Bimodal bilinguals are individuals with knowledge of two languages in different modalities. Here I am referring to children who are growing up acquiring a spoken (English) and a signed language (ASL). Two types of bimodal bilingual children are involved in this project: Kodas (hearing children of Deaf parents, up to the age of 12, that grow up in signing families, with either one or both parents Deaf (excluding children with cochlear implants (CIs)), and DDCIs (Deaf, signing children with CIs born to Deaf (signing) families). All the sessions considered in this project belong to the “Development of Bimodal Bilingualism” corpus (Quadros et al. 2014, 2015). What is special about the DDCIs in this study is that they are born to deaf parents; therefore they grow up bilingually, acquiring ASL from their parents and English from the environment and at school. Both Kodas and DDCIs are considered bimodal bilinguals; the DDCIs in this study being native signers with a later acquisition of English (after obtaining their CIs), while Kodas are acquiring both English and ASL from birth (Quadros et al. 2012).

Whether bilingualism is unimodal or bimodal, there is a natural tendency to mix the two languages. During this interaction, languages may influence each other. For example, in the case of English/ASL bilinguals, sometimes ASL will follow English grammar (1) and vice versa (2) (Emmorey et al. 2005, 2008, Lillo-Martin et al. 2012, Chen Pichler et al. in press, i.a.).
Additionally, Structural mixing can occur even when not obviously code-blending. The actual lexical items of the language influencing the structure may be null, yet the utterances can still be influenced by it. In this case, ASL can still influence English at the structural level, without having sign present\(^1\), like in (3):

(1) **Whisp:** ... but stay on.  
**Sign:** STAY ON\(^2\)  
‘...but they stayed on.’ (Gia 6;04)

(2) **Eng:** [...] the gutter going up the side of the building. Happen what?  
**Sign:** HAPPEN WHAT  
‘He goes over and sees the gutter going up the side of the building and asked: What happened?’ (Emmorey et al. 2005)

(3) **Eng:** TOM: Can Ø give me this?  
‘Can (you) give me this?’ (Koulidobrova 2012)

1. **Whispering**

An important difference between fully voiced and whispered utterances during CB is that when whispering, children are often in “ASL mode”, i.e. their spoken (whispered) English tends to follow ASL grammar even if this results in sentences that are ungrammatical in English. Interestingly, in the vast majority of cases, this occurs in the ASL sessions (i.e. in contexts where ASL is the target language for interaction) (Petroj et al., 2014). Additionally, while children’s English grammar improves drastically in fully voiced English utterances, whispered utterances retain their ungrammaticality (Goodwin 2012, Petroj et al. 2014). It follows that the rules of the English grammar have been acquired (Goodwin et al., to appear), so the ungrammaticality in whispering cannot occur due to incomplete acquisition. Though ungrammaticality occurs in various environments, here I only focus on English article distribution, as in (4):

(4) **Whisp:** Ø girl have Ø purple shirt\#  
**Sign:** AND GIRL HAVE PURPLE SHIRT  
‘...and the girl has a purple shirt.’ (Gia, 6;04)

2. **Articles**

2.1. **Grammatical function**

Articles, as functional items expressing definiteness, are overtly present in some, and missing in other languages. It has been assumed that articles are universal, occupying the position as the head of D and that languages that lack

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\(^1\) Subject omission is a process allowed in ASL, but not in English.  
\(^2\) Prepositional constructions are primarily expressed through classifiers in ASL and very rarely through actual prepositions.
overt articles have a null D (Abney 1987, Longobardi 1994). However, as proposed in Corver (1990) and developed in Bošković (2005, 2008), languages may actually differ structurally regarding the DP/NP parameter setting (Bošković 2008, Koulidobrova 2012) -- English (a DP language) having, and ASL (an NP language) lacking articles\(^3\) (5b). Here, I am assuming that English is a DP and ASL an NP language, English having, and ASL lacking articles\(^4\).

