Main Articles

The Modeling Hypothesis and child bilingual codemixing*

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*Acknowledgment**

The authors would like to thank the families who contributed their time to making this research possible, to the Social Sciences and Humanities Research Council, Ottawa, Canada, for its financial support of this project, and to the Natural Sciences and Engineering Research Council, Ottawa, Canada, for a post-graduate scholarship to LC.

Abstract

According to one explanation of child bilingual codemixing (the modeling hypothesis), bilingual children's rates of mixing are related to rates of mixing in the input addressed to them. An assumption of this hypothesis is that bilingual children are sensitive to codemixing in the input and that they can adjust their own rates on-line in accordance with the input. Despite its widespread appeal, evidence concerning its validity has been largely inconclusive. The assumption is largely noncontroversial in the case of older bilingual children, as evidenced by their adoption of the patterns of codemixing of the speech communities in which they live. However, it is not clear whether young bilingual children have the cognitive and linguistic capacities implicated by this assumption. The present study sought to examine this assumption directly. Six French-English bilingual children (average age 2;4 years) were recorded during play sessions with an assistant who engaged in relatively low (15%) or relatively high rates (40%) of mixing on three separate occasions. The results indicate that these children were sensitive to the language choices of their interlocutors and that they were able to adjust their rates of mixing accordingly; further, they appeared to do this by matching their language choice with that of their interlocutors on a turn-by-turn basis.

Key words

bilingual
codemixing

1 Introduction

Virtually all children who grow up bilingually codemix. In this study, we focused on lexical mixing since this is the most frequent form of mixing reported in most studies of children in the process of acquiring two languages. For the purpose of this study, lexical mixing is the use of at least one word from both English and French in its full adult form or the child's approximation to an adult form, with or without inflections, in the same utterance. A number of alternative explanations of BCM have been proposed in the research literature. According to the unitary language system hypothesis, for example, young bilingual children codemix because they initially have a fused linguistic system that does not distinguish between the two languages (e.g., Volterra & Taeschner, 1978). Research on bilingual children's

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pragmatic, lexical, and syntactic development, however, has failed to confirm this hypothesis (e.g., Genesee, 2002; Meisel, 2001; & Paradis, 2001). For example, Genesee, Nicoladis, and Paradis (1995) found that young bilingual children are able to use their developing languages differentially and appropriately with different interlocutors from the one-word stage onward; and Maneva and Genesee (2002) report that a 10–14 month old preverbal bilingual infant exhibited different phonological patterns when babbling with his French-speaking father in comparison with his English-speaking mother.

Other explanations of BCM have considered the role of input. Broadly speaking, there are two subcategories of such explanations, those that emphasize discourse features of input and those that emphasize statistical properties of the input. According to discourse explanations, child BCM and, in particular, individual differences in the extent to which individual bilingual children codemix, can be related to the discourse styles and strategies of their parents (and presumably others) who provide primary language input to the developing child. Lanza (2001) has provided the most detailed form of this explanation. In brief, according to Lanza, there is a continuum of speech acts that vary from those that signal that bilingual discourse is acceptable to those that signal that monolingual discourse is acceptable and, by implication, bilingual discourse is not. Depending on the extent to which particular sets of speech acts are used and how they are used, parents will convey that BCM is more or less acceptable within the family; each parent within the same family may even convey different levels of acceptance of BCM, as Lanza found in the case of Siri, whose language use she describes in some detail (Lanza, 1997).

According to explanations that emphasize the statistical properties of input, children's rates of BCM are related to the rate of BCM that they hear in input addressed to them independent of the broader discourse considerations that are included in Lanza's theory. Although we distinguish this explanation from discourse explanations, we recognize that it can be conceptualized as a subset of the discourse theory insofar as one type of parental speech act that encourages young bilingual children to codemix is "codemixing" itself. We nevertheless make this distinction, in part, because it reflects a widely held belief among parents and professionals alike that the best strategy for raising bilingual children is the one-parent/one-language strategy. First articulated by Grammont in 1902 (indeed, this is sometimes referred to as "the rule of Grammont"), this strategy is often recommended to parents in order to minimize children's mixing of their two languages on the assumption that individual children are more likely to codemix if their parents mix their two languages when addressing the child than if the parents keep their languages separate at all times. The rule of Grammont can be said to promote a model of nonmixing to the child. The hypothesis that child BCM is directly related to BCM in the input, or what we will refer to as the "modeling hypothesis" for short, makes an interesting and testable assumption about the language processing capacity of young bilingual children; namely, that they are sensitive to the rates of BCM in the input and can model their output in accordance with the input on-line. We wanted to examine the validity of this assumption in the present study.

