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ORIGINAL ARTICLE

Family language patterns in bilingual families and relationships with children's language outcomes

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Abstract

Past research shows that family language patterns (i.e., which languages are spoken in the family and by whom) are associated with bilingual children's language use. However, it is unclear how input properties such as input quantity, parental proficiency, and language mixing may differ across family language patterns. It is also unclear whether the effects of family language patterns on children's language proficiency remain when differences in input properties are controlled. We investigated (i) which family language patterns occurred in bilingual families in the Netherlands ($n = 136$), (ii) whether input properties differed across patterns, and (iii) how patterns related to children's proficiency, once input properties were controlled. Home language situations were assessed through a questionnaire, children's proficiency in Dutch and the minority language through vocabulary tests and parent ratings. Three language patterns were found: one-parent-one-language, both parents mixed languages or used the minority language. The results showed differences in input properties across all patterns, as well as effects of these patterns on children's proficiency in Dutch and the minority language that disappeared once input properties were controlled. These findings do not provide robust evidence that family language patterns predict children's proficiency, but rather, that input quantity is crucial.

Keywords: family language patterns; child bilingualism; input quantity; parental proficiency; language mixing

Family language patterns in bilingual families and relationships with children's language outcomes

Not all children who are exposed to two languages from a young age onward become active users of these languages themselves, and those who grow up bilingual show wide variation in the proficiency levels they achieve. This is in part determined by "family language patterns," that is, which languages are used in the family and which caregiver uses them. A large-scale study by De Houwer (2007) showed that children in families in Belgium in which a minority language was spoken besides Dutch were most likely to speak this language if both parents spoke the minority language and at most one parent spoke Dutch. If only one of the parents spoke the minority language and this parent also spoke the majority language, children were much less likely to speak the minority language (cf. Sirèn, 1995; Yamamoto, 2001). Thus, the likelihood that the minority language is transferred from parents to children appears to decrease as a function of whether one or both parents speak the minority language and, in case only one parent speaks this language, whether this parent also uses the majority language with the child.

A number of issues remain open from earlier work on relationships between family language patterns and bilingual children's language use. First, it is currently unclear how family language patterns relate to the input that children receive (cf. De Houwer, 2007). Family language patterns are likely associated with both the amount and type of input that children are exposed to, but these patterns and the type and amount of input cannot be equated: families adopting a particular family language pattern (e.g., one-parent-one-language (OPOL)) may still differ in the amount and type of language input they provide to their children. Investigating the relationship between family language patterns and input properties is important, as it may help explain earlier-attested effects of family language patterns on children's language use. Second, a hitherto under-investigated issue relates to the fact that, in previous research (De Houwer, 2007; Sirèn 1995; Yamamoto, 2001), the dependent variable was whether children spoke a given language or not, rather than *how well* they spoke this language. Thus, it is yet an open issue how differences in family language patterns relate to differences in children's language proficiency. Finally, an issue that remains open from past research is whether effects of family language patterns play out differently for children's proficiency in the minority and majority language, because the degree of support via media or outside the home typically differs between these languages. Specifically, associations with language development might be weaker for family language patterns with high degrees of exposure to the majority language, because children's development in the majority language – but not the minority language – is typically also supported by media and contacts outside of the home. The aim of this paper is to fill these gaps. Specifically, we analyzed questionnaire data from bilingual families with two- and three-year-old children ($n = 136$) as well as proficiency data from a subset of these children ($n = 96$), to address three questions: (i) Which family language patterns occur in our sample? (ii) Do these patterns differ from each other in the amount and type of language input children receive? (iii) How do patterns relate to children's use of the majority and minority language, as well as their proficiency therein?

Family language patterns and bilingual children's language use

The term "family language patterns" as used here refers to which home languages are spoken in a family by children's caregivers and who uses them, but note that alternative terms have been used, including "parental language input patterns" (De Houwer, 2007), "family language constellations" (Unsworth, et al., 2019), and "language strategies" (Barron-Hauwaert, 2004). Typically, across studies, these

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terms reflect both what languages are used (i.e., majority or minority language) and how these languages are used (i.e., OPOL, mixed). A common three-way classification is the following: (i) OPOL, (ii) minority language at home (ML@H), and (iii) mixed languages (MIX) (Barron-Hauwaert, 2004; Blom et al., 2018; Piller, 2001; Pearson, 2008; Slavkov, 2017). Parents' adherence to a particular pattern may stem from language ideologies (King & Fogle, 2017) or simply reflect the languages they feel comfortable using or can adequately communicate in (Barron-Hauwaert, 2004).