\[
(5) \quad \begin{align*}
\text{a. } & \text{[DP the [NP boy]}} \\
\text{b. } & \text{[NP boy]}
\end{align*}
\]

2.2. Phonological Function

In English, articles also participate in the rhythmic configuration of utterances. With the exception of occurring in environments where they are emphasized, articles are usually weak/unstressed syllables (Selkirk 1848, 1996) which organizes English rhythm into trochaic feet (Abercrombie, 1964): beginning with a stressed syllable that includes all unstressed ones until the next stressed syllable that represents the start of a new foot. The rhythm of spoken English preferentially incorporates weak, unfooted syllables into Strong-weak (S-w) trochaic feet (Liberman & Prince, 1977) as in (6a), but a dactyle is also allowed in cases where a strong syllable is followed by two consecutive weak syllables (6b). The iambic structure (6c) is less preferred, but it is very common in adult English where articles precede nouns in utterance-initial position.

\[
(6) \quad \begin{align*}
\text{a. Trochaic foot} & \quad \text{b. Dactyle} & \quad \text{c. Iambic foot} \\
S & w & S & w & w & w & S \\
\text{\ 'wash the (dishes)'} & \text{\ 'in the box'} & \text{\ 'the dog'}
\end{align*}
\]

\(^3\) Other D-like elements that are generally assumed to be in D in DP languages (e.g. demonstratives) are analyzed differently in NP languages, assumed to occur in AP.

\(^4\) This represents a controversial topic, with a group of researchers claiming ASL does have articles (McLaughlin 1997, Bernath 2009). In this paper, however, following the line of research of Bošković (2008) and Koulidobrova (2012), I assume that ASL is an NP language with no articles. Additionally, there is evidence that ASL behaves in the same way as other NP-languages do with respect to various tests used to illustrate what parameter setting is activated, NP or DP (Bošković 2008, Koulidobrova 2012).
3. Article distribution during language acquisition

In English, first uses of articles are reported as early as the age of 1;04, and although by the time children reach the age of 2;06 the use of articles improves with more than 80% of article production in required contexts, problems persist with respect to the pragmatically appropriate use (Brown 1973). There are two major research directions with respect to the acquisition of articles, from a syntactic and from a phonological point of view. In this paper, I will focus on the latter. The studies on article distribution relative to prosody claim that children do not omit articles due to the lack of grammatical knowledge; rather, it occurs due to prosodic constraints on the output form with children most likely omitting weak, unstressed syllables, and not syntactic categories (Demuth & McCullough 2009). Moreover, during the acquisition of English, children tend to omit determiners that cannot be prosodified as a part of a Strong-weak (S-w) foot, and the ones that can, tend to occur earlier (Gerken 1996). Since the majority of English words begin with a strong syllable (Cutler & Carter 1987), when pronouncing multisyllabic words, children are less likely to preserve weak syllables at the beginning of an utterance and more likely to preserve them in utterance-internal or utterance-final positions (Allen & Hawkins 1980, Echols & Newport 1992, a.o.). Gerken (1996) further notes this indicates that children organize their sentences into phonological phrases to which they apply a series of S-w metrical templates, leading to them omit weak syllables that do not fit in the metrical template (7a), and to preserve the ones that do, as in (7b):

(7) a. He [catches]₃ Ft (the) piggy.  
     b. He [kicks the]₃ Ft piggy.         (Gerken 1996)

3.1. Acquisition: Monolinguals versus (Bimodal) Bilinguals

Although both monolingual and bilingual children are reported to omit articles, bilinguals have been reported to show a delay with respect to the pragmatically appropriate use when compared to monolinguals within the same language. Two studies directly related to the current project looked at the article distribution in the production of (bimodal) bilinguals, Quadros et al. (2013) for looking at younger, and Davidson et al. (2013) at older children. Quadros et al.