It is widely recognized that, in the long run, children acquire the sociopragmatic constraints and patterns that characterize adult language usage in their community. This is likely to be equally true of BCM. Indeed, BCM has different characteristics and frequencies and serves different sociocultural functions in different communities (Myers-Scotton, 1993; Poplack, 1987). Children must acquire community-specific characteristics and functions of BCM in order to become fully functioning members of their language community. In contrast to some lexical and especially morphosyntactic features of language acquisition where the role of input is still in question, there is consensus that input is the critical factor in acquiring the pragmatic characteristics of language. In the present study we do not question the fundamental validity of the discoursal importance of input for child BCM, rather we set out to examine whether bilingual children are sensitive to BCM in the input on-line and, if they are, what form on-line linkage takes.

There are reasons to think that child BCM may not initially be closely related to adult input. First, sociopragmatically speaking, young bilingual children may simply be too egocentric and, thus, insensitive to the linguistic features of the language addressed to them to model their language use on that of their interlocutors (however, see Comeau & Genesee, 2001, for counterevidence for bilingual English-French children between 3;2 and 3;5 years of age). Second, in the early stages of acquisition when children's language skills are limited, they might do what they can do and may lack the linguistic skill required to model what is in the input. In other words, factors related to linguistic competence may be the most influential in young bilingual children's early language usage. There is some evidence for the latter possibility. Bilingual children from 2;0 to 3;0 years of age tend to codemix more when conversing with adults who speak their less proficient language than when conversing with others who speak their more proficient language (Genesee, Nicoladis, & Paradis, 1995); they also tend to codemix more when conversing with monolingual strangers (Genesee, Boivin, & Nicoladis, 1996), especially if the stranger is using the child's less proficient language, than when conversing with bilingual parents; and children mix more when they do not know words in the language used by the interlocutor (Genesee, Paradis, & Wolf, 1995; Nicoladis, 1995; Nicoladis & Secco, 2000; but see Deuchar & Quay, 2000, for divergent evidence).

Despite widespread belief in the modeling hypothesis, empirical evidence concerning it is surprisingly sparse and inconsistent. Explanations of differential rates of child BCM that are akin to the modeling hypothesis have been made in studies of bilingual children, but they lack generalizability because they are often impressionistic or based on single case studies. Moreover, claims concerning the influence of modeling have generally lacked statistical measures of correlation between BCM in the input and in the child's output and they have not systematically ruled out other possible explanations and, thus, we do not know the power of this effect, if it exists. For example, Redlinger & Park (1980) studied four two-year-old children growing up bilingually and attributed differences in their rates of BCM, in part, to parental differences in rates of mixing. However, these claims are based on impressionistic interpretation of the data only. Studies that have examined the statistical relationship between adult and child rates of BCM have produced inconsistent or null results. Nicoladis & Genesee (1996) failed to find a statistically reliable link between children's rates of codemixing and their parents' discourse styles and Genesee, Nicoladis, and Paradis (1995) were unable to observe a correlation between parental and children's rates of mixing, although statistical correlations were not carried out due to small sample sizes. In contrast, Goodz (1989), also working with French-English bilingual families in Montreal, reported significant positive correlations between parental and children's rates of codemixing, although this was the case for only one of four children when interacting with their fathers and three of four children when interacting with their mothers. In short, evidence for empirical links between children's and parent's rates of codemixing are inconsistent and, thus, inconclusive.

Testing the modeling hypothesis in bilingual families may be confounded by a variety of factors that obscure bilingual children's capacity to monitor BCM in the input and modify their language use on-line. For example, familiarity with each parent's competence in both languages, historical patterns of language use in the family, or parents' tolerance for bilingual discourse, following Lanza's model, may all obscure a direct modeling effect. Moreover, examining correlations between child and parent rates of BCM is dependent on natural fluctuations in parental rates of mixing and, thus, at best provides a hit-and-miss test of the hypothesis. In order to obviate these potential confounds and to examine young bilingual children's sensitivity to interlocutor codemixing on-line, we observed young English-French bilingual children in interaction with bilingual strangers who varied their rates of mixing across three sessions—from relatively low, to relatively high, and back to relatively low. In the event that we observed a relationship between interlocutor and child rates of BCM across sessions, we planned to examine how the children were able to modify their mixing in accordance with their adult interlocutors' rates. We did this simply by determining the probabilities that the child would mix following a mixed versus a nonmixed utterance by their interlocutor.