Several studies have investigated how family language patterns relate to bilingual children's language use. In the study by De Houwer (2007) that was briefly reviewed above, questionnaire data from 1899 bilingual Belgian families in which Dutch and a minority language were spoken were analyzed to see whether children spoke the minority language. Five different patterns were attested that were based on whether each parent reported to speak Dutch, a minority language, or both, three of which are discussed here because they are most relevant for the present study. First, the study showed that families were most likely to have at least one child who spoke the minority language if both parents spoke the minority language only (97% of the families) or if one parent spoke the minority language and the other spoke the minority language alongside Dutch (93% of the families). Second, if one parent spoke both Dutch and the minority language and the other parent spoke Dutch only, this percentage dropped to 36%. Finally, families with an OPOL approach fell in-between, with 74% of the families reporting having at least one child that spoke the minority language. De Houwer concluded that family language patterns are related to children's use of the minority language and that the OPOL approach is "neither a necessary nor a sufficient condition" for successful transmission (De Houwer, 2007: 420). De Houwer's findings are in keeping with results from Sirèn (1995), who studied questionnaire data from 600 families in Sweden in which at least one parent spoke another language than Swedish. Sirèn found that children were most likely to speak the minority language when both parents only spoke the minority language or one parent used both Swedish and the minority language and the other the minority language only. Similarly, based on a sample of 111 families in Japan in which at least one parent spoke English, Yamamoto (2001) observed that children were most likely to speak English if both parents spoke English as their only language or if both parents spoke English and one parent spoke Japanese as well. Thus, the pattern that emerges from these studies is that the likelihood of successful transmission of the minority language at least partially depends on whether both parents speak this language and – if only one parent speaks this language – whether this parent speaks the majority language as well.

Characterizing family language patterns: Three input properties

What remains unclear from earlier studies is how the observed relationships between family language patterns and children's language use should be explained. The amount and type of input a child receives in the languages spoken at home will depend to some extent on whether a family adopts an OPOL or ML@H approach. However, there may be considerable variation among families that adopt the same strategy. Below, we will review three input properties that likely differ across (and potentially also within) patterns and have been found to relate to bilingual children's

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development in earlier work: input quantity, parents' language proficiency, and parents' language mixing.

Input quantity

There is vast evidence that differences in the relative amount of input children receive in a given language are related to children's abilities in this language, for both vocabulary and grammar (Hoff et al., 2012; Paradis, 2011; Pearson, 2008). Most studies have looked at input from children's parents, showing that parental input is moderately to strongly correlated to children's proficiency (Unsworth, 2016). Some studies found that correlations are stronger for the minority than majority language (Bohnacker et al., 2016; Gathercole & Thomas, 2007; Hoff et al., 2014), presumably because the majority language is often also supported by input outside of the home (e.g., daycare). The few available studies that examined relationships with input from siblings (Bridges & Hoff, 2014; Caldas, 2006; Rojas et al., 2016) or preschool teachers (Bowers and Vasilyeva, 2011) suggest that input from these sources is associated with bilingual children's language development, too. Bridges and Hoff (2014), for example, found both direct and indirect effects of sibling input, such that Spanish-English toddlers without school-aged older siblings were more advanced in Spanish than toddlers with older siblings, and the presence of an older sibling increased mothers' use of English with their toddlers. For preschool teachers, Bowers and Vasilyeva (2011) found that input quantity, operationalized as the total number of words by the teacher, was related to English receptive vocabulary growth in children from families in which another language than English was spoken primarily (cf. for effects of exposure from daycare teachers, see NICHD Early Child Care Network, 2000). Thus, earlier work shows that input quantity from different sources (i.e., parents, siblings, and teachers) in a given language is a correlate of bilingual children's abilities in this language.

Parental language proficiency

Bilingual children are – on average, and depending on their bilingual environments – more likely than monolinguals to receive input in a language from non-native speakers of that language (Hoff, 2018). This non-native input has been claimed to be less supportive of language development than input from native speakers (Buac et al., 2014; Chondrogianni & Marinis, 2011; Hammer et al., 2012; Hoff et al, 2014; Stoehr et al., 2018). Earlier work looking into more qualitative aspects of language has demonstrated that speakers generally use a smaller vocabulary (Hoff et al. 2013) and less complex syntactic structure (Altan & Hoff, 2018) in a second language than in their native language. For young bilingual children, parents' language proficiency (Unsworth et al., 2019) or the amount of input from native speakers (Hoff et al., 2014; Place & Hoff, 2011; 2016) has been found to be associated with children's language outcomes. Place and Hoff (2011), for example, found that the proportion of English input from native speakers was positively related to English vocabulary and grammar abilities in Spanish-English toddlers, over and above effects of English input quantity. However, it is important to point out that effects were typically small (e.g., between 4% and 5% of explained variance in Place & Hoff, 2011). Additionally, since studies were correlational, no conclusions can be drawn about the directionality and causality of the effects.

