Bimodal Bilingualism: Code-blending between Spoken English and American Sign Language

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1. Introduction

The vast majority of bilingual studies involve two spoken languages. Such "unimodal" bilingualism automatically entails a severe production constraint because one cannot physically produce two spoken words or phrases at the same time. For unimodal (speech-speech) bilinguals, there is a single output channel, the vocal tract, for both languages. In contrast, for bimodal (speech-sign) bilinguals, there are two output channels: the vocal tract and the hands. In addition, for unimodal bilinguals both languages are perceived by the same sensory system (audition), whereas for bimodal bilinguals one language is perceived auditorily and the other is perceived visually. In this article, we present a preliminary investigation of bimodal bilingual communication among hearing people who are native users of American Sign Language (ASL) and who are also native English speakers.

First, it is important to emphasize that American Sign Language has a grammar that is independent of and quite distinct from English (see Emmorey (2002) for a review). For example, ASL allows much freer word order compared to English. English marks tense morphologically on verbs, whereas ASL (like many languages) expresses tense lexically via temporal adverbs. Conversely, ASL contains several verbal aspect markers (expressed as distinct movement patterns superimposed on a verb root) that are not found in English, but are found in many other spoken languages (e.g., habitual, punctual, and durational aspect). Obviously, ASL and English also differ in structure at the level of phonology. Signed languages, like spoken languages, exhibit a level of sublexical structure that involves segments and combinatorial rules, but phonological features are manual rather than oral (see Brentari (1998), Corina & Sandler (1993) for reviews). Finally, English and ASL differ quite dramatically with respect to how spatial information is encoded. English, like many spoken languages, expresses locative information with prepositions, such as "in," "on," or "under." In contrast, ASL encodes locative and motion information with verbal *classifier constructions*. In these constructions, handshape morphemes specify object type, and the position of the hands in signing space schematically represents the spatial relation between two objects. Movement of the hand specifies the movement of an object through space (within whole-entity classifier constructions, see Emmorey, 2003). Thus, English and ASL are quite distinct from each other within phonological, morphological, and syntactic domains.

In the current study, we chose to examine hearing ASL-English bilinguals because although Deaf[1] signers are generally bilingual in ASL and English, many Deaf people prefer to read and write English, rather than use spoken English. Also, Deaf individuals do not acquire spoken English in the same way that a second language is acquired by unimodal bilinguals. For example, early speech bilinguals may be exposed to two languages in the home or one language may be used in the home and another in the community. In contrast, spoken language is not accessible in the environment of a deaf person and deaf children require special intervention, including training in speech articulation, speech perception, and lip reading, unlike hearing children acquiring a spoken language (see Blamey, 2003). Therefore, we examined hearing bilinguals who have Deaf parents for whom speech and sign are equally accessible within the environment. Bimodal bilingual children acquire a signed language and a spoken language in the same way that unimodal bilingual children acquire two spoken languages (Petitto, Katerelos, Levy, Gauna, Tetreault, & Ferraro, 2001; Newport & Meier, 1985)

To our knowledge, this is the first study to examine bilingual communication in adults who acquired both signed and spoken languages naturally without explicit instruction. Hearing adults who grew up in Deaf families constitute an important bilingual community. Many identify themselves as

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CODAs or Children of Deaf Adults who have a cultural identity defined in part by their bimodal bilingualism, as well as by shared childhood experiences in Deaf families. CODA is also the name of the organization that hosts events, workshops, and meetings for hearing sons and daughters of Deaf parents. This group of bilinguals shares cultural similarities with other bilingual communities.

The unique nature of bimodal bilingualism raises several questions regarding the nature of bilingual communication, which we have begun to investigate. First, what are the ramifications of removing a major articulatory constraint on bilingual language production? Specifically, we examined whether code-switching occurs when articulatory constraints are lifted. For unimodal code-switching, the speaker must stop using one language and switch to a second language, either within a sentence or cross-sententially. What happens when the phonologies of the two languages are expressed by different articulators, thus allowing simultaneous expression? Do bimodal bilinguals pattern like unimodal bilinguals with respect to the temporal sequencing of code-switches? Or do they produce simultaneous speech-sign expressions?