2 Methods

2.1 *The children*

Six bilingual children (5 males and 1 female) were included in the study. The average age of the children at the time of the first recording with their parents was 2;4 (the individual children's ages are presented in Table 1). The children are identified by initials in the remainder of this report. The children were recruited from the Montreal area through daycare and community centers and advertisements in community newspapers. They were all learning both English and French in the home, and they all used both languages daily and spontaneously. JO's, NO's, OL's, and LI's mothers were native speakers of French, and their fathers were native speakers of English. In AN's case, the mother's native language was English and the father's was French. In the case of LU, the native language of both parents was French, but his mother was fluent in English and had been speaking to him in English since birth. All of the parents stated that they mainly used their native language when addressing their children (except LU's mother who consistently used English, her L2). These reports were confirmed by our observations during the first two recording sessions which included the children and each parent separately—to be reported in more detail later.

AN had a younger sister; JO and LU both had an older sister; and NO was the second of three boys; OL was an only child at the time of testing and LI had a teenage brother. All of the families would be considered "middle class." Both of AN's and OL's parents had completed university; JO's father had completed high school and his mother was completing a university degree; likewise, NO's father had completed high school and his mother was completing a university degree. LU's and LI's parents had both completed high school. At the time of the study, all of the mothers stayed at home with their children.

2.2
Procedure

The children were visited in their homes on five separate occasions. The aim of the first two visits was to observe the children's language use with each parent. To this end, the children were audio- and videotaped with each parent for approximately 30–45 mins. These sessions were approximately one week apart. LU was an exception; he was recorded only with his mother because his father did not wish to participate in the study. The parent sessions were filmed in the children's homes, except in the case of LU, who was filmed with his mother and our assistants in a lab at the university. The parents and children interacted and played freely with toys that the children normally played with. The parents were told to talk and interact with their child as they usually would. The parents used mainly their native language with their child (except for LU's mother who used her second language, English). The order of the sessions with each parent was not fixed, but these sessions always occurred before the "experimental" sessions with the assistants.

The recordings with the parents provided data for estimating the children's development in each language. To this end, we calculated separate indices in English and French for each of the following: (a) MLU in inflections, (b) MLU in words, (c) word types, (d) word tokens, and (e) multiword utterances (see Table 1 overleaf). Unintelligible and neutral utterances were excluded from all calculations. Each index was based on the transcription of each session with each parent separately; thus, the French indices were based on the session with the child's French-speaking parent, and vice versa for the English indices. Since LU's French-speaking father did not participate in the parent session, the calculations for his French language indices were based on his French utterances during his first two sessions with the native-French-speaking assistant, to be described later. While recognizing the limitations of this, it nevertheless provides proxy estimates of his development in French that would otherwise be unavailable.

Two separate MLUs were calculated: (1) MLUs that included all free and bound morphemes separately, and (2) whole word MLUs which did not count grammatical inflections separately. The whole word MLU provides a more conservative account of the children's language development and also obviates the difficulty posed by inflectional differences between English and French. Word types were calculated as the number of different words the child used in each language, and word tokens as the total number of words produced by the children in each language; both counts were then transformed into percentages based on the total number of words used in both languages during the relevant parental session. The multiword utterance (MWU) index was calculated as the number of utterances produced by each child in each parental session that contained two or more words. The counts in English and French were then transformed to percentages based on the total number of multiword utterances produced by the child in both languages during the relevant parental session. Mixed utterances were not included in the MWU calculations because they could not be attributed to either English or French.

According to the results summarized in Table 1, at least four of the five language development indices were greater in English than French for AN, JO, NO, and LI; and

Table 1

Indices of children's language development in French and English

	MLU	MLU[a] word	Word Types	Word Tokens	Multi-Word Utterances[b]
AN (2;5)					
French	1.586	1.540	50.49% (103)[c]	44.04% (251)	37.37% (37)
English	1.939	1.939	49.51% (101)	55.96% (319)	62.62% (62)
JO (2;4)					
French	1.956	1.900	49.34% (113)	47.62% (400)	37.79% (65)
English	2.119	2.063	50.66% (116)	52.38% (440)	62.21% (107)
LU (2;6)					
French[d]	1.870	1.779	45.22% (71)	51.71% (88)	58.40% (73)
English	1.728	1.602	54.78% (86)	48.29% (269)	41.60% (52)
NO (2;7)					
French	1.351	1.340	20.65% (38)	28.55% (179)	17.92% (19)
English	1.658	1.587	79.35% (146)	71.45% (448)	82.08% (87)
OL (2;0)					
French	1.706	1.647	55.66% (59)	57.24% (170)	58.21% (39)
English	1.375	1.307	44.34% (47)	42.76% (127)	41.79% (28)
LI (2;2)					
French	1.287	1.264	41.43% (58)	32.97% (150)	28.57% (22)
English	1.493	1.444	58.57% (82)	67.03% (305)	71.43% (55)