Language mixing

Language mixing is highly frequent among parents in bilingual families (Bail et al., 2015; Byers-Heinlein, 2013) and even occurs in parents who report to keep their languages apart (Bail et al., 2015; Goodz, 1989). Reasons for parents to mix their languages are, among others, to elicit attention, exert discipline, or encourage the child use a language that the child is comfortable with (Goodz, 1989), or to foster children's understanding or teach them vocabulary (Kremin et al., 2021). But mixing is also often idiosyncratic and its reasons often unclear (Gardner-Chloros, 2009). A distinction is often made between mixing across sentences (inter-sentential mixing) and mixing within sentences (intra-sentential mixing) (Poplack, 1980).

Earlier results on the relationship between parental language mixing and children's language outcomes are inconclusive. In a study with 181 toddlers, Byers-Heinlein (2013) found that higher rates of parental language mixing were negatively associated with receptive vocabulary in 1.5-year-olds who were exposed to English and another language. The author proposed that language mixing obscures cues that facilitate young children's language separation and, as such, negatively impacts vocabulary acquisition. Bail and colleagues (2015), in contrast, found no correlation between parents' inter-sentential language mixing and children's vocabulary scores in an observational study with 24 Spanish-English 18- to 24-month-olds. In fact, degree of intra-sentential mixing correlated positively with children's vocabulary scores in this study. Moreover, in a study by Place and Hoff (2016), there was no robust evidence that degree of parental (i.e., maternal) mixing was associated with two-year-old children's English and Spanish language abilities. In this study, degree of mixing, assessed with the same questionnaire scale as used by Byers-Heinlein (2013), showed a weak but significant negative relationship with children's abilities in Spanish, whereas a second measure of maternal mixing (collected through Language Diary records) did not show effects. As to children's processing of mixed utterances, Byers-Heinlein et al. (2017) showed that inter-sentential switches (that crossed a sentence boundary) were easier to process by bilingual 20-month-olds than intra-sentential switches. Taken together, these studies show that the current evidence on effects of parental mixing is inconclusive and that effects might vary as a function of the instruments used, the languages looked at, types of code-switches, as well as – perhaps – characteristics of the bilingual families and children investigated.

Effects of family language patterns on children's language use and proficiency

As described above, earlier work has shown relationships between family language patterns and children's *use* of the minority language, that is, whether children speak this language or not (De Houwer, 2007; Sirèn, 1995; Yamamoto, 2001). In these studies, language use was assessed through surveys in which parents indicated the languages their children spoke (De Houwer, 2007), used actively in

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communication with a parent (Sirèn, 1995), or used as a means of communication (Yamamoto, 2001). However, this work leaves unclear how these patterns relate to how *proficient* children are in a language. To the best of our knowledge, only one previous study has assessed how family language patterns, albeit operationalized differently, relate to children's language proficiency (Unsworth et al., 2019). In this study, Unsworth and colleagues (2019) investigated the role of family language patterns, alongside several aspects of input quantity and quality, on Dutch language proficiency in 50 three-year-old bilingual children who were exposed to Dutch and another language. Only families were included in which at least one parent was a non-native speaker of Dutch who spoke Dutch with the child at least some of the time. Children's proficiency was assessed with five language tests, targeting children's receptive and expressive vocabulary and receptive grammar abilities in Dutch. Family language patterns were based on two dimensions, representing (i) whether each parent mostly used Dutch or the minority language and (ii) whether there was a Dutch native-speaking parent, or more precisely, the self-reported proficiency level of any non-native-speaking parent(s). The authors found that children from families in which both parents mostly spoke Dutch and children from families where one parent mostly spoke the minority language and the other mostly spoke Dutch had higher receptive and expressive vocabulary scores than children from families where both parents mostly spoke the minority language. Moreover, in separate analyses, they found that the proficiency of any non-native parent(s) accounted for unique variance beyond the effects of family language patterns for two of the language measures (i.e., receptive vocabulary, morphosyntax). Taken together, these results show that family language patterns are important predictors of children's language abilities, but that specific aspects of the input (e.g., proficiency of non-native-speaking parents) may explain additional variance in children's abilities above and beyond the variance due to family language patterns.

