as the sum of the expressive enhancement and expressive suppression ability scores. The average FREE score was 66.75 (*SD* = 9.09), with the highest score possible being 96.

To assess emotion regulation behavior, two questionnaires were given to participants. For the ERQ, the average rating for cognitive reappraisal was 4.54 (*SD* = 0.86), whereas the average rating for expressive suppression was 3.97 (*SD* = 0.85).

Participants reported a significantly greater tendency to use cognitive reappraisal compared to expressive suppression, $t(49) = 3.63$, $p < .001$. These strategies were not correlated with each other, $r(50) = .15$, $p = .26$.

Finally, in the Emotional Closeness Questionnaire, participants were asked to rate how emotional they perceived Spanish and English to be using a scale from 1-5 (1 = "Not at all", 5 = "Absolutely"). See Table 4 for participants' average ratings broken down by language and language order. Eight participants listed English as their L1 and 41 participants listed Spanish as their L1. The mean rating for L1 being emotional (combined across Spanish and English) was 4.41 ($SD = 0.98$), whereas the mean rating for L2 being emotional was 4.06 ($SD = 0.97$). A paired samples $t$-test revealed that there was not a significant difference between L1 and L2 ratings, $t(48) = 1.76$, $p = .08$. The average rating for Spanish being emotional (combined across L1 and L2) was 4.49 ($SD = 0.87$), whereas the average rating for English being emotional was 3.98 ($SD = 1.03$). There was a significant difference between Spanish and English (combined across L1 and L2), $t(48) = 2.69$, $p = .01$, such that participants rated Spanish as being more emotional compared to English.

None of the means in Table 4 differed according to independent sample t-tests, $t$s $< 1$.

Table 4.
*Means and (SDs) from the Emotional Closeness Questionnaire (ECQ)*

| | L1 | L2 |
|---|---|---|
| Spanish | 4.46 (0.89) | 4.63 (1.36) |
| English | 4.13 (0.74) | 3.95 (0.97) |

Participants also reported how likely they were to use English, Spanish, or both with other Spanish-English bilingual friends, or with their parents, when expressing deep feelings using a scale from 1-5 (1 = "Never", 5 = "All the time", see Table 5). There was a significant difference in self-reported language preference with bilingual friends, $F(2, 138) = 23.28$, $p < .001$. Tukey's HSD Test for multiple comparisons found that participants are more likely to use English than Spanish ($p < .001$) or both ($p < .001$). However, there was no statistical difference between Spanish and both ($p = .72$). There was also a significant difference in self-reported language use with parents, $F(2, 126) = 30.68$, $p < .001$. Tukey's HSD Test for multiple comparisons found that participants are more likely to use Spanish than English ($p < .001$) or both ($p < .001$). However, there was no statistical difference between English and both ($p = .61$).

Table 5.
*Means and (SDs) from the Emotional Closeness Questionnaire (ECQ)*

| | English | Spanish | Both |
|---|---|---|---|
| Bilingual friends | 4.39 (0.79) | 3.02 (1.18) | 3.19 (1.14) |
| Parents | 2.67 (1.43) | 4.5 (0.83) | 2.86 (1.46) |

Participants also reported which language they prefer to use to express their emotions in one of the open-ended questions. Twenty participants reported English, four reported Spanish, and 24 reported both. However, because language use and emotion expression depend on a variety of factors, I asked participants to describe the relationship between language and emotion in a series of open-ended questions.

When asked which language participants prefer to use when recalling bad or difficult memories, 30 participants indicated English and three indicated Spanish. Nine participants stated that they feel comfortable using both languages, whereas four participants mentioned that they prefer to use a mix of Spanish and English.

When asked if their languages have different emotional significance, 16 participants responded "no" and 32 responded "yes." For those who responded "yes," some participants went into detail and described how they perceived each language in terms of emotional significance (see Table 6).

Finally, participants were asked whether it was easier or more difficult to talk about emotions in their second language. For participants who reported English as their second language ($n$ = 8), seven of them said that it was more difficult to talk about emotions in Spanish. The eighth participant said that it was equally easy to express emotions in both languages. For the participants who reported Spanish as their second language ($n$ = 41), 25 of them said it was more difficult to talk about emotions in Spanish and only one participant said Spanish was easier. Twelve participants said both languages were equally easy and two said that it depended on the emotion they were expressing.

To summarize findings from the ERQ, participants reported to have a greater preference for cognitive reappraisal compared to expressive suppression. From the ECQ, participants reported a strong preference for using English when expressing emotions. Most participants reported Spanish as the more emotional language, however, their open-ended responses seemed to suggest that they strategically use English to distance themselves from negative emotions.

Table 6.
*Participants' descriptions of how they perceive emotional significance differences in both languages from the Emotional Closeness Questionnaire*

| | *N* |
|---|---|
| Spanish is | |
| More emotional | 10 |
| Connected to family/culture | 5 |
| Sincere | 3 |
| Powerful | 2 |
| Serious | 2 |
| Direct | 1 |
| Descriptive | 1 |
| More authentic | 1 |
| Personal | 1 |
| Colorful | 1 |
| Prettier | 1 |
| English is | |
| More emotional | 9 |
| More comfortable | 2 |
| Has an extensive vocabulary | 2 |
| Professional | 1 |
| Cold | 1 |
| Direct | 1 |
| Casual | 1 |
| Less connected | 1 |
| More accurate | 1 |
| More serious | 1 |

## Correlations

**Affective Narrative and LHQ Correlations.** I predicted that the following self-report variables would positively correlate with the affective narrative overall code-switching frequency: Spanish proficiency (speak, understand, read, write), Spanish use, Spanish exposure, and self-reported code-switching frequency (average of intrasentential, intersentential, topic switching, situation switching scores). Only self-reported code-switching frequency significantly correlated with actual code-switching frequency, $r(50) = .41$, $p = .005$. Self-reported Spanish understanding was trending toward significant, $r(50) = .29$, $p = .057$. Scatterplots were inspected and were determined to have appropriate range and variability.

I also correlated the self-report variables (Spanish proficiency, Spanish use, Spanish exposure, and code-switching frequency) with the proportion of code-switching frequency for each of the affective narrative topics. Self-reported code-switching frequency significantly correlated with actual code-switching frequency in the positive ($r(49) = .42$, $p = .005$) and negative ($r(49) = .48$, $p = .001$) narratives. Self-reported Spanish understanding significantly correlated with actual code-switching frequency in the positive topic ($r(49) = .33$, $p = .029$) and was trending towards significant in the neutral topic ($r(49) = .28$, $p = .07$).