Second, does being a bimodal bilingual influence communication with monolinguals? In particular, we investigated whether the gestures that accompany speech in a conversation with a monolingual English speaker are affected by being an ASL-English bilingual. Research by McNeill has shown that co-speech gesture is ubiquitous and that gesture and speech are not separate independent systems, but form an expressive unit (McNeill, 1992; McNeill, 2000). We investigated whether bimodal bilinguals might actually produce ASL signs as part of their co-speech "gesture" when conversing with a monolingual English speaker who has no knowledge of ASL. In her master's thesis comparing ASL and gesture production, Naughton (1996) reported that one hearing (non-native) ASL signer produced a few clearly identifiable ASL signs while conversing in English with a non-signer. A micro-analysis of the timing of these ASL signs with respect to co-occuring speech indicated that the signs were produced with the same tight temporal alignment found for co-speech gesture. Naughton suggests that knowledge of ASL may change the gesture-speech interface for ASL-English bilinguals. We investigated this intriguing hypothesis with a larger group of *native* ASL-English bilingual participants.

Finally, we investigated how bilingual communication differs from simultaneous communication or SimCom. SimCom (sometimes referred to as Total Communication) is the communication system frequently used in deaf education. The use of SimCom is an attempt to produce grammatically correct spoken English and ASL at the same time. Grammatically correct English is important for educational purposes, and ASL is usually mixed with some form of Manually Coded English (an invented sign system designed to represent the morphology and syntax of English). SimCom is also used by bilinguals with a mixed audience of hearing persons who do not know ASL and of Deaf persons for whom spoken English is not accessible. The goal is to present the same information in both vocal and manual modalities, essentially a dual task because the two modalities have different properties and the two linguistic systems are distinct and non-identical. How does SimCom with its dual task properties differ from bilingual communication where speakers have both languages at their disposal, but are not forced to use the languages simultaneously?

In sum, our goal is to characterize the nature of bimodal bilingualism to provide insight into the nature of the bilingual mind and bilingual communication in general. Bimodal bilingualism offers a unique vantage point from which to study the temporal and linguistic constraints on code-mixing, the semantic, pragmatic, and sociolinguistic functions of bilingual communication (particularly when temporal constraints on simultaneous language production are removed), and the impact of bilingualism on language production in general (specifically on the production of co-speech gesture).

2. Method

2.1 Participants

Eleven ASL-English fluent bilinguals participated in the study (4 males; 7 females) with a mean age of 32 years (range 22-41 years). All were hearing and grew up in families with one or two Deaf parents. Participants rated themselves as fluent in both ASL and in English (a rating of 6 or higher on

a 7-point fluency scale). In addition, all of the participants had participated in CODA meetings or events.

2.2 Procedure

Participants were told that we were interested in how CODAs talked to each other, and they were asked to perform three tasks. In the first part of the study, each participant conversed with either another ASL-English bilingual whom they knew (either one of the experimenters (HB) or another friend) or with a monolingual English speaker whom they did not know and who did not know any ASL. Whether participants initially interacted with a bilingual or a monolingual partner was counter-balanced across participants. Each conversation lasted about fifteen minutes, and the topics differed in the bilingual and monolingual conditions. The topics for the bilingual conversation were related to CODA experiences (e.g., parent-teacher meetings in which the participant was asked to interpret for his or her parents), whereas the topics for the monolingual conversation were more general (e.g., differences between men and women). When interacting with the bilingual partner, participants were explicitly told that although they might begin talking in English, it was fine to use ASL "whenever you feel like it" and that "we want you to have both languages 'on'." We designed the interactions in this way because the participants would most likely be in a bilingual mode when interacting with a bilingual friend, discussing ASL and deafness-related topics and in a monolingual mode when interacting with an unfamiliar nonsigner on topics unrelated to their bilingualism (see Grosjean, 2001). Participants are most likely to code-mix when they are in a bilingual mode, and ASL is expected to be "deactivated" when bimodal bilinguals are in a monolingual mode (and the interlocutor is a nonsigning English speaker).

In the second part of the study, participants watched a seven minute cartoon (*Canary Row*) and then retold the cartoon to their conversational partner. Subjects watched and re-told the cartoon twice, once in the bilingual condition and once in the monolingual condition (again, order of condition was counter-balanced). This particular cartoon was chosen because it is commonly used to elicit co-speech gesture (e.g., McNeill, 1992), and therefore allowed us to easily compare the simultaneous production of ASL and spoken English with co-speech gesture.