[a] Calculation excluded all inflections.
[b] MWU=multiword utterances.
[c] Raw frequencies are provided in parentheses.
[d] Calculated from two sessions with assistant, as no data with French-speaking father were available.

at least four of five were greater in French than in English for OL and LU. Accordingly, one could characterize AN, JO, NO and LI as more advanced in English than in French, and vice versa for LU and OL.

Following the parental sessions, the children were audio- and videotaped with one of two research assistants during three separate visits; each session was approximately 30–45 mins long. The assistants were both bilingual in English and French, female, and in their early 20s. French was the native language of one and English the native language of the other. Each child was observed on all three occasions with the assistant whose L1 was the child's less developed language, according to our indices of language development. The assistant used her L1 predominantly in each session. The decision to use the child's less developed language as the base language of the interaction was made on the assumption that this would provide maximum opportunity to observe codemixing. Previous research has demonstrated that the bilingual children we have studied tend to codemix more when using their less developed language (Genesee, Nicoladis & Paradis, 1995). If the sessions were conducted in the child's more developed language, they might not mix at all since they might have sufficient linguistic resources to express themselves fully, without recourse to mixing. In short, examining the children converse in their less developed language gave them lots of leeway to codemix and to demonstrate that they could be sensitive to the rates of mixing in the input.

Accordingly, the native French-speaking assistant played and used predominantly French with AN, JO, NO, and LI, while the native English-speaking assistant played and used predominantly English with OL. LU's sessions with the assistant are a possible exception to this pattern since they were conducted in French even though French might be judged his stronger language. This mismatch occurred because we were unable to compare LU's level of development in each language systematically prior to the sessions with the assistant since his father did not participate. LU's language development indices indicate that he was arguably the most balanced of all six children, and this may explain our difficulty in forming an accurate impression of his relative level of development in each language based on our informal observations of him.

The assistants played and interacted with the children using toys of their own and some we provided. The assistants were trained to use the base language predominantly and to vary their rates of mixing from relatively low, to relatively high, and back to relatively low from Session 1 to Session 3. During the first visit, the assistants used low rates of mixing with the children. For the purpose of this study, mixing by the assistant included both interutterance and intrautterance mixing. That is to say, the assistant codemixed when she responded to the child using an utterance entirely in the child's more developed language (or his less developed language in the case of LU), or when she used an utterance containing both English and French, for example, "***tu veux jouer aux*** trucks ***maintenant?***" ('do you want to play trucks now?'). Averaging across children, the low level of language mixing was approximately 15% of all utterances produced by the assistant; exact rates of mixing by the assistants are summarized in Table 3. A second assistant who taped the sessions kept a tally of the language used by the assistant interacting with the child. She tabulated the percentage of mixed utterances every five minutes and indicated to the interlocutor-assistant, unobtrusively, whether she should increase or decrease her mixing, or keep the mixing level constant, in order to arrive at the targeted rate of 15%. Otherwise, the assistant codemixed randomly during the play sessions. The second assistant refrained from speaking during these sessions, but, if required to do so, used the base language of that session. With the exception of AN and LI, a parent was present in the room during the children's sessions with the assistant. This was to put the child at ease.

A second session with the assistant occurred between five days and one week after the first visit. The delay was kept short so that the children would remember the assistant.

The same assistant who participated in the first session interacted with the child in the second session. The assistant played with the child during the second session in the same way as during the first session. In this session, approximately 40% of the assistants' language contained either interutterance or intrautterance mixing. As in the first session, the assistant taping the second session occasionally notified the interlocutor-assistant playing with the child whether her mixing levels needed to be adjusted up or down in order to achieve an overall mixing rate of about 40%.