**Affective Narrative and Cognitive Control Correlations.** I was interested in understanding how individual differences in code-switching frequency in the affective narrative could be explained by variation in task-switching performance. I predicted that individuals with a smaller switch cost score would code-switch more frequently during

the affective narrative. There was no relation between overall code-switching frequency and the 2-composite switch score, $r(48) = -.008$, $p = .95$. This 2-composite switch score also did not correlate with code-switching frequency in any of the three topics. There was also a negative correlation between overall code-switching frequency and the WCST, however the relationship was not significant either, $r(48) = -.25$, $p = .09$.

Because the correlation for the WCST and overall code-switching frequency was trending toward significance, I examined whether the WCST correlated with code-switching frequency for each of the three topics individually. There was a significant negative correlation between code-switching frequency and the WCST only for the negative topic, $r(48) = .-.31$, $p = .04$ (see Figure 5).

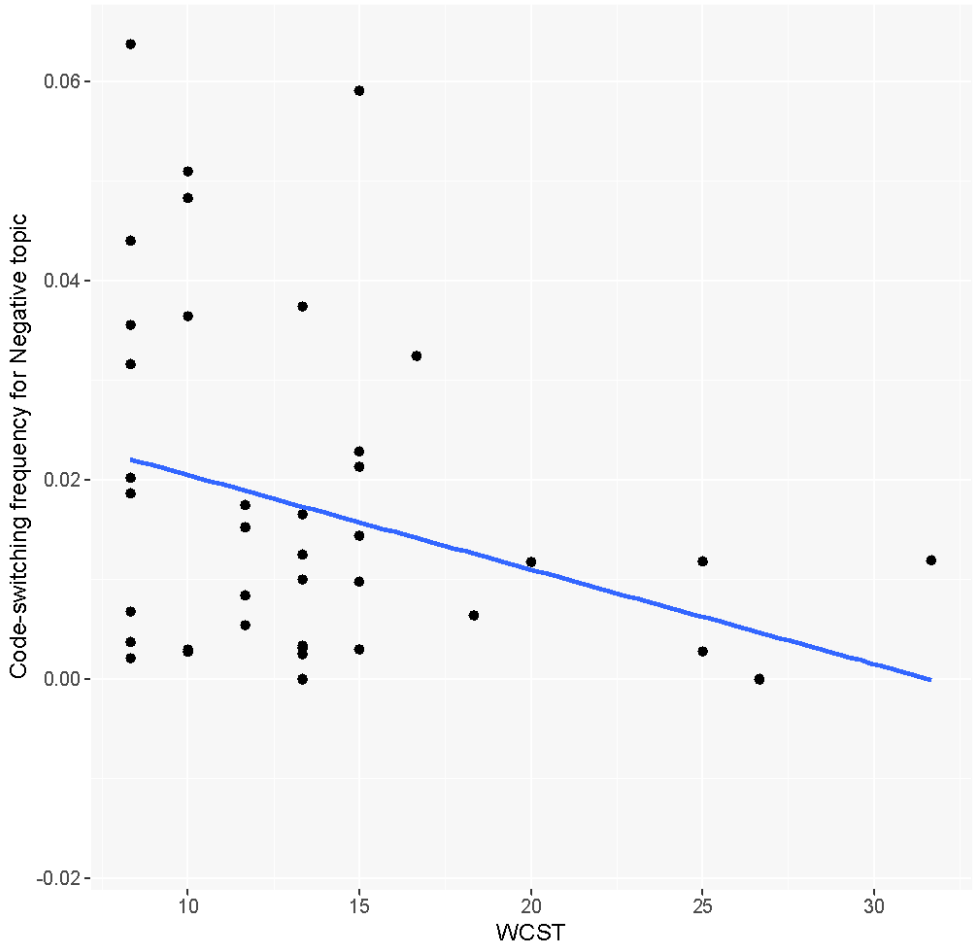


*Figure 5*. A negative relationship between code-switching frequency in the negative topic and the WCST. Individuals who had fewer errors on the WCST code-switched more frequently during the negative topic.

**Affective Narrative and ER Questionnaires Correlations.** For the FREE scale, there was a significant, positive correlation between the FREE score and overall code-switching frequency ($r(49) = .31$, $p = .04$), such that greater flexibility in emotion regulation predicted greater rates of overall code-switching (see Figure 6). I also examined how the FREE score related to code-switching frequency in each topic. The FREE score also significantly correlated with code-switching frequency only in the

negative topic, $r(49) = .34$, $p = .02$), such that greater flexibility in emotion regulation predicted greater rates of code-switching in the negative topic.

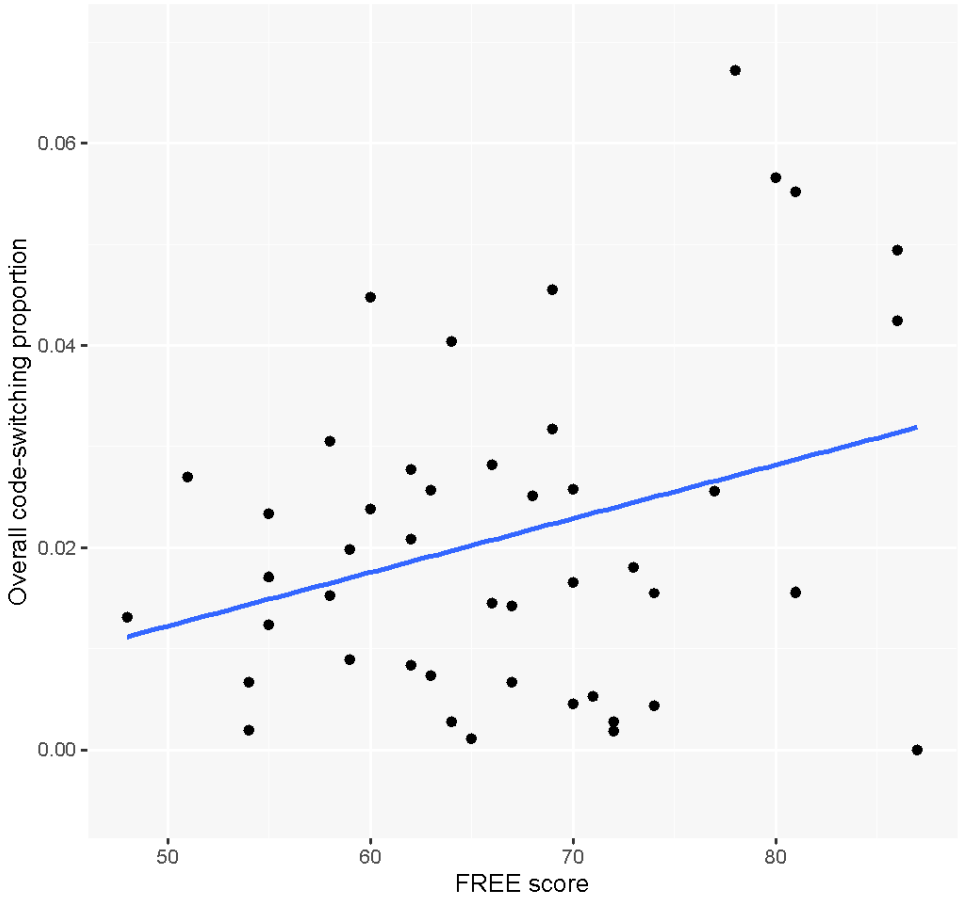


*Figure 6*. A positive relationship between overall code-switching frequency and FREE score.