Finally, participants were also asked to retell the cartoon a third time using SimCom, i.e. producing sign and speech at the same time, to their bilingual addressee. All interactions were videotaped for analysis. Filming took place at the Salk Institute in San Diego, at Gallaudet University in Washington DC, or in Iowa City, Iowa, where a group of ASL-English bilinguals were participating in a neuroimaging study at the University of Iowa.

3. Results and discussion

In this initial report, we focus on the data from the cartoon re-telling because the linguistic content is the same across all three situations (bilingual addressee, monolingual addressee, and SimCom production with a bilingual addressee), and the data from the cartoon re-telling permit a straight forward comparison with co-speech gesture. Finally, the portion of the cartoon that was analyzed for this presentation consisted of the two "pipe episodes" in which Sylvester the cat makes two attempts to climb a drainpipe to capture Tweety Bird who is in his cage in a nearby window. Sylvester is foiled each time in various ways by either Granny or Tweety.

English and ASL were transcribed from the videotapes by two coders, each checking the other's transcription for accuracy.

3.1 Results: bilingual situation

One participant elected to sign her re-telling of the cartoon without any speech. The other ten participants all used spoken English with occasional or frequent ASL signs and phrases.

The results indicate that speech-sign bilinguals rarely code-*switch*, that is, stop talking and switch to signing ASL. Only 5% of ASL signs in this data set were produced without speech. For example, after saying "pipe," participant 2 then produced an ASL classifier construction indicating a vertically

oriented thin cylinder without any accompanying speech. In this ASL construction, two "F" handshapes (thumb and index finger form a circle) overlapped with contact, and the right hand moved upward. This ASL expression does not have an exact English translation and describes the spatial orientation and general size of the pipe through which Sylvester climbed in order to reach Tweety.

Rather than producing code-switches, bimodal bilinguals produced what we will term *code-blends* in which ASL signs are produced simultaneously with English words (95% of ASL signs co-occurred with English words). Examples (1) and (2) illustrate code-blends from two participants. By convention, words in upper case represent English glosses (the nearest equivalent translation) for ASL signs. Multiword glosses connected by hyphens are used when more than one English word is required to translate a single sign. Brackets in the English transcription indicate the word(s) that co-occur with the ASL sign.

(1) P1: "So Sylvester who's on the ledge [jumps into] the apartment."
JUMP

(2) P7: "I [don't] [think] he would [really] [live]."
NOT THINK REALLY LIVE

The percentage of code-blending versus code-switching by these bilingual adults is quite similar to the percentages reported by Petitto et al. (2001) for three- to four-year-old bimodal bilinguals (Langues des Signes Québécoise (LSQ) and spoken French). They reported that 94% of the mixed utterances produced by two children were "simultaneous mixes" (code-blends in our terminology), and 6% were "sequential mixes" (i.e., code-switches).

3.1.1 Semantic equivalency of code-blends

Our first analysis of code-blends focused on whether the ASL and English forms were semantically equivalent. That is, do the two codes present the same or different information when blended? Of 186 code-blends, 174 (94%) of the ASL signs were semantically equivalent to the accompanying English. Examples of semantic equivalency can be found in (1) and (2) above. The percentage of semantically equivalent code-blends in our study of ten ASL-English adult bilinguals is also similar to what Petitto et al. (2001) reported for their two bimodal bilingual children. They found that 89% of simultaneously produced LSQ signs and French words were "semantically congruent mixes."

Example (3) and Figure 1 illustrate a semantically non-equivalent code-blend ("All of a sudden"/LOOK-AT-ME).

(3) P1: He's like hmm [all of a sudden] Ack!
LOOK-AT-ME

Figure 1. Illustration of the sign LOOK-AT-ME from the code-blend in Example (3).

In this example, the participant is talking about a scene in which Sylvester the cat has climbed up the outside of the drainpipe next to Tweety's window. In (3), "He" refers to Sylvester who is nonchalantly watching Tweety swinging inside his bird cage on the window sill. Then all of a sudden, Tweety turns around and looks right at Sylvester and screams ("Ack!"). The sign glossed as LOOK-AT-ME is produced at the same time as the English words "all of a

sudden." For this ASL verb, the signer's body represents the object of LOOK (i.e., Sylvester). In this code-blend example, the ASL and English expressions each convey quite distinct information, although both expressions refer to the same event.