The second session was followed by a third session which was the same as the previous two except that the assistant reverted to a relatively low rate of mixing—approximately 15% overall. The third session was intended to control for the possibility that any increase in the children's BCM during the second session was not due simply to familiarity and greater comfort with the assistant. The delay between the second and third sessions varied from two weeks to three months. The variation in this interval is due to the fact that this condition was added only subsequent to our analysis of the first two sessions and our realization that shifts in BCM had occurred and, thus, that a check for familiarity effects was called for. Once the decision to conduct a third session was made, the delay was reduced for the last two children.

2.3
Transcription

Twenty minutes of each session were transcribed using the CHAT transcription system (MacWhinney & Snow, 1990). Transcription began after the first five minutes of the session in order to allow the children to become comfortable with the taping equipment and their interlocutors. If the children did not produce at least 100 intelligible utterances during these 20 mins, transcription continued until 100 intelligible utterances had been recorded. This decision was made in order to have a large enough corpus to provide reliable results. The only exception was in NO's first low-mixing session when he produced only 68 intelligible utterances in the whole session.

The utterances of the children, parents, and interlocutor-assistants were transcribed using normal orthography for the most part. Each utterance was coded according to speaker (child, assistant) and the language of the utterance—mixed, nonmixed, neutral, or unintelligible. Mixed utterances consisted of utterances that were entirely in the nonbase language of the session or utterances that contained both English and French. For example, the utterance, "***ça*** **go** ***pas là***" ('that doesn't go there') was coded "mixed." Utterances were coded as "nonmixed" if they were entirely in the base language of the session. A neutral utterance was one which could belong to either language, such as "ah" and "oh", animal sounds that are similar in English and French (i.e., 'meow'), and the word 'ok'. However, when a neutral word appeared in an utterance of only one language, the entire utterance was coded as being in that language. For instance, the utterance "oh a truck" was coded as English, whereas the sentence "oh *un camion*" was coded as French. Finally, utterances which were incomprehensible were classified as unintelligible. Unintelligible and neutral utterances were excluded from all subsequent analyses.

All transcripts were reviewed by one of two bilingual assistants who was a native speaker of the primary language of the session. Any discrepancies were resolved by discussion.

3 Results

We begin by discussing the child's language use in the sessions with the parents and then turn to the results for the sessions with the interlocutor-assistants; the latter results are presented in two subsections, one that focuses on the children's and adults' overall rates of BCM with one another and one that focuses on the contingency between the child's and the interlocutor's turn-by-turn mixing. The latter analyses were undertaken in order to explore how the children were able to modulate their rates of mixing in accordance with those of their interlocutors.

3.1 *Children's language use with parents*

With respect to the patterns of child and parent language use during these sessions, we report only general trends here; detailed results for the sessions are available upon request. The sessions with the parents enabled us to observe the patterns of language use of each parent and, in particular, their rates of codemixing. As was expected, the parents used primarily their native languages with their children — use of the L1 with the child varied from 100% (OL's mother) to 89% (AN's mother). Again, LU's situation is an exception — his mother consistently used English, her L2, with him. Parental mixing rates (including both inter- and intra-utterance mixing) ranged from 0% to 11%. There did not seem to be any differences in the amounts of inter- and intra-utterance mixing in the parents' language addressed to the children. These recordings of the children with their parents also allowed us to calculate the children's "typical" mixing rates with their parents. Mixing rates varied considerably from 1.89% (LU with his mother) to 48.35% (NO with his mother). Finally, the percentage of partially or fully unintelligible utterances by the parents ranged from 0% (JO's mother and father) to 3.56% (AN's father). The children's rate of unintelligible utterances with their parents ranged from 10.27% (JO with his father) to 24.14% (AN with his father).

3.2 *Children's and adults' overall mixing rates*

Rates of inter- and intra-utterance mixing per child and assistant were initially calculated separately for each session, as percentages of all mixed utterances in each session, in order to examine whether there were differences in the types of mixing used by the assistants and the children. These analyses revealed that mixing by both the assistants and the children was primarily of the interutterance type. The rates of interutterance mixing by the assistant (as a percentage of all mixed utterances) ranged from 74.42% (JO low-mixing condition) to 98.44% (JO high-mixing condition) and the rates of interutterance mixing by the children ranged from 57.14% (AN high-mixing condition) to 100% (AN low mixing condition). Rates of intrautterance mixing are the reciprocals of these values. Subsequent analyses were based on aggregated inter- and intra-utterance mixing rates (see Table 2). With respect to the assistants, all increased their rates of mixing from Session 1 to 2 and then lowered then from 2 to 3, as was planned.