Next, I examined whether the emotion regulation questionnaire variables predicted overall affective narrative code-switching frequency. For the ERQ, only expressive suppression significantly correlated with overall code-switching frequency, $r(49) = .33$, $p = .02$ (see Figure 7). Individuals who reported a greater tendency to use expressive suppression also code-switched more frequently during the affective narrative.

There was no correlation between use of cognitive reappraisal and overall affective narrative code-switching frequency, $r(48) = -.16$, $p = .29$.

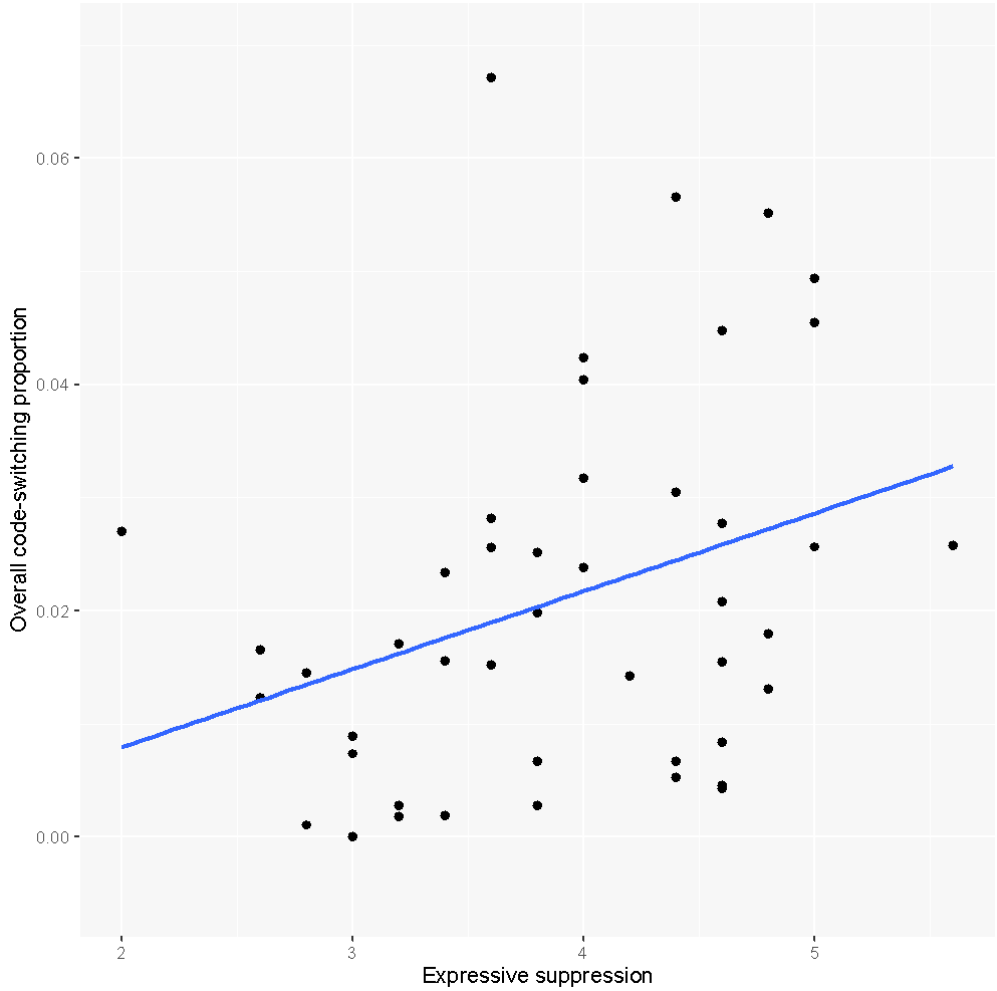


*Figure 7*. A positive relationship between overall code-switching proportion and expressive suppression scores.

Next, I examined how expressive suppression and cognitive reappraisal related to code-switching frequency in each topic. Code-switching frequency in the positive ($r(49) = .29$, $p = .045$) and negative ($r(49) = .35$, $p = .02$) topics positively correlated with expressive suppression scores. No correlation was observed for the neutral topic. There

were no correlations between use of cognitive reappraisal and affective narrative code-switching frequency in any of the three topics.

Finally, I examined whether emotional ratings of Spanish and English predicted how much participants spoke in those languages. I predicted that the language that participants rated as more emotional would also be the language that they spoke the most during the affective narrative conversation. I correlated participants' emotional ratings of Spanish and English with the proportion of Spanish and English words spoken in each topic and overall. The emotional rating of Spanish did not significantly predict the proportion of Spanish words spoken in each topic or overall. However, the emotional rating of English did significantly predict the proportion of English words spoken during the positive topic, $r(50) = .32$, $p = .03$, such that the higher participants rated English as being emotional, the more English they spoke during the positive topic. The emotional rating of English did not significantly predict the proportion of English words spoken during the neutral topic, negative topic, or overall.

Several factors predicted actual code-switching frequency during the affective narrative. As expected, self-reported code-switching frequency positively correlated with actual code-switching frequency overall. Performance on the WCST negatively correlated with code-switching frequency, however this was only true for the negative topic. Fewer errors on the WCST predicted greater rates of code-switching during the negative topic. Expressive suppression from the ERQ was associated with greater code-switching frequency for the positive topic, negative topic, and overall. Similarly, the FREE score was associated with greater code-switching frequency only in the negative

topic. Lastly, participants' emotional rating of English was associated with greater uses of English during the positive topic.