Semantically non-equivalent code-blends were relatively rare (only 6% of examples in our data set). Interestingly, Wagner, Nusbaum, and Goldin-Meadow (2003) reported a similar percentage of gesture-speech mismatches (5%). Mismatches occurred in their study when explanations of math problems (by adults) contained information in gesture that was not found in the speech. Like ASL-English code-blends, gesture and speech tended to convey the same information. Our findings thus suggest that code-blends pattern like the gestures that accompany speech with respect to the distribution of information across modalities.

3.1.2 Grammatical categories of ASL-English code-blends

In addition to the semantics of code-blending, we also examined syntactic aspects of code-blending. Specifically, we categorized the grammatical functions of the ASL signs that occurred in each code-blend. For unimodal speech-speech bilinguals, nouns are easily code-switched, but verbs switch much less frequently (Muysken, 2000; Myers-Scotton & Jake, 2003). In contrast, we found that verbs participated in code-blends more often than nouns for bimodal bilinguals (see Figure 2).

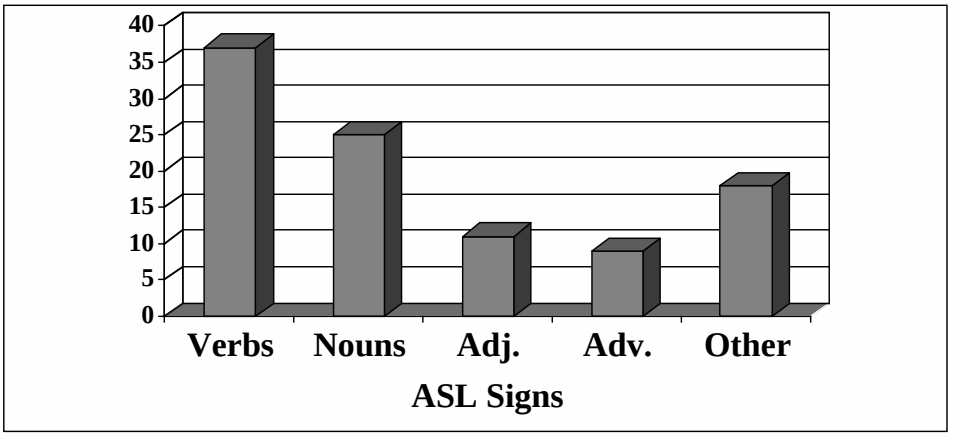

Figure 2. Grammatical categories of ASL code-blends.

There are several possible reasons for the propensity of ASL verbs to participate in code-blends. For example, the inflectional morphology of the two languages does not have to be integrated in ASL-English code-blends. English tense inflections can remain in the speech while the ASL verb is produced simultaneously. For example, for the code-blend in (1) above, the English verb is inflected for third person ("jumps"), and the ASL verb JUMP is produced at the same time. In this example, the ASL verb JUMP moves outward from the signer indicating "jump toward a location" rather than "jump in place." Additionally, there are ways in which the languages can be adapted to match the morphology of the other. We observed examples in which an English verb was repeated in order to match the aspectual morphology of the ASL verb. For example, one participant used the reduplicative form of the ASL verb CHASE to indicate that Sylvester was chased all around the room. The English verb "chase" was repeated with each of the repetitions of the ASL verb (an example of ASL-influenced English, see below).

Another possible reason that ASL verbs and English verbs are often code-blended may be that ASL verbs convey subtle semantic nuances, not present in the English verbs. For example, some ASL verbs inflect for location (e.g., not just "jump" but "jump toward a location"), and classifier predicates often convey additional visual-spatial information not expressed by the English verb. ASL nouns are less likely to convey such additional information. Further, ASL is a pro-drop language, which might lead to fewer nominal code-blends.

3.1.3 ASL-influenced spoken English

It was not the case that ASL signs were always just added to English utterances. We also observed examples of spoken English that were clearly influenced by the accompanying ASL:

(4) P7: "He goes over and sees the gutter going up the side of the building. [Happen] [what]?
HAPPEN WHAT
Right [next to] [the window]!" (laughter by both participants)
NEXT-TO WINDOW

In example (4), the phrase "Happen what?" is a word-for-sign translation of an ASL conjunction phrase that could be translated in this context as "And guess what?". This rhetorical question is followed by the answer "[it's] right next to the window!" (where Tweety is sitting). In the answer, the English expletive "it" and copula "is" are deleted, which could also be considered an example of ASL-influenced English. A more extensive example of ASL-influenced English is given in (5):

