CHAPTER 9

Experimentally inducing Spanish-English code-switching

A new conversation paradigm

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U.S. Spanish-English bilinguals intentionally engage in code-switching. Its experimental study is challenging, due to the lack of a meaningful context or turn-taking between speakers. We report on the use of a referential communication task to experimentally elicit code-switching. Data from 10 sessions indicate participants' willingness to code-switch but that frequency of code-switching is constrained by individual factors. Self-reported code-switching use is correlated with the proportion of English and Spanish spoken, validating self-reported measures of code-switching use but not exposure. The results underscore an asymmetric contribution of the bilingual's languages in code-switching. The use of this task paves the way for experimental studies on naturalistic and spontaneous code-switching and provides a potential avenue for a more quantified measure of code-switching proficiency.

Keywords: code-switching, psycholinguistcs, referential communication tasks, self-reported measures

Introduction

Code-switching, generally defined as the fluid alternation between languages during bilingual speech (Poplack, 1980), has been systematically studied over the last four to five decades mainly from sociolinguistic (e.g. Bentahila & Davies, 1997; Lipski, 2005; Myers-Scotton, 1993; Milroy & Li Wei, 1995; Torres Cacoullos & Travis, *in press*) and theoretical (e.g. Belazi, Rubin, & Toribio, 1994; MacSwan, 1999; Deuchar, 2006; Di Sciullo, Muysken, & Singh, 1986; Myers-Scotton & Jake, 2001; Woolford, 1983, see also Vergara & López, this volume) perspectives. Although it is not easy to summarize this large body of work, we list some of the core findings. First, code-switching is not random and thus is constraint-based

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or rule-governed;[1] however, the specific constraints or rules that license or ban specific code-switching junctures continue to be hotly contested. Second, not all bilinguals or community of bilingual speakers exhibit the same patterns or rates of use of code-switching even when similar language pairs are involved (e.g. Poplack, 1988), thus, underscoring code-switching as a socially-driven phenomenon. Third, bilinguals must be highly proficient in both languages in order to engage in intra-sentential code-switches, i.e. code-switches that occur within major clause boundaries, most typically defined as the Complementizer Phrase (CP, e.g., Miccio, Schaffer Hammer, & Rodríquez, 2009). In contrast, bilinguals who are less proficient in one of their two languages are more likely to engage in inter-sentential code-switches, i.e., code-switches that occur across CPs, or in single word, insertional code-switches. This last point on proficiency further indicates that beyond the social dimension, individual differences also modulate code-switching. These central findings overall lead to a broader picture that code-switching is a unique and skillful linguistic behavior amongst bilingual speakers that is highly influenced by linguistic, social, and individual factors.

In part due to this complex interaction of factors, code-switching has been notoriously difficult to study in an experimental setting (Gullberg, Indefrey, & Muysken, 2009) yet is increasingly capturing the interest of psycholinguists and cognitive scientists. The primary goal of the work reported here is to provide a first step towards uncovering an objective means of capturing bilingual individuals' code-switching practices through the use of referential communication tasks (e.g. Yule, 1997; Brown-Schmidt & Tanenhaus, 2008). These tasks offer an advantage in that they are semi-controlled yet provide a vehicle for spontaneous conversation, thus providing the contextual setting in which code-switchers are more naturally situated. In the following sections we will first provide a brief review of psycholinguistic studies of code-switching, followed by an overview of referential communication tasks. We then present a case study in which we make use of a modified map task between an experimenter and a naive participant to examine the use of both languages and how their use is modulated by the participants' own self-reflected behavior. To foreshadow the results, we believe referential communication tasks provide a fruitful path for the experimental study of marked forms of speech like code-switching and other minority languages (e.g., the populations disussed in the chapters by Baird and Adamou in this volume) that are otherwise hard to study with the typical set of psycholinguistic tools.

1. We include in this statement the work of MacSwan (1999) and colleagues. Although they term their framework a constraint-free approach to code-switching, they claim that code-switching is grammatical and thus is systematic; their framework centers on the assumption that no code-switching specific constraints are necessary.

Psycholinguistic approaches to code-switching

More recently, psycholinguists have become interested in the phenomenon of code-switching from a cognitive perspective (e.g. Abutalebi et al., 2007; Altarriba, Kroll, Sholl, & Rayner, 1996; Dussias, 2003; Dussias, Guzzardo Tamargo, Valdés Kroff, & Gerfen, 2014; Guzzardo Tamargo, Valdés Kroff, & Dussias, 2016; Kootstra, Van Hell, & Dijkstra, 2010, 2012; Li, 1996; Moreno, Federmeier, & Kutas, 2002; Ng, Gonzalez, & Wicha, 2014; Valdés Kroff, Dussias, Gerfen, Perrotti, & Bajo, 2016). Code-switching presents a fascinating conundrum in that switching is generally considered to be a cognitively difficult task, both in non-linguistic and linguistic domains. In other words, humans do not typically engage in cognitively less efficient behavior, yet code-switching amongst certain bilingual communities is prolific. In non-linguistic switching tasks, participants are typically asked to conduct perceptual decisions on objects that vary minimally on 2 dimensions (e.g. color and shape). For example, a participant may see on a computer screen a circle or square that is presented in red or blue. Objects are presented as isolated trials, and a cue concomitantly appears that indicates whether the participant must respond to either the color or shape of each presented object. Crucially, mixed blocks switch between the shape and color cues. These tasks have robustly shown that switching between responses (e.g., respond to color on trial 1, respond to shape on trial 2, etc.) takes longer when compared to repeated trials (e.g. respond to color on trial 1, respond to color on trial 2, etc.; see Monsell, 2003 for review). Interestingly, Meuter and Allport (1999) extended the logic of the task to bilingual speakers substituting language as the two dimensions by which responses can switch. In these *cued language switching* experiments, bilingual speakers see numerical digits or line drawings of objects and via the color of the computer screen are cued to name in one of their two languages (e.g. if red, name in Spanish, if blue name in English). The basic paradigm has been replicated several times manipulating additional factors such as the language pairing (e.g. Costa & Santesteban, 2004; Prior & Gollan, 2011; Prior & MacWhinney, 2010) and whether bilinguals can voluntarily switch (Gollan & Ferreira, 2012). Despite these modifications, across the board, bilinguals are slower to name when they have to switch between languages when compared to repeating within the same language. Essentially, switching between languages is cognitively more difficult than sticking to the same language.