Table 2

Mixing rates of interlocutors and children in low–1, high and low–2 input conditions

		Low–1 Condition	High Condition	Low–2 Condition	z-score[1] Low–1 vs. High	z-score High vs. Low–2
AN						
	Child	3.85% (4)	14.00% (14)	33.67% (33)	2.56*	3.25*
	Interlocutor	12.05% (44)	37.62% (196)	15.79% (44)		
JO						
	Child	14.84% (23)	27.36% (29)	5.77% (6)	2.49*	4.20*
	Interlocutor	15.93% (43)	29.22% (64)	5.83% (7)		
LU						
	Child	10.48% (11)	46.79% (51)	14.77% (13)	5.85*	4.77*
	Interlocutor	12.26% (70)	47.61% (219)	16.31% (69)		
NO						
	Child	36.92% (24)	72.13% (88)	63.76% (95)	4.71*	1.47
	Interlocutor	15.58% (60)	37.46% (106)	17.63% (52)		
OL						
	Child	19.42% (20)	41.90% (44)	25.15% (43)	3.51*	2.91*
	Interlocutor	8.61% (36)	36.15% (107)	14.88% (54)		
LI						
	Child	21.70% (23)	36.50% (50)	13.51% (10)	2.50*	3.53*
	Interlocutor	17.79% (50)	35.90% (112)	15.98% (31)		
ALL CHILDREN COMBINED		16.43% (639)	40.88% (680)	29.24% (684)	9.78*	4.51*

[1] Tests of Two Proportions were conducted between conditions. These can be squared to obtain chi-square statistic.
* $p < .05$

Comparisons were made of the children's total rates of mixing in the first (low) versus second (high) sessions and in the second (high) versus third (low) sessions using tests of proportions. Analyses of the results aggregated across children as well as analyses of individual children's results were carried out. The comparisons of mixing rates in the high condition in comparison to the initial low condition aggregated across children indicate that there was a significant increase in mixing from Session 1 to Session 2—16.43% in Session 1 and 40.88 in Session 2; $z = 9.78$, $p < .001$. Analyses of the individual children revealed that all the children exhibited a significant increase. Comparisons of the children's total rates of mixing in the second low condition in comparison to the high condition indicate that, overall, there was a significant decrease in mixing from Session 2 to Session 3—40.88% in Session 2 and 29.24% in Session 3. Four of the six children (JO, LU, OL, LI) exhibited significant decreases, while one (NO) showed a nonsignificant decrease, and one (AN) showed a significant increase. It is noteworthy that the two youngest children (LI and OL) demonstrated significant increases and decreases across sessions attesting to their sensitivity to the input despite their age. That these two children who had short intervals between Sessions 2 and 3 demonstrated the same patterns as the other children who had relatively longer intervals between these sessions also indicates that the variability between sessions was relatively inconsequential and, in particular, even children who might have been expected to remember the assistant well (the last 2 children) showed a decrease in BCM in Session 3.

3.3
Child-Adult BCM contingencies

In light of the evident sensitivity of the children to the overall rates of mixing by their adult interlocutors, we were prompted to do an additional set of analyses to address the question of how they were able to adjust their own rates of codemixing in accordance with those of their adult interlocutors. The simplest and most obvious possibility is that the children were simply using whatever language the interlocutor had used in her previous turn as a cue to codemix in the following turn. This possibility seemed particularly plausible given the remarkably similar rates of mixing by some of the children and their interlocutors, especially during the first two sessions—see JO, LU, LI, and OL (Session 2 only). To this end, we calculated the probabilities that each child would mix (including intra- or inter-utterance mixing) following a mixed versus a nonmixed utterance by the assistant; the probability that each child did not mix following mixed and nonmixed turns by the assistant were also calculated. The contingencies for each child in each condition are presented in Table 3 (overleaf). These analyses leave out turns when the assistants mixed but the child's following turn was either incomprehensible or neutral and, vice versa, when the child mixed following an incomprehensible or neutral turn by the assistant. Thus, these totals are not the same as those in the previous analyses.