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5 Article omission has been attested crosslinguistically during both monolingual and bilingual language acquisition (de Villiers & Roep & Roep 1994; Shaef & de Villiers 2000; Roep, et al. 2001, Demuth & McCullough 2009, Kupisch 2004, a.o.).

6 For discussions on the acquisition of articles from a syntactic point of view, cf. Brown (1973), Chierchio (1998), Koulidobova (under review) and the references within.

7 This tendency of has been also attested crosslinguistically (cf. Gerken 1996, Demuth & McCullough, 2009 and the references within).

8 Mede & Gürel (2010) reported English article omission in production of a Serbo-Croatian/English bilingual, and Geçkin (2012) of Turkish/English bilinguals, in children as late as 4 years old (when monolinguals are typically at adult levels of production).
included two groups of bimodal bilinguals (ASL/English and Brazilian Portuguese (BP)/Brazilian Sign Language (Libras) bilinguals), a unimodal bilingual (English/Cantonese Chinese) and an English monolingual child. In all language pairs, one language had articles (English, BP) and the other lacked them (Cantonese, ASL, Libras). Both studies found that article omission is more frequent in signed versus spoken sessions, with omission in spoken sessions at virtually zero by age 4. Moreover, some bimodal bilinguals in the study by Davidson et al. (2013) show article omission in as high as 63% of the obligatory contexts in ASL target sessions, even at the age of 6.

4. Data and methods

Data includes whispered utterances from 11 experimental and spontaneous production ASL target sessions with seven children (Kodas or DDCIs) where either a Deaf or a Coda (Child of Deaf Adult) experimenter was present. Table 1 shows additional information about the coded sessions. Exclusions from the analysis included sessions where either no whispering was present or where the number of whispered utterances per session was lower than 10.

<table>
<thead>
<tr>
<th>Child(^{10}) (Age)</th>
<th>Utterances</th>
<th>Whispered Utterances</th>
<th>Whispered NPs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nik(^{12}) (5;02)</td>
<td>77</td>
<td>51</td>
<td>21</td>
</tr>
<tr>
<td>Sun (5;07)</td>
<td>55</td>
<td>55</td>
<td>25</td>
</tr>
<tr>
<td>Ben (5;10)</td>
<td>99</td>
<td>99</td>
<td>40</td>
</tr>
<tr>
<td>Tom (5;10)</td>
<td>55</td>
<td>53</td>
<td>22</td>
</tr>
<tr>
<td>Pet (6;02)</td>
<td>42</td>
<td>42</td>
<td>15</td>
</tr>
<tr>
<td>Gia(^{12}) (6;04)</td>
<td>69</td>
<td>94</td>
<td>52</td>
</tr>
<tr>
<td>Zak (6;06)</td>
<td>64</td>
<td>64</td>
<td>39</td>
</tr>
<tr>
<td>Ben (7;07)</td>
<td>105</td>
<td>105</td>
<td>35</td>
</tr>
<tr>
<td>Ben (8;02)</td>
<td>192</td>
<td>68</td>
<td>25</td>
</tr>
</tbody>
</table>

5. Results and Analysis

When children are in ASL mode (i.e. in a language with no DP layer), the use of the English articles should be limited. However, data shows that articles can be present when children are whispering while code-blending. The analysis was based on whispered English NPs during code-blended production and the presence or omission of articles within these NPs that represented obligatory or appropriate environment for article production in adult English.

\(^9\) Spoken language was assessed in both spoken and sign targeted session.

\(^{10}\) Children who participated in multiple sessions at the same age (Nik and Gia) each have their sessions grouped together.
Figure 1: Article distribution across children

When put on a 100% scale, in all but three occurrences articles were more likely to be supplied than omitted, with more than 50% of omission across all environments. Given the claim from Petroj et al. (2014) that incomplete acquisition is not the reason for ungrammatical English utterances, I offer a phonological hypothesis to explain the distribution of articles in whispered code-blended speech of bimodal bilingual children.  