The consistent switch costs found in cued language switching experiments leave the preponderance of code-switching as a cognitive puzzle. Due to this paradox, psycholinguists and cognitive scientists have expressed increasing interest in the phenomenon of code-switching (e.g. Green, 2011; Green & Abutalebi, 2013). Similar to the cued language switching studies, code-switching as studied within psycholinguistic experiments consistently report switch costs. That is, when

bilingual participants encounter a code-switch embedded in a sentential context, they are slower to process the code-switch when compared to staying within the same language, even when the semantic content is highly expected (Altarriba et al., 1996). However, not all code-switches result in the same processing difficulty. The nascent emerging picture is that code-switching costs can be modulated, i.e. some code-switches are easier than others, be they because some constructions are more common within a code-switching community (e.g. Guzzardo Tamargo et al., 2016; Valdés Kroff et al., 2016), code-switching is in part facilitated by structural or lexical priming across speakers (Kootstra et al., 2010; 2012), or because the cost may be more associated with an unexpected code-switch than with processing difficulty *per se* (e.g. Moreno et al., 2002). The fact that code-switching costs in comprehension can be modulated is assuring given its ubiquity amongst bilingual speakers.

Nevertheless, experimental approaches to code-switching have faced several challenges in the research lab setting (e.g. Gullberg et al., 2009). One overarching difficulty inherent to experimental studies is that psycholinguists are attempting to investigate a speech mode that in many communities is stigmatized. Similarly, code-switching remains an inherently interactional speech act; in other words, the discourse function and the social context in which code-switching occurs is hard to replicate in the research lab. Apart from these inherent difficulties, we identify two other major challenges, which we classify as (1) methodological and (2) "proficiency" based.

Apart from the social and discourse aspects of code-switching which are difficult to replicate in an experimental setting, many psycholinguistic designs involve the primary use of written stimuli to study code-switching (e.g. Altarriba et al., 1996; Guzzardo Tamargo et al., 2016; Moreno et al., 2002). Although studies have documented the growing use of code-switching in writing, such as in emails and in group chats (e.g. Callahan, 2004; Dorleijn & Nortier, 2009; Montes-Alacalá, 2000, 2005; Montes-Alcalá & Lapidus Shin, 2011), code-switching remains overwhelmingly a spoken language phenomenon. Additionally, largely due to the design constraints on psycholinguistic studies, the experimental studies conducted thus far on code-switching predominantly use stimuli that include single word, insertional code-switches (e.g. Altarriba et al., 1996; Li, 1996; Moreno et al., 2002). On the one hand, the use of insertional code-switched materials facilitates the requisite experimental control of processing factors such as lexical frequency and sentence length that are not of experimental interest but are known to influence comprehension and production. However, the overwhelming use of insertional code-switches, in effect, leads to experimental stimuli that involve switches into one grammatical category, nouns. Code-switches into nouns are highly frequent in bilingual speech (e.g. Poplack, 1980) but underestimate the broad repertoire of code-switching junctures and types (e.g., insertional v. alternational, see Muysken, 2000) that

occur in naturalistic bilingual speech. Additionally, code-switched stimuli are primarily presented as isolated sentences. This design feature also facilitates the ability to introduce experimental control but removes the conversational context between speakers in which code-switching is most likely to occur. We argue that the combination of these features essentially leads to participants experiencing code-switches as exogenous (i.e. externally-presented) cues to switches between languages, thus paralleling the design features of cued language switching studies (e.g. Meuter & Allport, 1999; see also Gullberg et al., 2009 for a similar argument). Although the cognitive processes recruited for cued language switching may be similar to spontaneous code-switching, we currently do not know the extent to which they are shared, independent, or partially overlap.