**Cognitive Control and ER Questionnaire Correlations.** Because cognitive control and emotion regulation are two types of self-regulation, I hypothesized that there would be a negative relationship between the task-switching score(s) and responses on the emotion regulation questionnaires (ERQ and FREE scale). I predicted that smaller task-switching scores, reflecting better performance would correlate with larger scores on the emotion regulation questionnaires. There was no relationship between the 2-composite switch cost and cognitive reappraisal score, $r(49) = .06$, $p = .67$. I also correlated the WCST error score and cognitive reappraisal and did not find a significant relationship between the two variables, $r(48) = .07$, $p = .66$. There was also no correlation between the WCST error score and expressive suppression, $r(48) = -.23$, $p = .14$.

As an exploratory hypothesis, I predicted that there would be a negative relationship between the 2-composite switch score and the overall FREE score, but none was observed, $r(49) = .19$, $p = .21$. However, the WCST significantly correlated with the overall FREE score, such that fewer perseverative errors were associated with higher FREE scores (i.e., greater flexibility in regulating emotions), $r(49) = -0.34$, $p = .02$ (see Figure 8).

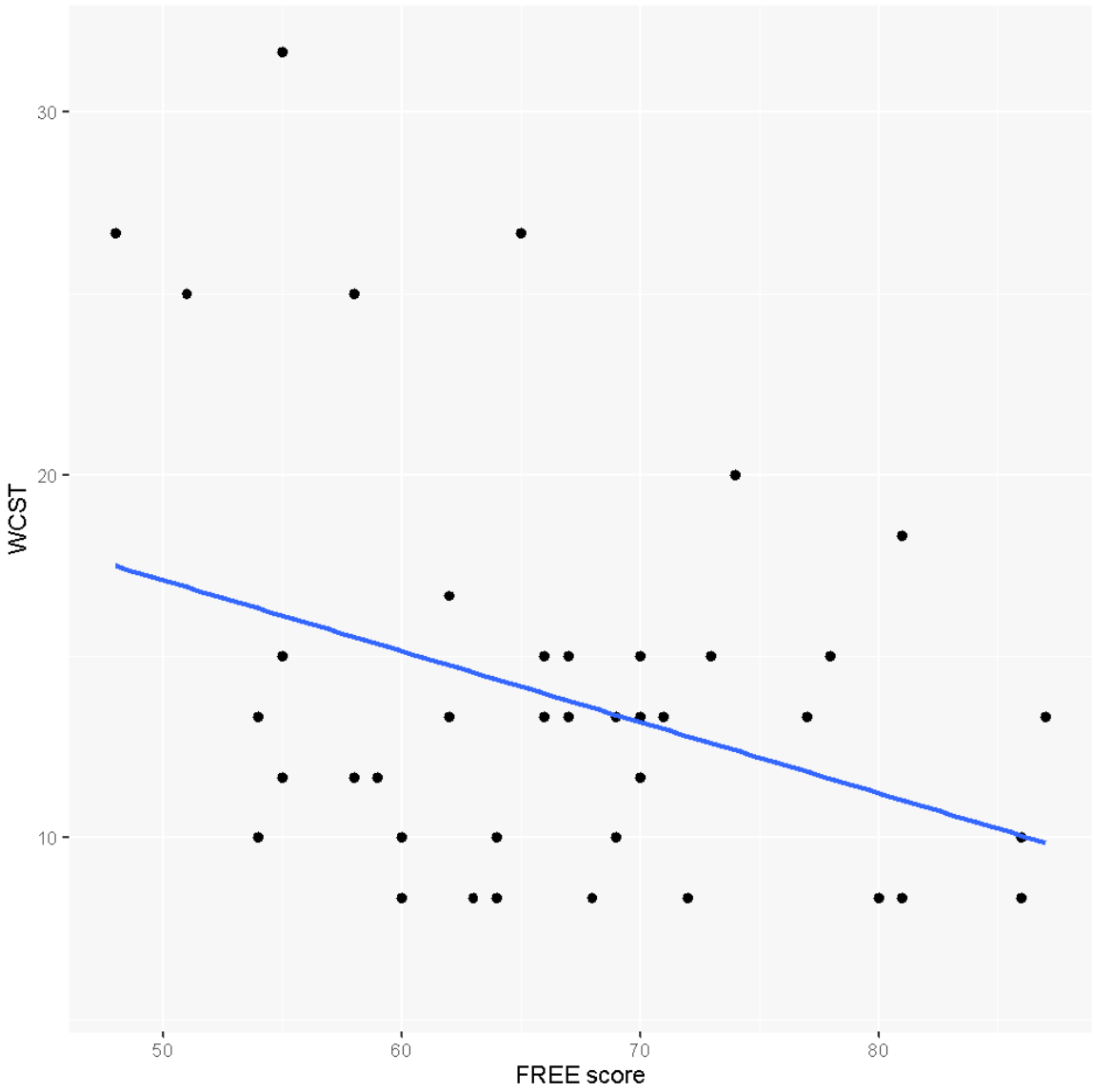


*Figure 8*. A negative relationship between the WCST and overall FREE score. Fewer errors on the WCST correlated with higher FREE scores.

**Multiple Regressions**

Simultaneous multiple regressions were conducted to determine which self-report variables accounted for unique variance in participants' language production. As with

previous analyses, I used the overall code-switching frequency proportion and proportion of Spanish words spoken as the outcome variables for their respective models. Overall English word count was not considered as an outcome variable because in general all participants used significantly more English than Spanish throughout the affective narrative and there was not a great deal of variability amongst participants.

Table 7 shows the $\beta$-weights and *t*-values for each variable in the model predicting overall code-switching frequency (Model 1), while Table 8 displays the $\beta$-weights and *t*-values for each variable in the model predicting overall Spanish word count (Model 2). Predictors were chosen based on their relevance to the research questions.

Overall, Model 1 was trending toward significance, $F(4, 37) = 2.41$, $p = .07$. The only variable that significantly predicted overall code-switching frequency was self-reported code-switching frequency, $p = .02$. Ultimately, the model only explained about 12.1% of the variance in overall code-switching frequency, so it is quite possible that other factors that were not considered would provide better explanatory power to the model.

Table 7.
*Predictors of overall code-switching frequency from the affective narrative.*

| Predictors | Standardized $\beta$ | *t*-value |
|---|---|---|
| Self-reported code-switching frequency | **0.38** | **2.54** |
| WCST | -0.21 | -1.33 |
| Spanish speaking proficiency | 0.05 | 0.29 |
| Current Spanish use | -0.09 | -0.63 |

*Note.* **Bolded** values indicate a significant predictor at $p < .05$.