(5) P2: "[An] [old] [woman] [seem] [her] [bird] [she] [protect]."
A-N OLD WOMAN SEEM POSS BIRD. PRO PROTECT

Note: A-N = fingerspelled article; PRO = pronoun, a point to a location in signing space; POSS = possessive pronoun, a B handshape (fingers extended and together) directed toward the same location in space

Example (5) is another word-for-sign translation of grammatical ASL. The ASL phrases could be translated as "There's this old woman, and it seems it's her bird. She protects it." Examples (4) and (5) illustrate what we have informally called "CODA-speak," a variant of English that bimodal bilinguals use together, almost always accompanied by simultaneous ASL. There was a continuum with respect to the degree to which English followed the ASL during bilingual communication. Some participants never produced such speech during the cartoon narrative. Some participants produced occasional examples, and for participant 2 (example 5), almost his entire narrative consisted of code-blending and ASL-influenced speech. For this participant, it may be that ASL was actually the base language of production, not English. Furthermore, this type of bimodal bilingual speech can be distinguished from SimCom, the intentional simultaneous expression of grammatical ASL and English. Example (6) below is from participant 2, who is a certified interpreter and unusually skilled in the simultaneous production of ASL and English.

Sim Com condition:
(6) P2: "(he) [goes in] and [tries] [to get] [the bird] [but] [the old] [woman] [who] [owns]
GO-IN TRY CATCH BIRD BUT OLD WOMAN WHO #OWNS

[the bird] [whacks him over the head][and he falls out of the building]
BIRD BEAT-OVER-HEAD$_{[repeat]}$ Classifier construction: "animal falls from flat surface"

Note: #OWN = fingerspelled form; [repeat] = a reduplicated verb

The contrast between examples (5) and (6) illustrate that participant 2 is skilled at ASL-English code-blending and at simultaneously producing grammatical English and ASL. Furthermore, this contrast also indicates that for this participant, code-blending and SimCom are clearly distinct forms of simultaneous communication. As we will see below (*3.3 Results: SimCom situation*), not all participants were as skilled as participant 2 in their ability to SimCom.

3.2 Results: monolingual situation

As noted in Methods, in the monolingual situation, participants re-told the cartoon to an unfamiliar addressee whom they knew did not know any ASL. One subject did not participate in the monolingual condition (a monolingual addressee was not available), and thus our analysis is based on data from ten participants.

Unlike the bilingual situation, we did not observe any examples of ASL-influenced English. However, the bimodal bilinguals occasionally produced an ASL sign when speaking to a monolingual addressee. In the monolingual situation, an average of 6% of English words were accompanied by an ASL sign. In contrast, in the bilingual situation reported above, 23% of English words were accompanied by an ASL sign. Example (7) and Figure 3 provide an example of an ASL "intrusion" during the re-telling of the cartoon to a non-signer.

(7) P2: "So [now] he's like, you know, scanning the streets."
NOW

Figure 3. Illustration of the sign NOW from example (7), an ASL intrusion into an English-only narrative.

The fact that ASL intrusions occurred during conversations with monolingual English speakers provides further evidence that both languages are active in the minds of bilinguals, even if those languages are in different modalities. In addition, these intrusions suggest that the nature of the gesture-speech interface can be affected by the acquisition of ASL. Knowledge of ASL provides a speaker with access to a large inventory of manual symbols that are unavailable to monolingual speakers. It appears that speakers produce ASL signs unintentionally and without conscious awareness. The bilingual participants in our study did not appear to be producing ASL signs with communicative intent, given that their addressee could not understand ASL.

Finally, the fact that ASL-influenced speech was *not* produced while talking with the monolingual addressee suggests a distinction between the two codes of the ASL-English code-blend. That is, ASL may "intrude" into a monolingual English narrative because co-speech gesture provides an avenue for unobtrusive insertion. None of the monolingual addressees appeared to notice the ASL signs produced by the bilingual speakers. In contrast, English word-for-sign expressions would be immediately detected as unusual, just as if a Spanish-English bilingual produced a code-switch from English to Spanish when conversing with a monolingual English speaker. Thus, becoming a bimodal bilingual may have a unique effect on language production in general because of the shared modality for the production of co-speech gesture and sign language.