The second major challenge to experimental research on code-switching is that we do not have a clear standard for how we include bilingual participants in a code-switching study. We term this challenge the "proficiency" issue in the sense that most typical experimental studies on bilingualism (including second language acquisition and psycholinguistics) typically deploy rigorous standards in acquiring self-reported (e.g. self-rated proficiency measures in listening, speaking, reading, and writing) and more objective proficiency measures (e.g. verbal fluency, standardized grammatical tests), thus acknowledging that bilingualism is due to a varied set of experiences which subsequently leads to a high level of variability between bilingual speakers. In contrast, some experimental studies that include mixed language stimuli include bilingual participants without reference to their code-switching behavior (e.g. Altarriba et al., 1996; Ju & Luce, 2004), despite our knowledge that not all bilinguals code-switch (e.g. Miccio et al., 2009). Of the psycholinguistic studies that do make reference to their participants' own code-switching behavior (e.g. Guzzardo Tamargo et al., 2016; Kootstra et al., 2010; Valdés Kroff et al., 2016; Yim & Bialystok, 2012), these studies are relegated to relying upon self-reported data compiled from language history questionnaires (LHQ). LHQs are highly correlated with more quantitative measures of proficiency (e.g. Marian, Blumenfeld, & Kaushanskaya, 2007); however, a similar correlation has not been established for code-switching behavior and self-reported ratings of code-switching use and exposure. The negative stigma that often accompanies the use of code-switching in certain bilingual communities may affect a participant's own self-ratings. Moreover, given the wide scope of mixed language phenomena that falls under the umbrella of code-switching (Muysken, 2000), bilinguals may be responding to questions on code-switching use for different reasons. For example, some bilinguals may answer that they code-switch frequently even if most of their code-switching consists of single word insertional switches or inter-sentential code-switching even though these patterns of code-switching require less proficiency than fluid, alternational intra-sentential code-switching (Miccio et al., 2009).

We note that Yim and Bialystok (2012) are unique in their approach to measuring code-switching proficiency within an experimental setting. In their study investigating how the degree of conversational code-switching relates to task switching, they prompted participants to talk about two personal and culturally-specific topics, i.e. Chinese New Year and future career plans in Canada. Each topic was introduced with the "incongruent" language such that Chinese New Year was introduced in English and future career plans was introduced in Cantonese and included single language and code-switched prompts. Participants spoke for 92 seconds on average in this task and varied in the amount of code-switching that they produced. Although this methodological approach more closely aligns the social and discourse properties of code-switching within an experimental setting, one potential critique is that the task is essentially a monologue on the part of the participants apart from the initial prompts from the experimenter, and the experimenter's prompts are scripted, thus removing the spontaneity that is typically associated with speaker initiated and produced code-switching.

As psycholinguists increasingly shift their attention to the cognitive and neural underpinning of code-switching and how code-switched speech is processed in production and comprehension, our aim is to introduce a semi-controlled conversational paradigm that builds on referential communication tasks common in minority language research, second language studies, and the experimental study of spoken dialogue. Our goals are threefold: (1) to determine whether code-switching can be induced in an experimental setting between a quasi-confederate experimenter and a naive bilingual participant, (2) examine whether the experimenter is capable of producing sufficient code-switches in an unscripted dialogue thus establishing an appropriate conversational context in which code-switching is more likely to occur, and (3) to investigate the extent to which participants' self-rated exposure to and use of code-switching as well as typical proficiency measures in each of their languages are related to their degree of code-switching.

Referential communication tasks

Referential communication tasks are defined as communicative tasks in which information must be exchanged between (at least two) speakers (Yule, 1997). This information exchange can take the form of describing objects or events (e.g. tangram task, Krauss & Glucksberg, 1969; Carletta, Hill, Nichol, et al., 2010; Dale, Kirkham, & Richardson, 2011; Clark, 1996) or taking turns in instructing a conversation partner in manipulating or drawing unknown objects (e.g. map task, Anderson, Bader, Bard, et al., 1991; Bard, Anderson, Sotillo, et al., 2000; Bard, Anderson, Chen, et al., 2007; Brown-Schmidt & Tanenhaus, 2008; toy game, McDonough

& Lachler, 2010; Whalen & McDonough, 2015). For example, the map task is a commonly used referential communication task in which conversation partners each have access to an individual map in which landmarks and the geographical layout are shared between partners. Each partner has access to either a privileged set of objects or the same set of objects but in differing locations.

The primary goal of the map task is to coordinate through dialogue to achieve a common map. The design features of referential communication tasks provide substantial unscripted conversation as output in the service of playing an interactive game. In the case of the map task, even though conversation is unscripted, the experimenter is able to provide some level of control by limiting the size of the map (e.g., a defined geographic space) and by selecting the objects that the conversation partners are likely to name on various turns. In this manner, researchers can introduce variables of interest such as animacy or referential ambiguity into the experimental design.

Although referential communication tasks have been used successfully in acquisition studies and the experimental study of dialogue, to our knowledge, its use is innovative in the experimental study of code-switching. In light of the methodological challenges highlighted above, referential communication tasks such as the map task have several advantages for the experimental study of code-switching. First and foremost, these tasks provide a conversational context thus enabling code-switching to surface in connected discourse between speakers. Second, because code-switching is now embedded within running speech, both comprehension and production of code-switches within a single participant can be investigated. Third, through the manipulation of the referring objects that conversation partners are likely to name, researchers can track the extent to which one person's language choice in naming an object affects their partner's language choice (i.e. lexical priming) and whether conversation partners influence the syntactic position where code-switches occur (i.e. structural priming) – both cognitive processes that have appeared prominently in the psycholinguistic literature on code-switching (e.g. Kootstra et al., 2010, 2012). Finally, the compilation of unscripted speech elicited through referential communication tasks effectively builds a corpus of code-switched speech in a compressed time frame.

One potential disadvantage to the use of referential communication tasks to elicit code-switched speech is that researchers may not elicit sufficient code-switched speech precisely because of the unscripted nature of the task. In order to ameliorate this concern, our study includes a quasi-confederate experimenter as one of the two conversation partners. If the experimenter is a bilingual code-switcher, then they can naturally introduce code-switching into the conversational game in order to further support the use of code-switching by a naive participant (if they are predisposed to code-switching to begin with). We note,

however, that in our modified version, the experimenter is not a true confederate (cf. Kootsra et al., 2010, 2012) because the experimenter does not know the objects that will be presented on the maps beforehand, and the experimenter does not follow a script. Additionally, in the modified version that we use in the present study, conversation partners see the same set of objects but they originate in different locations across the two maps (see Figure 1).