Model 2 was significant, $F(4, 37) = 3.46$, $p = .02$, however none of the variables predicted the proportion of Spanish words spoken. Self-reported code-switching frequency ($p = .08$) and current Spanish use ($p = .06$) were trending toward significance. Ultimately, the model only explained about 19.4% of the variance in overall code-switching frequency, showing slightly better explanatory power compared to Model 1.

Table 8.
*Predictors of proportion of Spanish words spoken from the affective narrative.*

| Predictors | Standardized $\beta$ | *t*-value |
|---|---|---|
| Self-reported code-switching frequency | 0.26 | 1.81 |
| WCST | -0.15 | -0.99 |
| Spanish speaking proficiency | 0.17 | 1.13 |
| Current Spanish use | 0.29 | 1.9 |

# Chapter 4

## Discussion

Language serves an important role in cognition and impacts abilities such as cognitive control and emotion. Therefore, it is reasonable to assume that experience with two languages may affect an individual's abilities in these different domains. The current study aimed to understand how individual differences in cognitive control and emotion regulation account for code-switching behavior in early heritage bilinguals. The use of questionnaires, cognitive control tasks, and conversational data allowed me to examine how bilinguals use their languages in different emotional contexts and to what extent this relates to individual differences in cognitive control. While most emotional regulation research has focused on late sequential bilinguals, this study focuses on heritage bilinguals.

### Integration of Cognitive Control and Emotion Regulation

The first hypothesis of this study explored how bilinguals use their two languages in different affective contexts. I predicted that participants would show greater rates of code-switching while discussing the negative topic compared to the positive and neutral topics. I also predicted that code-switching would be used as a regulatory mechanism, aiding participants to regulate their emotions while discussing a negative life event. Previous work has suggested that sustained states of heightened negative emotion influence cognitive control capacity, resulting in reduced top-down control (Cohen et al., 2016). In addition, Abutalebi and Green (2013) proposed that reduced cognitive control allows for code-switching to manifest, as neither language is inhibited. I hypothesized

that, if participants recalled a negative life event, this would induce a negative affective state, reduce cognitive control capacity, and ultimately result in frequent code-switching.

Contrary to my hypothesis, participants code-switched more frequently during the positive topic compared to the negative topic. However, code-switching frequency during the neutral topic did not significantly differ from either the positive or the negative topic. Hence, it cannot be determined whether code-switching frequency increased during the positive topic or decreased during the negative topic. Nonetheless, the lower frequency of code-switching during the negative topic does not support my prediction. I posit that the differential proportions of code-switching across the three topics is a result of the interaction between emotion regulation and cognitive control. There are two possible ways to interpret this relationship. First, different emotional states might affect cognition and language in a chain-like reaction. For example, an emotional event (e.g., recalling a negative life event) might first produce changes in emotion, then recruit different cognitive control processes, and finally affect bilingual language production. A second interpretation is that different emotional states affect both cognitive control and language, but do so separately. In other words, different emotional states might directly influence language production, independent of changes in cognitive control. The current study was not designed to test the order in which cognitive and linguistic changes occur. Nevertheless, the data suggest that bilingual language production is differentially affected by positive and negative emotional states. I consider below which cognitive processes might be recruited and when they might change.

One possible explanation for the different proportions of code-switching during the positive and negative topics is that positive and negative emotions differentially recruit inhibitory control. Some research has shown that positive emotions impair inhibition (Phillips, Bull, Adams, & Fraser, 2002), while other studies have shown that positive emotions have no effect on prepotent response inhibition (Martin & Kerns, 2011). As for negative emotion, a substantial amount of research has found that negative emotion impairs inhibitory control (Houwer & Tibboel, 2010; Padmala, Bauer, & Pessoa, 2011; Verbruggen & De Houwer, 2007). Importantly, these latter studies usually presented emotional stimuli while participants completed a cognitive control task, such as the Flanker or Stroop tasks. However, it is important to consider that the relationship between emotion regulation and cognitive control during spontaneous language production might be different than the relationship that has been previously reported during cognitive control computer-controlled information processing tasks. Responding to emotional stimuli in an experimental context may involve different mechanisms as compared to speech production during emotional conversations.

I propose that participants flexibly engaged in inhibitory control to meet situation-specific demands in different affective states, as revealed through greater rates of code-switching during the positive topic, relative to the negative topic.

According to hedonic accounts, people generally want to feel good (Tugade & Fredrickson, 2007). The hedonic contingency model (Wegener and Petty, 1994) suggests that when in a positive state, individuals seek out activities to maintain that state. When discussing positive life events, it is conceivable that participants aimed to maintain or

upregulate positive emotions. In contrast, when discussing negative life events, participants might have aimed to inhibit certain behaviors in order to maintain their composure throughout a conversation. Although inhibition cannot be directly measured during the conversations, the amount of code-switching (and consequently the amount of Spanish and English produced) might provide insight into how inhibition is being recruited.

Green and Abutalebi's (2013) Adaptive Control Hypothesis (ACH) suggests that different language contexts require different types of cognitive control to manage competition between a bilingual's two languages. When bilinguals only use one language, it is thought that the target language is activated while the non-target language is inhibited. In contrast, when bilinguals frequently switch languages in the same context, it is thought that less inhibition is required, therefore allowing them to switch with ease. Importantly, the ACH suggests that inhibitory control is domain-general, such that it applies to a variety of cognitive domains, including language. Language use during the positive and negative topics might reflect these contrasting language contexts. Positive emotions are generally thought to broaden the scopes of attention and cognition, often referred to as *broaden hypothesis* (Fredrickson & Branigan, 2005). Isen (1990) proposed that one consequence of such broadening is flexible and creative thinking. For example, individuals induced to feel positive affect more frequently identified fringe exemplars of a given category, such as *elevator* and *camel* as exemplars of the category *vehicle* (Isen & Daubman, 1984). When discussing positive emotions, participants might have experienced enhanced flexibility and creative thinking which allowed them to use both

Spanish and English more freely. As a result, neither language was inhibited and participants code-switched frequently. Conversely, when discussing negative emotions, participants might have increased domain-general inhibitory control as an emotion regulation strategy. As a result, Spanish was inhibited, and participants code-switched less frequently compared to the positive topic. Participants might have inhibited Spanish because English is their dominant language and the language of their everyday lives. Some participants explicitly mentioned in the open-ended portion of the ECQ that they simply felt more comfortable talking about negative emotions in English. Language use during the negative topic is not entirely analogous to a single-language context, as participants still used some Spanish. However, participants used significantly less Spanish during the negative topic compared to the positive and neutral topics (see Figure 3).