PHONOLOGICAL HYPOTHESIS:

Articles may be omitted/missing:
- if found in an unstressed syllable, followed or preceded by a strong syllable, but not belonging to the same foot;
- in the initial position of a phonological unit

Articles may occur:
- as rhythmic fillers (adhering to phonological rules)

5.1. Testing the Phonological Hypothesis

The distribution was analyzed according to whether the article was found in a w-S syllable structure (where the article would occupy the weak syllable) or a S-w or S-w-w syllable structure (where the article would occupy the last

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11 One factor contributing to the distribution of articles is certainly ASL influence. ASL lacking the DP (consequently, lacking articles too), very few or no English articles should be present during whispered speech. Although the frequency of article omission is over 50% in most cases, the influence of ASL on the English syntax cannot be the only factor.

12 This category includes utterances like (i) where ‘the’, as the third weak syllables in a row, is unable to be a part of either the preceding or following trochaic foot. Therefore, it was analyzed as a weak syllable preceding a Strong one (w-S):

(i) [and then]s[t] [the] [other]s[t] bug got one

‘And then the other bug got one.’ (Ben, 8;02)
(weak) syllable). This included NPs as the ones in (8) and (9), in which 'x' stands for the position where an article should be present in adult English:

(8) \textbf{Whisp}: \textit{x} boy wears \\
\textbf{Sign}: BOY WEAR BLUE SHIRT \\
"The boy wears a purple shirt..." \hspace{1cm} (Gia, 6;04)

(9) \textbf{Whisp}: should wash \textit{x} dishes \\
\textbf{Sign}: ‘…FS(or) IX(olivia's-mom) SHOULD WASH WASH-2 WASH \\
"Or Olivia's mom should wash the dishes" \hspace{1cm} (Ben, 5;10)

The comparisons between article distributions in a weak-Strong configuration and is shown in \textbf{Figure 2} and in a Strong-weak(-weak) in \textbf{Figure 3}. Data was also used to run the Fisher Exact Test (FET) to calculate the probability of the article distribution in initial (w-S) versus medial position (S-w-(w)). 5/9 children at a certain age showed significance at both one-tailed and two-tailed FET (method of more extreme tables, p < .001) and these are indicated with an *\hspace{1cm}13.

\begin{figure}[h]
\centering
\includegraphics[width=\columnwidth]{figure2.png}
\caption{Article distribution in weak-Strong syllables}
\end{figure}

As predicted, the article is more likely to be omitted than supplied in the utterance initial (w-S) position, with all but three children omitting more than 50% of articles in obligatory contexts. In contrast, when it comes to supplying the article, all but two children supply the article when found in the medial position. This is illustrated in the figure below:

13 The exact reason behind this discrepancy is not completely clear, however, it is a fact that the children included in this study have a very different background in both input, production, but also in the type of interlocutors they interact with on a daily basis. An additional factor influencing these values might be the low number of whispered utterances for some children, which is considered as a limitation to this study.
6. Discussion

The study by Petroj et al. (2014), the data presented in this paper, as well as studies by Davidson et al. (2013), Quadros et al. (2013), Goodwin (2016), and Goodwin (et al., to appear)\textsuperscript{14} all confirm that children show high competency in article usage. Consequentially, a more important question emerges: Why do older bimodal bilinguals show similar patterns of article distribution like children in the process of acquiring English? Moreover, what connects these two phenomena - acquisition of articles and article distribution in bimodal bilingual whispering?

6.1. ASL Influence and Language Mixing

ASL influence on the whispered speech is inevitable, even if it is clearly not completely dominant over all the utterances. Language influence may be present in any bilingual interaction since both languages seem to always be active (Paradis 2007, Emmorey et al. 2008), and this influence may be magnified even more during CB, due to simultaneous activation and production. It follows that, language influence in (bimodal) bilinguals does not have a clear-cut distinction as to where each language will resurface. This confirms that one language being dominant during the entire production of code-blended speech (cf. Myers-Scotton 1993) is unlikely (Bhatia & Ritchie 1996, den Dikken, 2011, Gonzales et. al 2011, Goodwin & Lillo-Martin 2017), and that variations in language dominance should be expected, though rules still exist\textsuperscript{15}.