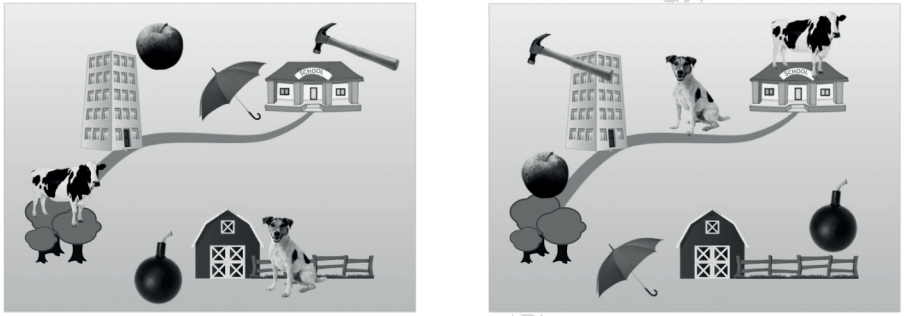

Figure 1. Example of modified map task used in the Study.
*Individual maps for conversation partners in the modified map task. Each map shares identical locations for landmarks (e.g., building, barn, trees) but common objects are scattered in different locations across the maps (e.g., dog, cow, hammer). Partners must build a common map through unscripted dialogue.

Present study

We use a modified map task (see Figure 1) between an experimenter and a bilingual participant in order to investigate whether participants produce code-switched speech within a semi-controlled and experimental setting with an unknown individual (i.e. the experimenter).

Participants

Ten Spanish-English bilinguals (age, mean = 20.6, *SD* = 2.2) were recruited from an American university to participate in the study. All participants self-reported an earlier age of acquisition (AoA) for Spanish (mean = 0.5, *SD* = 0.5) than for English (mean = 4.7, *SD* = 1.8) as indicated by a paired t-test ($t(9) = -7.324$, $p < 0.001$). Six of the 10 participants were raised in Spanish-speaking countries and had been living in the United States for 1–3 years. The rest of the participants were raised in the United States in Spanish-speaking households. Most participants

had Latin heritage (Mexico, Puerto Rico, Colombia) and one participant was from Spain. Participants also completed two proficiency measures testing vocabulary and grammar in English and Spanish. The first is a picture naming test adapted from the Boston Naming Test (BNT; Kaplan, Goodglass, Weintraub, & Segal, 1983) in which participants named a block of 30 line drawings in English and another block of 30 line drawings in Spanish (order of presentation counterbalanced across participants). Items were presented on a computer monitor via E-prime (Psychology Software Tools), and a bilingual experimenter manually coded correct responses. Out of 30 total correct responses, bilingual participants had a mean score of 21.8 (SD = 3.5) in the English BNT and a mean score of 23.2 (SD = 6.2) in the Spanish BNT. A paired t-test did not reveal a statistical difference between the two means ($t(9) = 0.602$, $p = 0.562$). For the grammar tests, participants completed a 50 multiple-choice adaptation of the *Michigan English Langauge Institute College English Test* (MELICET) for English and a 50 multiple-choice test for Spanish adapted from the *Diploma de español como lengua extranjera* [Diploma of Spanish as a Foreign Language] (DELE). Both tests were completed on a computer, where correct scores were automatically tabulated. For the MELICET, participants had a mean score of 46.3 (SD = 4.5) and a mean score of 41.9 (SD = 4.9) for the DELE. Unlike the BNT measures, these scores are not directly comparable.

In addition to the proficiency tests, participants were also given an extensive language history questionnaire (LHQ), which they completed via Qualtrics <http://www.qualtrics.com>. Participants were asked to rate themselves in English and Spanish in speaking, listening, reading, and writing using a scale of 1 to 10 where 1 indicates not proficient at all and 10 indicates native proficiency. Mean self-reported ratings are reported in Table 1. In speaking, participants reported a higher Spanish self-rating than English ($t(9) = 3.43$, $p = 0.044$). Participants also reported a marginally higher Spanish self-rating for listening ($t(9) = 1.868$, $p = 0.095$). For reading and writing, no differences were found between Spanish and English (reading, $t(9) = -0.218$, $p = 0.832$; writing, $t(9) = 0.48$, $p = 0.642$). Finally, participants also indicated on a scale from 1 to 5 their frequency of code-switching use and exposure, where 1 indicates never and 5 always. Participants reported a mean code-switching use rating of 4.1 (SD = 0.7) and an exposure mean self-rating of 3.3 (SD = 0.8). A paired t-test revealed that participants significantly rated themselves higher on code-switching use than exposure ($t(9) = 4$, $p = 0.003$).

In summary, the Spanish-English bilingual participants are highly proficient in both languages with an overall slight advantage for Spanish as indicated by self-reported proficiency measures from the LHQ. These participants are overall frequent code-switchers and rate themselves as producing code-switching more than being exposed to code-switching.

Table 1. Mean proficiency self-ratings from the LHQ

Category	Spanish	English	Difference
Speaking	9.3 (1.1)	8.1 (1.4)	*
Listening	9.6 (0.5)	8.7 (1.4)	†
Reading	8.3 (1.6)	8.1 (1.4)	n.s.
Writing	8.6 (1.5)	8.7 (0.9)	n.s.