This hypothesized pattern of reduced inhibition during the positive topic and increased inhibition during the negative topic both concurs with, and conflicts with, previous research. Previous research provides some support for the argument that positive mood states reduce inhibitory control. For example, Dreisbach (2006) found that sustained processing of positive stimuli resulted in poorer performance (i.e., response inhibition task, the AX-CPT (Braver et al., 2001). With respect to language production, reduced inhibitory control might actually benefit bilinguals. Code-switching might be indicative of freer word retrieval, as bilinguals are not restricted to using only one

language[3]. Ashby, Isen and Turken (1999) reported that positive affect is likely to improve word fluency due to enhanced flexibility in seeing new ways to categorize and think about words. This suggests that positive mood should improve performance on tasks that require word retrieval. Thus, it is not surprising that bilinguals code-switched more frequently during the positive topic compared to the negative topic. Bilinguals likely aimed to maintain or upregulate positive emotions, which in turn did not require them to engage in inhibitory control. The lessening of inhibition therefore allowed bilingual to more flexibility switch between their two languages, which supports the ACH (Green & Abutalebi, 2013).

With respect to the negative topic, I argue that participants increased inhibitory control as an emotion regulation strategy, which contradicts some previous findings. Negative mood states are generally thought to narrow one's thoughts and scope of attention (Finucane, 2011; Fox, 2008), and consequentially require considerable attentional resources (Gupta, 2019). When an individual encounters high-arousal information (e.g., threat), there is competition for resources to meet task demands (Pessoa, 2009; Czapka, Schwieter, & Festman, 2022). Following this interpretation, discussing negative emotions should have depleted cognitive resources, leaving participants less able to engage in inhibitory control and thus less likely to inhibit one of their languages (leading to an increased frequency of code-switching). Instead, participants code-switched less frequently compared to the positive topic. Current models

[3] Some research has suggested that code-switching can be used as a strategy to aid lexical retrieval (Gollan & Ferreira, 2009; Tomic & Valdés Kroff, 2021)

(Czapka, Schwieter, & Festman, 2022) examining the relationship between emotion regulation and cognitive control cannot account for the lower frequently of code-switching during the negative topic.

However, Saunders and colleagues (2015) have proposed a model in which implementing cognitive control can be viewed as an emotion regulation strategy. When cognitive control is initiated, it can reduce the unpleasant experience of challenges to goal-directed behavior. They suggest that during negative emotional events, individuals can either increase control or shift priorities in order to achieve "cognitive comfort." Like the hedonic contingency model (Wegener and Petty, 1994), Saunders et al. propose that individuals aim to achieve a pleasant state that is free of conflict. Although I did not include manipulations that would serve as a conflict, it is possible that the task itself inevitably created conflict. For example, it might have been uncomfortable for participants to divulge details of a difficult time in their lives with a recent acquaintance. They might not have wanted to risk outward displays of emotions (e.g., crying) and giving the impression of being vulnerable. Thus, there could have been a conflict between successfully talking about a negative life event and maintaining their composure.

Many participants acknowledge this conflict in their open-ended responses in the Emotional Closeness Questionnaire. When asked which language they prefer to use to recall bad or difficult memories, 30 out of 50 participants reported English and explained why. Some common explanations were that English, compared to Spanish, made them feel more comfortable or that it was simply easier to talk about those memories in English. Some participants mentioned how strategically using English would allow them

to talk about the memories without feeling sad afterwards. One participant explicitly mentioned that they prefer to use English so that they will not cry. Participants' responses to the open-ended questions demonstrate that many of them are aware of how and why they strategically use English over Spanish to discuss negative life events.

Interestingly, most heritage bilinguals in this study reported that they perceive Spanish to be more emotional or that Spanish and English are equally emotional. For my third hypothesis, I predicted that the language participants rated as being more emotional would also be the language that they spoke the majority of the time during the affective narrative. The data provide some support for this hypothesis, such that the higher participants rated English as being emotional, the more English they spoke only during the positive topic. However, as discussed in the previous paragraph, participants have a strong preference for using English to express negative emotions. There appears to be a disconnect between the emotional connotations of a language and which language is the preferred language for emotional expression. Pavlenko (2006) observed similar findings, such that late sequential bilinguals preferred to use their L2 when discussing negative emotions. Though the late bilinguals in Pavlenko's study acquired their L2 as adults, their L2 became their preferred language of emotional expression due to living and interacting in an environment where their L2 was the majority language. Thus, perhaps the societal or community language has greater influence on bilinguals' preferred language for expressing negative emotions.

**Cognitive Control Tasks and Code-Switching.** For my second hypothesis, I predicted that there would be an inverse relationship between code-switching frequency

and task-switching performance, such that participants who showed greater rates of code-switching overall during the affective narrative conversation would also experience less switch costs in the switching tasks. In a previous study, Hartano and Yang (2016) found that habitual code-switchers showed smaller switch costs on the color-shape switching task compared to non-code-switchers. The current study did not replicate this finding, as overall code-switching frequency during the affective narrative did not correlate with the 2-composite switch score. However, code-switching frequency during the negative topic did correlate with performance on the Wisconsin Card Sorting Test (WCST). In what follows, I will first interpret the null correlation between the 2-composite switch score and code-switching frequency, followed by my interpretation of the negative correlation between the WCST and negative topic code-switching frequency. Finally, I will discuss the different features of the three cognitive tasks and how such variations may account for the different correlations.

Code-switching is thought to be analogous to task-switching (Yang, Hartano, & Yang, 2017), yet they are very different. Conceptually and functionally, both require an individual to switch between different rules (or languages) depending on contextual demands (Monsell, 2003). However, there are key features that differentiate these tasks and may explain why these behaviors are not correlated. In what follows, I will describe two possible reasons for the null correlation between code-switching and task-switching: differences in inhibition and differences in switching contexts.

First, task-switching and code-switching may recruit inhibition differently. Successful performance on switching tasks relies on inhibition to manage goal-irrelevant

stimuli. Switching tasks were designed to measure an individual's ability to allocate attention to a single task or rule in the context of two potential options, so that a correct response can be made. For example, in the mixed blocks of the color-shape switching task, competition occurs at a local level, as participants need to switch between rules trial-to-trial. In order to produce a correct response, participants must resolve such competition by inhibiting the rule from the previous trial. Thus, inhibition is applied at a local level.