The contingencies were analyzed using chi-square procedures; separate analyses were carried out for each child in each condition (see Table 3). These analyses revealed that the adults' use of a mixed utterance was much more likely to be followed by a mixed than a nonmixed utterance by the children—this was numerically true in 17 of 18 comparisons and statistically significant in all but two cases (OL: low–1; and JO: low–2). Complementary to these findings, the adults' use of a nonmixed utterance was much more likely to be followed by a nonmixed than a mixed utterance by the children; an exception to this pattern was JO in Session 3. Again, Chi-square analyses were statistically significant in all but two of these cases (as above). Reciprocity between the adults' and children's use of mixed and nonmixed utterances was most evident in the high-mixing

Table 3

Contingencies between child and interlocutor mixing

	interlocutor mixing rates & utterance types					
	LOW–1		HIGH		LOW–2	
	mixed	*nonmixed*	*mixed*	*nonmixed*	*mixed*	*nonmixed*
AN						
mixed	16.7	83.3	86.5	13.5	41.7	58.3
nonmixed	5.6	94.4	11.8	88.2	6.4	93.6
Chi-Square	χ^2=21.25, $p < .001$		χ^2=3.83, $p < .05$		χ^2=16.48, $p < .001$	
JO						
mixed	75	25	61.5	38.5	44.8	55.2
nonmixed	5.1	94.9	32.8	67.2	8.2	91.8
Chi-Square	χ^2=11.87, $p < .001$		χ^2=28.65, $p < .001$		χ^2=0.27, $p < .1.0$	
LU						
mixed	36.4	63.6	58.1	41.9	33.7	66.3
nonmixed	0	100	11.5	88.5	2.2	97.8
Chi-Square	χ^2=18.10, $p < .001$		χ^2=30.45, $p < .001$		χ^2=6.60, $p < .025$	
NO						
mixed	50	50	89.5	10.5	36.4	63.6
nonmixed	4.8	95.2	29.8	70.2	8.3	91.7
Chi-Square	χ^2=12.89, $p < .001$		χ^2=16.07, $p < .001$		χ^2=16.85, $p < .001$	
OL						
mixed	52.6	47.4	61.4	38.6	50	50
nonmixed	5.7	94.3	17.1	82.9	6.8	93.2
Chi-Square	χ^2=2.48, $p < .2$		χ^2=48.80, $p < .001$		χ^2=26.41, $p < .001$	
LI						
mixed	42.1	57.9	73.7	26.3	0	100
nonmixed	11.2	88.8	12.3	87.7	6.3	93.7
Chi-Square	χ^2=24.82, $p < .001$		χ^2=24.56, $p < .001$		χ^2=10.59, $p < .01$	

condition, probably as a result of the increased frequency of mixing by both the children and the assistants. The frequencies of mixing in the two low conditions were so low that it was probably virtually impossible for the mix/mix probabilities to exceed the mix/nonmix probabilities in most cases.

4 Discussion

Two major findings emerged from this study. First, these bilingual children were sensitive to the overall rates of mixing of their interlocutors and adjusted their overall rates of codemixing accordingly. All of the children increased their rates of mixing significantly from Session 1 (low) to Session 2 (high), and five children subsequently decreased their rates of mixing in Session 3 (four at statistically significant levels). We have no explanation of why AN increased his rate of mixing in the third session, contrary to the pattern among the other children; however, individual differences in language performance are not uncommon in such young children. The shift from Session 2 to Session 3 indicates that the increase from Session 1 to 2 cannot be attributed simply to familiarity with the assistant. At the same time, rates of mixing in Session 3 did not return to their original low levels in Session 1 for some of the children (AN, NO, OL) suggesting that familiarity may have played a role, although not a predominant one, in Session 3.

The second major finding was that the children appear to have adjusted their rates of mixing in accordance with those of their interlocutors by matching their language choice to that of the interlocutor on a turn-by-turn basis. This did not occur in every instance, but it did occur to a statistically significant extent. It is interesting to note that of all six children, OL and LI had the lowest MLU scores in the language used during the test sessions with the assistants—namely English for OL and French for LI, and yet they demonstrated significant contingencies in five of six cases. This suggests that the shifts in mixing that were demonstrated by the children cannot be explained in any simple terms with reference to their proficiency in the language of testing. Nor do we think that these contingencies can be explained in terms of simple repetition effects since none of the child's mixed utterances following a mixed utterance by the adult were repetitions of the adult's preceding utterance, and only 5.8% of the child's nonmixed utterances following a nonmixed utterance by the adult were repetitions.

The present findings differ from those reported by Genesee et al. in a study in which they failed to observe a correlation between English-French bilingual children's rates of mixing and that of their parents (Genesee, Nicoladis & Paradis, 1995). This discrepancy may be explained by our earlier conjecture that parent-child patterns may be subject to a variety of factors and, in particular, the kind of language socialization effects discussed by Lanza. In effect, the parent-child context may not be optimal to examine young bilingual children's on-line sensitivity to mixing in the input addressed to them.