*Mean self-rating from the LHQ are presented for Spanish and English for 4 categories: speaking, listening, reading, and writing. Standard Deviation are presented in parentheses. The different represents the p-value from a paired t-test on the difference between Spanish and English mean self-ratings:
† $p < 0.1$,
* $p < 0.05$,
n.s. not significant.

Procedure

Participants were tested on two separate days. On the first day, participants completed the online LHQ, Spanish and English BNT, and the Spanish and English grammar tests. Testing lasted approximately 75 minutes. On a separate day, participants were seated at a desk with an experimenter. The participant and the experimenter each had a laptop upon which different versions of a map were displayed (see Figure 1). In between the two speakers was an omnidirectional condenser boundary microphone attached to a solid-state recorder. Crucially, a separate experimenter not participating in the modified map task completed the lab set-up, recording, and provided instructions. The participating experimenter and the participant were told that they each had similar versions of a map and had to make their maps as similar as possible. Speakers alternated in taking turns directing the other person to move their objects using a computer mouse. Participants were instructed to be as specific as possible in describing their objects and goal locations. The experimenter and bilingual participant completed 2 versions of the map task and concluded with an open-ended sociolinguistic interview on code-switching use. The experimenters were native Spanish speakers, known to code-switch during bilingual conversation. The experimenter always initiated the first modified map task and began in Spanish. The experimenter had as a primary goal to code-switch as naturally and frequently as possible and to use a balanced proportion of Spanish and English without specific reference to where code-switching should occur, but no script was followed. In order to reduce experimenter habituation to the map task, several versions of the task (i.e., varying backgrounds and objects) were used to avoid the repetition of similar phrases and create a novel and natural conversation. Additionally, the experimenters engaged in several practice

sessions with each other to determine their ability to maintain both languages active throughout a conversational setting.[2] The entire session lasted about 1 hour. Participants were compensated $10 per hour for both sessions.

Transcription and coding

Transcription and coding were conducted using ELAN <http://tla.mpi.nl/tools/tla-tools/elan/>, a free multimedia annotation software package provided through the Max Planck Institute in The Netherlands. ELAN allows for the layering and nesting of annotation tiers. Using this functionality, we transcribed participant and experimenter speech on separate annotation tiers. An additional language tier was linked to each speaker in which the language of the utterance was coded as 'e' for English and 's' for Spanish (see Figure 2). This additional language tier was later used to determine the proportion of Spanish and English spoken by each speaker and was used to plot the timecourse of language used during each map task game.

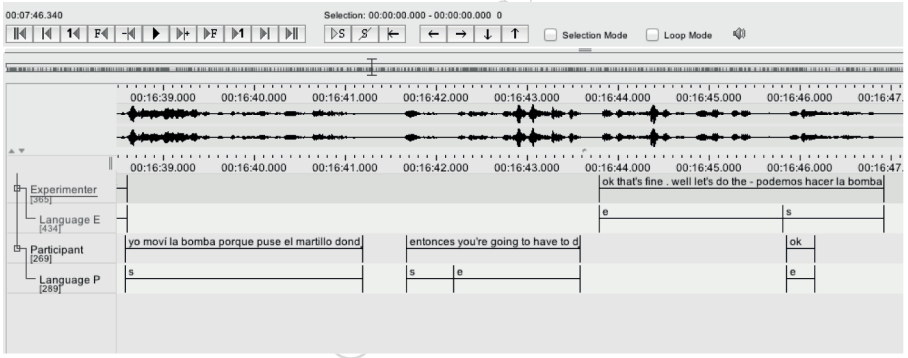

Figure 2. Sample screenshot of ELAN transcription tool.
*Transcriptions were completed in ELAN, a free multimedia annotation software package that permits building nested annotation tiers. For the map task, we transcribed the experimenter and participant on separate tiers and added an additional language tier to code the language of the utterance, 'e' for parts of the utterance that were in English and 's' for Spanish.

2. An anonymous reviewer asks whether experimenters repeated phrases due to completing the task multiple times. The scene changed between sessions, thus, no fixed collocations were produced; however, experimenters may have repeated code-switching strategies. This is the subject of a follow-up study on lexical and structural priming.

Results

We report on the results of the first map task. On average, the completion of the map task lasted 24 minutes 6 seconds (*SD* = 5 min 24 s) and generated speech produced in both languages on the part of the experimenter and the participant. However, participants varied greatly in their ability to produce speech in both languages. Hence, we will mainly present data at the individual level and not at group levels. In Table 2, we present the proportion of each language used for each participant. In Figure 3, we graphically present the proportion of language used during the map task for participants and experimenters during each session. The visual representation presented in Figure 3 reveals several noteworthy observations. First, the experimenter is able to intentionally sustain the use of both languages although specific use of each language varies from one session to the next. Second, all participants are able to use both languages during the task, indicating that the task is appropriate for inducing Spanish-English code-switching. Third, apart from the map task data from Participant 2, the participants and experimenters show a tendency to align in the distributions of Spanish and English used. That is, conversations were likely to be more Spanish-dominant or English dominant with the exception of Participant 2 where the experimenter produced a higher proportion of Spanish whereas the participant produced a higher proportion of English. However, participants did not simply mirror the distribution patterns of the experimenter, likely ruling out a strict priming account guiding the elicitation of code-switching.