Code-switching, on the other hand, may not necessitate inhibition of one language, especially when switching between languages appears to occur seamlessly in natural situations for habitual code-switchers. This interpretation accords with the control process model proposed by Green and Li (2014), such that different interactional contexts demand different control or attentional states. Contexts in which bilingual speakers may use items from either language are thought to induce a broader attentional state (Green, 2018), and therefore allow different types of code-switching (e.g., single word insertions or dense code-switching). Green and Li provide the analogy that the language "gates" remain open, allowing for words of either language to enter the utterance planning mechanism. The authors highlight that inhibitory control is not required for code-switching because there is no disengagement of one entire language system. Many studies that have found a switch cost in language switching required speakers to name pictures in one language or the other as directed by cues (i.e., switches were cued, forced, and required) (Meuter & Allport, 1999; Costa & Santesteban, 2004; Calabria, Hernández, Branzi, & Costa, 2012). However, self-generated code-switching has been shown to be

less costly and less taxing compared to cue-dependent code-switching (Kang & Lust, 2018; Gullberg, Indefrey & Muysken, 2009; Gollan & Ferreira, 2009; Kleinmann & Gollan, 2016; Blanco-Elorrieta & Pylkkänen, 2018). When bilinguals are not forced to use a specific language, especially if one language is relatively less accessible, there would be no need to monitor which language is produced when responding to stimuli, and consequently, no need to disengage or inhibit an entire language system. In conclusion, self-generated code-switching likely does not require inhibition, whereas successful performance on cue-dependent switching tasks (e.g., the color-shape and Navon tasks) relies on inhibitory control.

The contexts in which switching occurred may also have contributed to the null correlation. For example, the affective narrative conversations took place in an emotional context (i.e., talking about positive and negative life events). As previously discussed, different emotional states can differentially affect cognition. Although changes in cognition across the three topics could not be directly measured, I interpret the differential amounts of code-switching (more during the positive topic relative to the negative) to reflect different cognitive processes at play. More specifically, increased code-switching during the positive topic reflects decreases in inhibitory control, whereas decreased code-switching (and the suppression of Spanish) during the negative topic reflects increased inhibitory control. As for the color-shape and Navon tasks, the switching occurred in a context devoid of both emotional and linguistic information. If emotional stimuli were used in the switching tasks (e.g., happy, neutral, and sad faces), it is possible that the valence of the stimuli could have affected cognitive processes (e.g.,

inhibition), and thus affected performance. If task-switching had taken place in an emotional context, perhaps the switch cost would have correlated with the affective narrative code-switching frequency. An alternative experimental paradigm will be proposed in the Future Directions section.

Although the 2-composite switch score did not predict actual code-switching frequency, the perseverance score from the WCST did predict code-switching frequency during the negative topic, such that lower perseverance scores was associated with increased amounts of code-switching. At first glance, one could interpret this correlation to mean that bilinguals who are good at rapidly switching to new rules, code-switch more frequently. Perseverance scores are commonly used as an index of cognitive flexibility (Miyake et al., 2000). Cognitive flexibility refers to the ability to adapt to new, changing, and unexpected environmental demands (Scott, 1962) and is thought to emerge from the interaction between several subdomains of executive function, such as attention, working memory, inhibition, and switching (Dajani and Uddin, 2017). To successfully perform the WCST, participants must identify that the rule has changed, maintain alternative responses in working memory, inhibit the previous rule, and switch to the new rule. Essentially, they must employ cognitive flexibility to adapt to unexpected rule changes and respond appropriately. Similarly, bilinguals can utilize code-switching to adapt to conversational changes, such as changes in topic or conversation partner. This interpretation would support the argument that cognitive flexibility is domain-general, such that cognitive flexibility required to perform computer-controlled information processing tasks is also used in the natural, flexible use of two languages.

However, this relationship was only true for code-switching during the negative topic. One possible reason that the WCST perseverance scores correlated with code-switching frequency only in the negative topic is that, relative to positive affective states, code-switching might reflect the ability to remain cognitively flexible in the midst of negative affect. As previously mentioned with respect to the broaden hypothesis (Fredrickson & Branigan, 2005), participants might have experienced enhanced flexibility during the positive topic due to a broadened scope of attention and cognition, which in turn manifested as frequent code-switching. However, when participants encountered the negative topic, some individuals (those with more flexible cognition as demonstrated on the WCST) were better able to maintain cognitive flexibility in light of the negative affect (i.e., greater rates of code-switching), while those with less cognitive flexibility were not able to do so.

If performance on the WCST represents cognitive flexibility, why then did perseverance scores not correlate with the 2-composite switch cost? A critical factor distinguishing the two switching tasks (color-shape and Navon) from the WCST is rule uncertainly. The color-shape and Navon tasks require participants to switch between two rules (color and shape for the color-shape task, local and global for the Navon task), whereas the WCST has three task rules (color, shape, and number). If participants incorrectly respond to a card in the WCST, they cannot simply deduce what the correct answer is because there are two alternative responses as opposed to one. Second, some of the stimuli in the WCST are ambiguous because they contain three dimensions (color, shape, and number). If a participant correctly learns a new rule, sometimes it is unclear

*which* rule is now the correct one. Finally, the way in which rule changes occur in the three tasks is different. In the color-shape and Navon task, the rule changes are explicit or cued. In the color-shape task, participants see a color or shape cue that indicates which rule they need to respond to. In the Navon task, the rule is explicit, as participants know that they need to pay attention to both local and global features of the shapes. However, the rule change in the WCST is implicit. Participants not only need to figure out the new rule on their own, but they also do not know when the rule will change. Overall, while the three tasks involve some aspect of switching, there are distinct task differences that may contribute to the null correlation.

A more nuanced, and perhaps better, interpretation is that code-switching frequency during the negative topic reflects cognitive flexibility, and this is why it correlates with perseverance scores.

**Additional Support for Domain-General Flexibility.** Code-switching frequency during the negative topic gives insight into the interaction between emotion regulation and cognitive flexibility. I have already proposed that the WCST perseverance scores and code-switching frequency during the negative topic may indicate individual differences in cognitive flexibility. Additional data support this interpretation. The FREE scale correlated with the WCST perseverance scores, as well as with code-switching frequency during the negative topic. Individuals with higher FREE scores are thought to have a greater repertoire of emotion regulation strategies, and accordingly, are thought to be more flexible in terms of finding an appropriate emotion regulation strategy in a given context. Emotion regulation flexibility predicted individual differences in cognitive

control, such that higher FREE scores correlated with fewer WCST perseverance scores. Similarly, emotion regulation flexibility predicted individual differences in code-switching frequency in the negative topic, such that higher FREE scores correlated with greater rates of code-switching. In my fourth hypothesis, I predicted that higher FREE scores would correlate with overall code-switching frequency, however the correlation was only significant for the negative topic. While both correlations (WCST and FREE correlating with code-switching frequency) appear to support the notion of domain-general flexibility, it is the correlation between the FREE score and code-switching frequency that illustrates the relation between emotion regulation and cognitive control. Participants likely only needed to regulate emotional expression during the negative topic. As the correlation suggests, individuals with larger repertoires of regulation strategies code-switched more frequently in a context that likely required emotion regulation. Hence, both the FREE score and the WCST data imply that there is an underlying construct of flexibility that is important for the domains of cognition and emotion, and that influences code-switching.