Although the simultaneous production of both languages in CB has many overlaps between what is spoken and what is signed, as we have seen with articles alone, in areas where English and ASL grammar cannot directly overlap,

\textsuperscript{14} Although these studies did not take into account whether utterances were whispered or fully voiced, they did look at sessions where English is the target language, and as reported by Petroj et al. (2014), whispering is a rare occurrence in English sessions.

\textsuperscript{15} These rules, however, operate according to UG principles and not to rules specific only to language mixing environments (Gonzales et. al 2011).
it is more likely to observe different material from two languages. However, both languages work together towards expressing one single idea, the main distinction between monolinguals and (bimodal) bilinguals being that bilinguals have a larger set of elements to choose from (den Dikken 2011), both when it comes to vocabulary, but also to the rest of the grammar. Lillo-Martín et al. (2012) capture this complex system in their Language Synthesis Model (Figure 4). In this model, roots or morphemes from the two languages are all available and eligible to enter the syntactic derivation, which later has consequences on what vocabulary items might be inserted. Words from both languages may be considered, as long as they do not clash with the necessary syntactic requirements. The same can be applied to CB: as long as there is no clash in the syntactic structure, elements from either ASL or English (or both) are equally likely to be used.

Figure 4: The synthesis model (Lillo-Martín et al. 2012)

Considering the phonological aspect in CB brings additional and unique complexity. In this particular case, while the voice is reduced to whispering, the basic rhythmic structure of English has a tendency to remain preserved. In whispering, the syntax seems to be suppressed in some cases, which allows for the prosody to override syntactic rules (e.g. avoiding w-S syllable configuration by not pronouncing the article in this environment). Therefore, two additional questions arise: 1) How much of English phonology is actually reduced; and 2) What is the underlying structure of the code-blended whispered utterances.

1) How much of English phonology is actually reduced? It seems that during CB, there is quite a lot of the English phonology preserved. Although there is an obvious reduction in the volume of English (voicing being reduced to whispering) lexical items do get pronounced and article distribution follows the basic rhythmic structure of English even more rigidly than in adult fully voiced structures\textsuperscript{16}. On the other hand, omission of functional items (i.e. articles,  

\textsuperscript{16} Here I am referring to the tendency to preserve the trochaic syllable structure as opposed to allowing structures that are permitted in adult English (i.e. w-S).
inflections, a.o.) is frequent. I argue that when children whisper English while signing, there are two levels of (partial, not complete) suppression of English. First, structurally, the syntax of English is being somewhat suppressed due to the presence of ASL syntax in the simultaneous production. Secondly, phonologically, while the voice is reduced to whispering, the basic rhythmic structure has a tendency to remain preserved. More specifically, while fully voiced, adult-like English allows for the violation of the trochaic foot structure to adhere to the syntactic rules of the grammar - in which case syntax overrides prosody - when whispering, the syntax is being suppressed just enough to allow for the tendency of the prosody to override syntactic rules.

2) What is the underlying structure of the code-blended whispered utterances? The fact that the resulting speech operates based on a tendency and is not exclusively present throughout all cases has interesting implications for the underlying structure. A question that is still a matter of debate in the literature is whether there is a specific system, more than one, or a combination of systems governing the mixed utterances. As evident from the studies presented in this paper, it can at least be concluded that it is not the case that there is only a single fixed system governing all the code-mixed utterances; in fact, both languages influence the structure. More importantly, one language will not be prevalently more influential than the other across all utterances. Furthermore, which language will influence at any point in the structure is not a given, but it depends on various formal (such as how similar and compatible the overlapping structures are) and informal factors (such as the social context that will influence which language will resurface more). This choice may not be just a matter of structural hierarchy, it can also be random; a fluent (bimodal) bilingual can simply make an (un)intentional choice at a given point during their production. Considering the DP/NP domain, I propose that there are three structural possibilities for representing the observed data. When the article is pronounced, the structure may be completely English-like, as in (10a). When the article is omitted, the structure may have a DP layer with a silent D (i.e. article) as in (10b), or it may lack the DP layer entirely, exhibiting an ASL-like configuration, as in (10c):