Table 2. Proportion of each language used by Participant in Map task

Participant	Spanish	English
1	0.334	0.666
2	0.38	0.62
3	0.826	0.174
4	0.788	0.212
5	0.281	0.719
6	0.263	0.737
7	0.862	0.138
8	0.938	0.062
9	0.976	0.025
10	0.833	0.168

The language distributions plotted in Figure 3 underscore that individuals vary greatly in their ability (or willingness) to actively produce both languages within the same conversational setting. By rank sorting the proportion of English used within the task, we sorted individual participants into dense and sparse dual

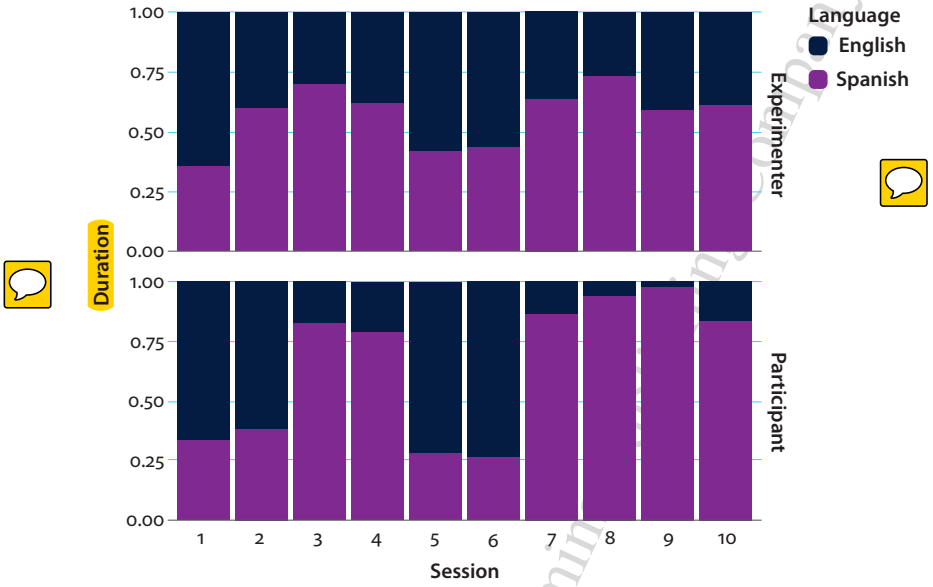

Figure 3. Proportion of language used during map task by Participant and Experimenter *Proportion of Spanish and English used during each session between a quasi-confederate experimenter and a naive participant. Data are presented in stacked bars per conversation session, with proportion of English use occupying the upper portion of each bar. Experimenters are presented in the top panel and participants in the bottom panel.

language users. However, proportion of language use alone does not inform us on a participant's propensity to code-switch. To get a closer approximation to participants' code-switching use, we plotted individual dialogue sessions including the timecourse information of language produced throughout the dialogue.

Figures 4 and 5 plot language produced by each speaker over time for the top 3 dense and sparse dual language participants, respectively. The conversations in Figure 4 are characterized by frequent alternations between the two languages on the part of the participants and the experimenters, as evidenced by the frequent back and forth between language segments. Although these three speakers were originally classified as dense dual language users, the participant presented in the bottom subplot presents a different profile of code-switching. In particular, the participant's alternation between languages is characterized by extended stretches in each language, suggesting a greater production of inter-sentential code-switching as a means to shift between languages. The bilingual profile of this participant supports this observation as the participant is a Mexican student who recently immigrated to the U.S. to attend university. The student attended a private English school in Mexico but reported maintaining a strict separation between Spanish

and English. This participant rated their code-switching use as higher (4) than their exposure (3).

The dialogues of the dense dual language users are noticeably different from the conversations of the sparse dual language users represented in Figure 5. All three participants overwhelmingly use Spanish in their speech despite the frequent code-switches on the part of the experimenter. In particular, their pattern of code-switching use is dominated by Spanish use with English insertions as evidenced by very minimal and brief switches into English. Interestingly, the experimenter's own production of code-switching is affected by the participants' lack of code-switching, as the last third of each session exhibits less use of code-switching. A direct comparison between the dense and sparse dual language users confirms that the proportion of English used during the Map task is different (Dense users mean = 0.692, Sparse users mean = 0.075, $t(3.96)^3 = -12.518$, $p < 0.001$), despite the lack of difference in the English BNT ($t(3.723) = -1.567$, $p = 0.198$) or the MELICET ($t(2.306) = -0.267$, $p = 0.811$). Subsequently, English proficiency does not seem to be influencing the difference between dense and sparse dual language users.

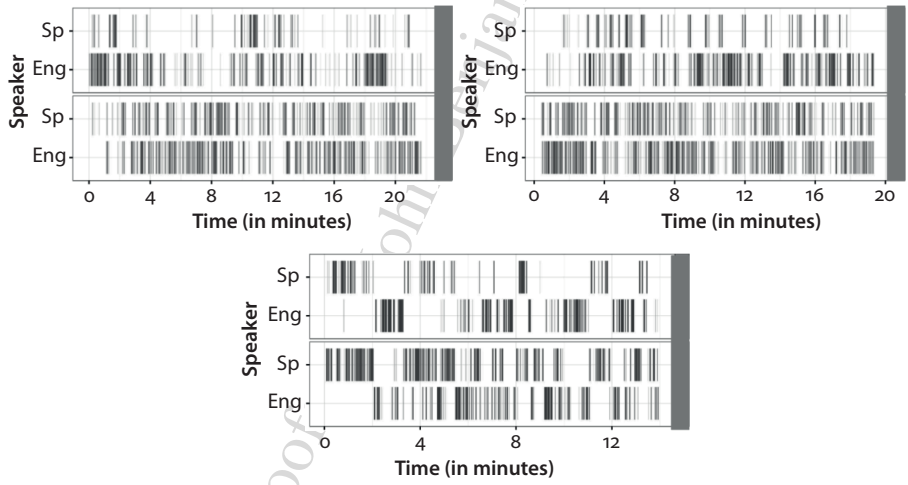

Figure 4. Timecourse plots of language used for dense dual language user
*Timecourse plots of language used are shown for the top three dense dual language users paired with the experimenter. Within each sublot, the top panel presents the participant's output. The amount of Spanish spoken is presented in "Sp" and English in "Eng."