**Expressive Suppression and Task Switching**. For my fifth hypothesis, I predicted that the composite switch score would correlate with cognitive reappraisal scores from the Emotion Regulation Questionnaire (ERQ). Cognitive reappraisal scores were not associated with neither the 2-composite switch score nor the WCST perseverance scores. One possible reason I did not observe a correlation is that the way in which some of the cognitive reappraisal items are structured may not accurately reflect the construct of reappraisal as intended (Brockman, Ciarrochi, Parker & Kashdan, 2016).

For example, two of the items might reflect forms of distractions rather than reappraising the meaning of an event.

**The Unique Experience of Heritage Bilinguals**

Research examining the relationship between bilingualism and emotion has provided consistent support for differential reactions to emotional stimuli, such that reactions are weaker in bilinguals' second language (L2) compared to the dominant and more proficient first language (L1) (Harris et al., 2003; Pavlenko, 2005). However, much of this research has focused on late sequential bilinguals who acquired their L2 as adults. For these late sequential bilinguals, perceived emotional detachment in their L2 is likely a result of learning their L2 in an emotionally neutral academic setting (Bond & Lai, 1986). The heritage bilinguals in this study also demonstrated evidence of emotional detachment in their L2 English, however it is unlikely that such emotional detachment can be attributed solely to learning English in a classroom setting. I propose that the societal language and environment plays a critical role in determining which language heritage bilinguals prefer when expressing negative emotions. The public environment creates a demand for heritage bilinguals to use their L2 English frequently in their everyday lives, as their education, social lives, and jobs all require English use. Despite reporting to be equally proficient in Spanish and English, there is no denying that this sample of heritage bilinguals uses English more frequently. It is possible that researchers sometimes conflate proficiency with use. For example, if a bilingual is equally proficient in both languages, then it has been assumed that they use both languages with equal frequency. The late Turkish-English bilinguals from Harris and colleagues' (2003) study are a good example

of how the effects of the environment supersede the effects of balanced proficiency. In their study, the late bilinguals reported to be equally proficient in Turkish and English, as Turkish was their native language and they had immigrated to the United States. Unexpectedly, skin conductance activity was just as high for L2 English taboo words as they were for L1 Turkish taboo words. Despite living in the United States for an average of four years, some bilinguals had become emotionally sensitive to taboo words in English. Although this result is limited to reactivity to taboo words, it nonetheless provides support for the argument that the environment plays an important role in how individuals experience emotions in different languages. Altogether, heritage bilinguals are a unique group of bilinguals because their emotional resonance with each language appears to be heavily dependent on the contexts and frequency with which they use their languages.

**Limitations and Future Directions**

While some limitations of the current study have already been addressed in the preceding sections, there are still several other points worth mentioning. First, the two switching tasks did not correlate with code-switching frequency. As previously discussed, the emotional context in which conflict occurs might affect which cognitive processes are recruited. I cannot rule out the possibility that had I used emotional stimuli for the switching tasks that I would have found a significant correlation between switch cost and code-switching frequency. In the future, it would be ideal to incorporate emotional stimuli (e.g., facial expressions) as part of the switching tasks and examine whether performance is associated with code-switching frequency in different affective contexts.

Additionally, because the WCST is a complex task, future studies should be directed to determining which aspects of the task other than switching could account for this relationship. It would be worthwhile to examine how other measures of executive function, such as working memory capacity or inhibitory control, relate to emotion regulation and code-switching.

Next, although the number of participants in the study was satisfactory, the sample was not large enough to use Structural Equation Modeling (SEM) to examine the relationship between code-switching, emotion regulation, and cognitive control. Future studies should aim to recruit a larger sample that would satisfy the statistical power required for SEM analyses. For example, SEM could be used to test whether there is common factor underlying code-switching, emotion regulation, and cognitive control (e.g., flexibility). Additionally, SEM could examine whether emotion separately affects cognition and language, or if the relationship occurs in a cascade-fashion, such that emotion affects cognition, and consequently, changes in cognition affect language production.

Future studies should also include language proficiency tests to measure proficiency and dominance. Verbal production tasks such as a verbal fluency task or picture naming task are commonly used in the bilingualism literature. Including these tasks will allow researchers to not only quantify bilinguals' proficiency in two languages, but also validate self-report responses from the LHQ.

With respect to the affective narrative, I cannot rule out the possibility that the fixed order of topics did not affect the amount of code-switching that participants

produced. Future studies should counterbalance the order of the positive and negative topics to identify if the order affects code-switching frequency.

Future studies that employ the affective narrative should also include a post-conversation interview to inquire about participants' emotion expression and regulation strategies. For example, it would be helpful to know if participants felt comfortable or reserved when sharing intimate and emotional memories, as this could affect code-switching frequency and which language(s) participants use.

Finally, the sample in this study was restricted to early heritage bilinguals living in the United States. I can only draw conclusions based on what the data suggest for this group of bilinguals. In the future, it would be interesting to conduct the same experiment with late bilinguals who immigrated to the United States, as well as heritage bilinguals in other countries. For both groups, I would predict that the societal language would also heavily influence how they express negative emotions.

**Conclusions**

This study is the first of its kind to study bilingual language use in different affective contexts and examine how spontaneous speech relates to cognitive control and emotion regulation. Studies on emotion regulation and bilingualism have often ignored heritage speakers, despite having a unique bilingual experience. This dissertation aimed to understand whether heritage speakers perceived emotional differences between their two languages, and if so, examine how differences manifest in spontaneous speech. Like late sequential bilinguals, the heritage bilinguals also perceived their L1 Spanish to be "more emotional," yet they acknowledged that their L2 English was their preferred

language when talking about negative emotions. This was also seen in their spontaneous speech, as bilinguals predominantly used English when discussing negative life events. Their preference for their L2 English seems to stem from the public environment, which Creates a demand for heritage speakers to use their L2 frequently in their everyday lives.

Domain-general flexibility also seems to play an important role in code-switching, task-switching, and emotion regulation. Bilinguals who code-switched more frequently during the negative topic also 1) had better performance on a cognitive flexibility task and 2) engaged in more flexible use of emotion regulation strategies. Overall, it appears that flexibility involved with frequent language switching is also associated with flexibility in cognitive control and emotion regulation.

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