(10)  a. DP  
      the, a(n)  
      girl

The structures in (10a) & (10b) are found in utterances that have a DP parameter setting, in which case the DP layer is present and the bilingual chooses whether to pronounces the article or not, presumably based on the prosodic preferences. If, however, we assume that the whispered code-blended speech allows an NP parameter setting (which, in principle is expected), we get something like (10c), a configuration that lacks the DP layer entirely. Since these bilinguals have encountered both parameter settings when using their languages, both DP and
NP layers as syntactic possibilities are available. In addition, since what has been observed in their article distribution is merely a tendency, cases that do not follow this tendency are also present and the distribution as a whole needs to be accounted for. Although allowing multiple structures might seem like an overgeneralization, when additional factors are taken into account, the situation complicates even more. This includes the occasional use of an ASL element (whether it is pointing or fingerspelling) signed during the production of the English article, as in (11); and the use of ASL word order in NPs (adjective/demonstrative following the noun), as in (12) below. Though these examples are rare, they do occur and they should be accounted for as well.

(11) a. Whisp: do the baby have to go bath with
Sign: T-H-E BABY MUST GO BATH WITH the girl
T-H-E GIRL
'Does the baby have to take a bath with the girl?' Zak (6;06)

b. Whisp: how did the the boy get in here
Sign: HOW IX IX(boy) BOY GET-IN IX(box)
'How did the boy get in the box?' TOM (5;10)

(12) Whisp: give me toy that now
Sign: TOY IX(toys) NOW
'Give me that toy, now.' (TOM, 5;10)

I suggest that in utterances that follow the English word order, it is more likely to have the DP layer, whether the article is present or absent. However, when the English utterance clearly follows the ASL word-order and the article is absent, it is logical to allow for the NP layer to be the highest projection in that domain. More generally, when two language with two different parameter settings interact, both parameter settings are available as options that may vary across utterances, even within the same child. Furthermore, this is not only the case with bimodal bilinguals, since parameter setting and structure mixing may vary during all language mixing interactions (Petroj 2014).

7. Conclusion

This paper examined article distribution in code-blended whispered utterances and found that, at least when it comes to articles, English prosody

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17 Though these cases are rare, when an NP with an ASL word occurs, the article is always absent (e.g. there are no reported hypothetical cases where an article preceds an 'ASL NP', such as 'the house big').
18 This, however, gets more complicated where the English and the ASL word order match, in which case there are additional tests that can show whether we are dealing with a DP or an NP language (Bošković 2008, Koulidobrova 2012).
tends to have a priority over syntactic rules. Whether and how much influence is present from ASL is still to be investigated, given that this narrow area of research is different across the two languages in question, thus making it harder to tease apart the exact factors behind the obtained results. Moreover, having areas that are similar, but where multiple structures still emerge is also another reason for more research. What has been revealed here, however, is that mixing two languages involves a very complex system with multiple choices that are simultaneously available during a code-blended utterance. What is more, we have also seen that one choice need not be consistent throughout all the utterances and that variations exist both across single and multiple individuals. This has shed light upon broader questions regarding language mixing in general, opening up new possibilities and perspectives as to how language mixing should be analyzed: analyzing utterance by utterance, rather than trying to generalize across all utterances. In order to make these ideas more generally applicable, more research is needed targeting multiple narrow areas where languages mix across multiple language pairs.

References