3. Note that because of the low sample sizes per group ($n = 3$), we have conducted 2-sample t-tests without the assumption of equal variances, hence the non-whole degrees of freedom.

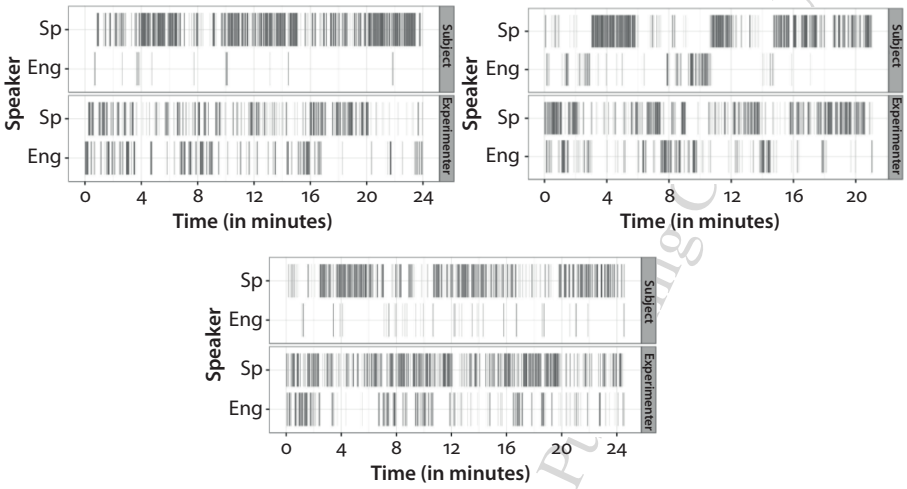

Figure 5. Timecourse plots of language used for sparse dual language users
*Timecourse plots of language used are shown for the top three sparse dual language users paired with the experimenter. Within each sublot, the top panel presents the participant's output. The amount of Spanish spoken is presented in "Sp" and English in "Eng."

We also computed correlations between the self-reported and proficiency measures and the proportion of English used to determine if there was a relationship between a quantified approximation of code-switching use and our proficiency measures. We reasoned that because the experimenter initiated the map task in Spanish and then switched into English, the conversations were mainly framed as Spanish conversations that could then switch into English. This assumption is tentatively supported, as the overall proportion of English spoken (0.352) is numerically (and marginally) lower than the overall proportion of Spanish used by the participants (0.648, $t(9) = -1.594$, $p = 0.073$). Interestingly, the proportion of English spoken by the participants was positively correlated with self-reported code-switching use ($r = 0.464$) but not with self-reported code-switching exposure ($r = -0.036$). This difference suggests that self-reported code-switching use is a more accurate and reflective measure of participants' actual ability to code-switch. Additionally, the proportion of English spoken by the participants was also positively correlated with the English BNT measures ($r = 0.479$) but the proportion of Spanish spoken by the participants was not correlated with the Spanish BNT measure ($r = -0.085$). This asymmetry suggests that fluency in English impacts a bilingual's propensity to code-switch into English. In other words, code-switched speech that goes beyond insertional English switches is related to a bilingual's fluency in English.

General discussion

The primary goal of the present study was to determine whether spontaneous and unscripted code-switched speech can be induced in an experimental setting with an unknown conversation partner (i.e., the experimenter). In order to test this goal, we utilized a modified map task built on the successful use of referential communication tasks in first and second language acquisition and experimental pragmatics (e.g. Anderson et al, 1993; Clark, 1996; Yule, 1997). Participants interacted with a bilingual experimenter to work together to create a common map. A bilingual experimenter who was knowledgeable of the experimental goals was used in order to investigate whether the experimenter could sustainably maintain frequent code-switches as a means to increase the likelihood that participants would produce naturally occurring code-switches.

In terms of the viability of using this approach, all bilingual participants tested (n = 10) produced code-switched speech, and the bilingual experimenter was able to frequently code-switch throughout the conversation game. At a minimum, this success means that bilingual researchers and assistants can be trained to maintain unscripted speech that alternates between English-only, Spanish-only, and code-switched utterances. This ability is non-trivial as the paradigm addresses some of the methodological challenges faced by the experimental study of code-switching in lab settings (Gullberg, et al., 2009). In particular, it establishes a discourse context, provides an interactional exchange of information, and is conducted orally – all features that are predominantly associated with code-switching in bilingual speech. This approach, then, provides social and discourse support for the use of code-switching in a semi-controlled experimental setting. Because the objects that appear in the map scenes are *a priori* selected by researchers, grammatical and referential manipulations can also be introduced into the paradigm. Although not discussed in the current study, we included a second version of a map task in which two objects share the same noun form, necessitating disambiguation by some modifying expression (e.g. "the antique key" v. "the modern/typical key"). Given the differences in noun-adjective word order in Spanish and English, such a manipulation may help contribute further empirical data to adjudicate between competing grammatical theories on code-switching (e.g. Parafita Couto, Fusser, & Deuchar, 2015; Herring, Deuchar, Parafita Couto, & Moro Quintanilla, 2010; Cantone & Müller, 2005). In this sense, we believe that referential communication tasks may serve as a critical bridge, linking theoretical, sociolinguistic, and psycholinguistic perspectives on code-switching. In a similar fashion, future research can also manipulate the cultural identity of objects (e.g. pretzels v. *empanadas*) to determine the influence on linguistic choice in surrounding discourse. Thus, the ability to relatively quickly compile a corpus of code-switched speech with targeted

grammatical and pragmatic manipulations will greatly complement the fieldwork methods employed by sociolinguists (e.g. Torres Cacoullos & Travis, 2015).