3.3 Results: SimCom situation

In this situation, participants were asked to produce English and ASL at the same time, and their addressee was a bilingual friend. One subject did not participate in the SimCom condition, and thus our results are based on data from ten participants.

As found for the bilingual situation, the ASL signs produced during SimCom were generally semantically equivalent to the co-occurring English productions. For SimCom, 85% of ASL-English combinations were semantically equivalent. We hypothesize that the percentage of semantic equivalency was somewhat less than in the bilingual condition (94%) because participants were

required to produce the two languages at the same time. Under this constraint, it is not always possible to quickly and easily retrieve semantically equivalent words or phrases. The following are some examples of semantic non-equivalencies found in SimCom productions across participants:

ASL	English	ASL	English
CAT	Sylvester	NEXT	then
BIRD	Tweety	FIGURE$_{[repeated]}$	does different things
CARETAKER	owner	TIME	part
CATCH/GRAB	get	STAND	there
SEE	hear	HAPPEN	well
Classifier construction:	goes up	HAVE	there's
"animal moves up through		ON	side
a cylindrical object"		HOWEVER	want

As found by many other investigators (e.g., Marmor & Petitto, 1979; Strong & Charlson, 1987; Whitehead, Schiavetti, Whitehead, & Metz, 1995), we found that SimCom tends to engender speech dysfluencies. For example, the proportion of filled pauses ("ums" and "uhs") was twice that of the bilingual situation (.012 filled pauses per word versus .038 filled pauses per word for the bilingual and SimCom situations, respectively). In addition, pauses were more frequent than in the bilingual condition (.044 per word versus .065 per word for the bilingual and SimCom situations, respectively). Finally, although we did not measure the speech acoustically, it was easy to hear that the vowels in the English words were often lengthened in SimCom productions in order to keep pace with the ASL signs (see also Windsor & Fristoe, 1991). This type of vowel lengthening was not obvious in code-blends that occurred in the bilingual situation.

Thus, it appears that the dual-task properties of SimCom exacted semantic and fluency costs that were not apparent during natural bilingual communication.

3.4 Results: preliminary gesture analysis

Participants gestured in all three situations, but gesture was most frequent in the monolingual situation, as can be seen in Table 1.

Table 1. Percentage of English words accompanied by gesture.

Communication Situation		
Bilingual	Monolingual	SimCom
36%	41%	12%

Examples of gestures (in italics) from each condition are given below:

Bilingual situation
(8) P7: So [Tweety] [sees] this and [says], "hmm"
#TWEETY SEE SAY *puts hand on chin as if thinking*

Monolingual situation
(9) P9: and hits him with an [umbrella]
hand imitates holding a stick-like object

SimCom situation
(10) P1: The [bird] (pause) [bops him on the head]
BIRD PRO *imitates hitting someone over the head with a stick-like object*

Gestures were distinguished from ASL signs in several ways. First, lexicalized signs such as NOW or SEE are clearly distinguished from gesture by their form. Common gestures are also clearly not ASL signs, e.g., scratching one's chin while saying "hmmm" or a circling of the hand to indicate word-finding difficulty. In addition, the nature of the articulation distinguished signs from gestures. ASL signs tend to have a more crisp articulation with clearly formed hand configurations. In contrast, gestures often have a loosely formed hand configuration.

We are beginning to examine whether gestures produced by bimodal bilinguals differ in any measurable way from the gestures produced by monolinguals and whether code-blends differ from co-speech gesture. One way that co-speech gesture, code-blending, and SimCom might differ is in the timing between the speech and the manual component. Thus, we have undertaken an initial analysis of where precisely the gesture or sign begins with respect to speech. Using Final Cut Pro (a digital video editing program), we can measure within milliseconds where a manual expression (sign or gesture) begins with respect to the speech, displayed as a wave form.

Our preliminary results indicate that ASL signs were initiated prior to the beginning of the corresponding English words for both SimCom and code-blending. However, the lag time between sign and speech was longer and more variable for SimCom. Based on measurements from six participants (an average of 8 measurements per participant per condition), we found that ASL signs preceded the associated English word by an average of 100 milliseconds in ASL-English code-blends, whereas signs preceded the associated English word by 230 milliseconds during SimCom. Measurements were based on the start of the ASL sign proper, not on the transitional movement of the sign. Thus, these data can be comparable to the stroke phase of co-speech gesture, rather than to the preparatory phase (Kendon, 1980).