In conclusion, the present results reinforce previous findings that young bilingual children are able to differentiate their developing languages pragmatically and, at the same time, they extend our understanding of bilingual children's pragmatic skills by demonstrating that children in the early verbal stages of dual language acquisition can monitor rates of mixing in the input addressed to them and modify their own rates of mixing on-line and in accord with the input. The performance of our two youngest children demonstrated the same pattern of behavior to their interlocutors, overall and turn-by-turn, as the four older children indicating that sensitivity to BCM rates in the input is within the capacity of even bilingual children in the early one-word stage of development.

Received: Feburary, 2002; revised: July, 2002; accepted: August, 2002

References

COMEAU, L., & GENESEE, F. (2001). Bilingual children's repair strategies during dyadic communication. In J. Cenoz & F. Genesee (Eds.), *Trends in bilingual acquisition (*pp. 231–256). Amsterdam: John Benjamins.

DEUCHAR, M., & QUAY, S. (2000). *Bilingual acquisition: Theoretical implications of a case study*. Oxford: Oxford University Press.

GENESEE, F. (2002). Portrait of the bilingual child. In V. Cook (Ed.), *Portraits of the second language user* (pp. 219–250). Clevedon, Eng.: Multilingual Matters.

GENESEE, F., BOIVIN, I., & NICOLADIS, E. (1996). Talking with strangers: A study of bilingual children's communicative competence. *Applied Psycholinguistics,* **17**, 427–442.

GENESEE, F., NICOLADIS, E., & PARADIS, J. (1995). Language differentiation in early bilingual development. *Journal of Child Language,* **22**, 611–631.

GENESEE, F., PARADIS, J., & WOLF, L. (1995). Lexical development in young preschool bilinguals. Unpublished paper, Psychology Department, McGill University.

GOODZ, N. S. (1989). Parental language mixing in bilingual families. *Journal of Infant Mental Health*, **10**, 25–44.

GRAMMONT, M. (1902). *Observations sur le langage des enfants*. Paris: Melanges Meillet.

LANZA, E. (1997). *Language mixing in infant bilingualism: A sociolinguistic perspective*. Oxford: Clarendon Press.

LANZA, E. (2001). Bilingual first language acquisition: A discourse perspective on language contact in parent-child interaction. In J. Cenoz & F. Genesee (Eds.), *Trends in bilingual acquisition* (pp. 201–230). Amsterdam: John Benjamins.

MACWHINNEY, B., & SNOW, C. (1990). The child language data exchange system: An update. *Journal of Child Language*, **17**, 457–472.

MANEVA, B., & GENESEE, F. (2002). Bilingual babbling: Evidence for language differentiation in dual language acquisition. In *Proceedings of the 26th Boston University Conference on Language Development*. Cascadilla Press.

MEISEL, J. M. (2001). The simultaneous acquisition of two first languages: Early differentiation and subsequent development of grammars. In J. Cenoz & F. Genesee (Eds.), *Trends in bilingual acquisition* (pp. 11–42). Amsterdam: John Benjamins.

MYERS-SCOTTON, C. (1993). *Social motivation for codeswitching: Evidence from Africa*. Oxford: Oxford University Press.

NICOLADIS, E. (1995). Codemixing in young bilingual children. Unpublished Ph.D. dissertation, Psychology Department, McGill University.

NICOLADIS, E., & GENESEE, F. (1996). A longitudinal study of pragmatic differentiation in young bilingual children. *Language Learning*, **46**, 439–464.

NICOLADIS, E., & SECCO, G. (2000). The role of a child's productive vocabulary in the language choice of a bilingual family. *First Language*, **20**, 3–28.

PARADIS, J. (2001). Do bilingual two-year-olds have separate phonological systems? *International Journal of Bilingualism*, **5**, 19–38.

POPLACK, S. (1987). Contrasting patterns of codeswitching in two communities. In E. Wande, J. Anward, B. Nordberg, L. Steensland, & M. Thelander (Eds.), *Aspects of multilingualism* (pp. 51–77). Uppsala: Borgströms, Motala.

REDLINGER, W., & PARK, T. Z. (1980). Language mixing in young bilinguals. *Journal of Child Language,* **7**, 337–352.

VOLTERRA, V., & TAESCHNER, T. (1978). The acquisition and development of language by bilingual children. *Journal of Child Language,* **5**, 311–326.