Beyond the viability of the map task to induce code-switched speech in bilingual participants, a secondary goal of the current study was to determine the extent to which self-reported ratings on code-switching use and exposure reflect actual patterns of code-switching use given that no real quantitative measure of code-switching proficiency currently exists (cf. Yim & Bialystok, 2012). Validating current practices in psycholinguistic studies on code-switching (see e.g. Valdés Kroff et al., 2016; Kootstra et al., 2012), self-reported code-switching use shows a positive correlation with a bilingual's production of English in otherwise Spanish-initiated conversations. However, our study also provides a warning against the reliance on self-reported code-switching exposure, which resulted in no correlation to a bilingual's ability to produce English. The disparity between the two self-reported ratings is not currently clear, especially due to our small sample. We can only speculate on two alternatives: potentially, the negative stigma associated with the use of Spanish-English code-switching in the U.S. may be influencing the participants' self-ratings. Under this scenario participants may admit they themselves produce code-switched speech but are reluctant to reveal that they belong to a community of speakers who all engage in code-switching. Alternatively, the participants themselves may actually not pertain to a community of code-switching speakers, i.e. may not come from code-switching hubs along the east coast of U.S. such as Miami and New York or much of southwestern U.S. Clearly, more participants and detailed social network analyses are needed to replicate the difference between code-switching use and exposure as well as to determine the underlying cause of this discrepancy. Nevertheless, for the time being, a prudent approach to determining a bilingual's propensity to code-switch is to rely more upon code-switching use than exposure in language history questionnaires.

From the compiled corpus generated by the dialogues, participants and the experimenter showed a tendency towards alignment in their overall use of both languages. This pattern is in line with interactive alignment theories of language production and comprehension in which structural and lexical priming are primary cognitive mechanisms of coordination (e.g. Kootstra et al., 2010, 2012; Pickering & Garrod, 2004). However, when turning to the timecourse plots, priming as a primary cognitive mechanism in code-switched speech is not as apparent. In particular, the timecourse plots of the sparse dual language users (Figure 5) show strikingly different patterns of shifting between languages between the experimenter and the participant. One methodological difference between our approach and other approaches that have found a strong role for priming is that the dialogue generated by the modified map task is unscripted and not decomposed into singular alternating trials as is common in structural priming paradigms (e.g. Bock,

1986). Yet at the same time, the reluctance of the sparse dual language users to code-switch began to affect the experimenter's own code-switching patterns by the end of the conversational session, thus indicating that priming and interactive alignment do play a role in bilingual speech. One of the strongest advantages that we see from this conversational paradigm is that the strength of lexical and structural priming can be investigated in a more fine-grained manner. Specifically, given that the objects presented in the modified map task are putatively named by both partners, the extent to which speakers stick to the language used in the first naming of the object can be tracked throughout the entire conversation, thus reducing the search space of finding repeated lexical forms in large-scale corpora while also increasing the likelihood of generating sufficient repetitions of specific lexical forms. We are beginning to investigate this issue with the current paradigm.

Finally, we must note that the conversational paradigm continues to face some challenges. In particular, its successful implementation requires the recruitment of bilingual code-switching researchers onto a research team. We recognize that this may be limiting to many research teams; however, as many funding agencies have as primary goals the increased presence of underrepresented groups in the sciences, we believe that this challenge is one that can and should be overcome. Second, the transcription and coding of actual conversations remains labor and time intensive. These challenges are not new to the sociolinguistic researcher; however, if one aim is for the conversational paradigm to be used as a more quantitative proficiency measure of code-switching, then the time to achieve output will have to become more efficient. One near-term goal that we are investigating is whether shorter segments of each conversation session will equally reflect a bilingual participant's overall propensity to code-switch. Most likely, an undetermined amount of time has to pass during the conversation in order to overcome an initial phase of negotiating code-switching use between two unknown conversation partners interacting with each other.

Conclusions

We have framed the current study as mainly a case study on the viability of the modified map task as an important methodological tool in the experimental study of code-switching; however, it's viability now lays the groundwork for several important advances. The use of referential communication tasks to induce code-switching in an experimental setting will greatly increase the number of conversational corpora for research use. Our preliminary investigation into the use of a modified map task to elicit code-switches indicates that participants are willing to code-switch with an unknown bilingual experimenter, although

the participant's propensity to code-switch does not automatically mirror that of the bilingual experimenter. The use of referential communication tasks for code-switching research is just at a nascent stage but has the potential to further expand our understanding of this unique bilingual skill. One as of now untapped application of the task is the ability to study both production and comprehension processes within the same speaker. Although the efficient and large-scale use of referential communication tasks in code-switching research continues to face several challenges, its successful implementation will pave the way for conducting a greater number of socially-informed psycholinguistic studies on the production and comprehension of code-switched speech as well as clarify several outstanding issues on the social and linguistic profile of bilinguals who intentionally code-switch.

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