Our preliminary analysis of co-speech gestures produced by bilingual speakers revealed that the stroke of the gesture was nearly simultaneous with the associated speech, but thus far we have only conducted a few measurements. Nonetheless, the preliminary findings are consistent with previous gesture-timing investigations, which report that the stroke of a gesture is most often produced simultaneously with the associated speech (Kendon, 1980; McNeill, 1992).

In sum, the preliminary timing results suggest that the temporal association of sign and speech within code-blends is more similar to co-speech gesture than to the timing of sign and speech that occurs during SimCom production.

4. Conclusions

Bimodal (sign-speech) bilingualism differs from unimodal (speech-speech) bilingualism with respect to the temporal sequencing of languages during code-mixing. ASL-English bilinguals produce code-*blends*, rather than code-*switches*. Bimodal bilinguals do not stop speaking to sign or stop signing to speak. Rather, they produce sign and speech simultaneously when in a bilingual mode of communication. In general, code-blends are semantically equivalent in ASL and English, suggesting that code-blending is not produced in an effort to distribute distinct information across modalities. Code-blends also differ from code-switches with respect to grammatical category. Nouns tend to be easily inserted within an intra-sentential code-switch, but we found that verbs were most likely to be code-blended for ASL-English bilinguals.

Code-blending can also influence the structure of spoken English. Some participants produced examples of "CODA-speak" in which the spoken English followed the ASL in a word-for-sign translation. Examples of such ASL-influenced English were most prevalent in the data from recordings made in Iowa where several CODAs spent a fair amount of time together. These participants were most comfortable with each other and were frequently in a bilingual mode. The fact that ASL-influenced speech did not occur when bilinguals were speaking with monolingual English speakers suggests that such speech is a clear marker of ASL-English bilingual communication. Such speech should not be viewed as "bad English," but as a form of bilingual communication that is parallel to the code-mixing that occurs with unimodal bilinguals.

Our results indicate that bilingual communication differs from "simultaneous communication" or SimCom. The timing of ASL signs with respect to English words during SimCom production was not as tightly linked as for code-blends. SimCom productions contained more semantic mismatches

between ASL signs and English words than code-blends. Finally, the participants were more dysfluent in the SimCom condition than in the bilingual condition, and several participants remarked upon the difficulty of the SimCom task. Thus, although SimCom involves the simultaneous production of ASL and English, the sociolinguistic functions and the cognitive demands of this type of communication are quite different than the code-blending that occurs naturally during bimodal bilingual interactions.

Finally, ASL-English code-blends share some interesting properties with co-speech gesture. Like the gestures that accompany speech, the information conveyed by ASL generally matches the information conveyed by the speech. Gesture-speech mismatches in which the gesture and speech convey different information appear to occur at approximately the same rate as semantically non-equivalent code-blends (Wagner et al., 2003). In addition, the temporal link between the production of ASL signs and English words appears to be nearly as tight as that observed for gesture and speech. However, there are also clear differences between co-speech gesture and code-blends. Unlike the gestures that accompany speech, ASL-English code-blends are shaped by linguistic constraints on structure. For example, ASL signs differ from gestures with respect to form. Signs have an internal phonological structure, whereas gestures are idiosyncratic with no standards of form. Code-blended phrases, such as those illustrated in examples (5) and (6) exhibit a syntactic hierarchical structure. In contrast, successive co-speech gestures do not form a larger hierarchical structure. Future research will further illuminate the parallels and distinctions between ASL-English code-blends and co-speech gesture.

The fact that ASL signs occasionally intruded when bimodal bilinguals talked with monolingual nonsigners suggests that both languages may be always active to some extent within the bilingual brain. We created a situation in which the bilingual participant would be at the monolingual end of the continuum proposed by Grosjean. Even in this situation, however, ASL signs slipped in. Anecdotally, many ASL-English bilinguals have reported to us that they sometimes produce ASL signs unintentionally while talking with nonsigners. It may be that the existence of co-speech gesture allows these intrusions to occur. In contrast, although both spoken languages may be active within the mind of a unimodal bilingual, articulatory constraints generally prevent unintentional code-switches to a language unknown to their interlocutor. The nature of bimodal bilingualism thus provides a unique window into the bilingual mind.

Note

[1]Following convention, lowercase *deaf* refers to audiological status, and uppercase *Deaf* is used when membership in the Deaf community is at issue.

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