In the current study, we analyzed questionnaire data from 136 bilingual families with two- and three-year-old children in the Netherlands as well as proficiency data from a subset of these children ($n = 96$). We addressed three questions:

1. Which family language patterns do we find in our sample of bilingual families with two- to three-year-old children in the Netherlands?
2. Do families adhering to these patterns show differences in the amount and type of input provided? Specifically, do they differ in the following parental input properties: input quantity, parental language proficiency, and parental language mixing?
3. How do the family language patterns relate to children's use of and proficiency in Dutch and the minority language when parental input properties are also taken into analysis?

Since question 1 is descriptive, we did not have a specific hypothesis, but we anticipated to find the same types of patterns as in earlier work, that is, families in which each parent spoke a different language, families in which both parents spoke a minority language, and families in which one or both parent(s) spoke both the minority language and Dutch (Blom et al., 2018; De Houwer, 2007). For question 2, we did not have very specific hypotheses either, because we did not know which

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exact patterns would be found. However, based on the previous literature we had some general predictions for input quantity and parental mixing. First, for input quantity, we expected that input quantity in the minority language would be higher in families in which both parents would speak the minority language than in families in which only one parent would speak this language or both parents would speak both a minority language and Dutch. The reverse pattern was expected for input quantity in Dutch. For parental mixing, we expected – not very surprisingly – the amount of mixing to be positively related to the number of parents who mixed languages in the family. Question 3 was exploratory, given that the one study that looked into this issue (Unsworth et al., 2019) focused on a specific sample (e.g., families with a non-native-speaking parent), making it difficult to derive specific hypotheses for the current study.

Method

Participants

Data were analyzed from families in the Netherlands that participated in a longitudinal study on the effects of Dutch-English daycare on language development (i.e., MIND study, for more details on this study, see Keydeniers et al., 2021). In this study, two- to four-year-old children's development in Dutch and English was investigated through language tests administered in four data waves, and information on children's language backgrounds was obtained through parental questionnaires. Participants were recruited via daycare centers that had been selected for participation by the Dutch Ministry of Social Affairs, which commissioned the study. Specifically, parents were asked for participation through information letters sent out by daycare staff. Written informed consent was obtained for each child from their parents. For the current study, 136 families were selected out of a larger sample of 368 families whose children participated in the MIND project and had filled out the parental questionnaire in the first, second, or third data wave. Families were selected if parents (i) reported no language disorders for their child and (ii) indicated that they spoke one minority language instead of or in addition to Dutch. The reason for excluding families in which two or more other languages than Dutch were spoken was that estimates of parental proficiency and language mixing could not be calculated in the same way for bilingual and multilingual families, and thus not directly be compared. Children's mean age was 37.70 months ($SD = 8.01$, min-max = 24–55), and there were 63 girls (46%). About one-third of them had older siblings ($n = 45$, 33%). Parental education was high: 107/130 (82%) children were from families in which both parents had completed higher education (data missing for six children). A diverse set of languages other than Dutch was spoken at children's homes, of which English was the most frequent: English ($n = 54$), German ($n = 11$), French ($n = 10$), Greek, Italian, Portuguese, Spanish (all $n = 6$), Russian, Turkish (both $n = 5$), Papiamentu, Romanian (both $n = 3$), Croatian ($n = 2$), Farsi, Japanese, Polish (all $n = 2$), Kanda, Mandarin Chinese, Bosnian, Catalan, Finnish, Hebrew, Slovakian, Somali, Sranan Tongo, Tamil, and Vietnamese (all $n = 1$). All children were from two-parent families. For 133 out of 136 children (98%), the main caregivers involved the parents. For the remaining three children, these were a combination of a parent and a grandparent. Note that we use the terms “parent” and “parental” in our study, while, for three of the children, one of the caregivers was not a parent but a grandparent. For 96 children (71%), data were available from one or two proficiency tests in Dutch: the Dutch version o f the Peabody Picture Vocabulary Test (PPVT-III-NL, Dunn & Dunn, 2005) and the Expressive Vocabulary subtest of the Clinical Evaluation of Language Fundamentals (CELF-Preschool-NL, Wigg et al., 2012). The mean age of this subset was 37.93 months (SD = 7.21, min-max = 24–53), and there were 46 girls (48%). The distribution of languages other than Dutch was comparable to that in the larger sample, with English being the most frequent ($n = 36$), followed by German ($n = 9$), French ($n = 9$), Portuguese ($n = 6$), Italian ($n = 5$), and Russian ($n = 5$), and the remaining languages being reported only once or twice. In the remainder of this paper, we will refer to these languages as “minority languages,” since these are spoken by a minority in the larger linguistic area (the Netherlands). Note, however, that English may rather have the status of a lingua franca in the Netherlands, especially in urban areas (van Oostendorp, 2012).

Measures and variables

Family language use and parental input characteristics

An online parental questionnaire was used to collect information on family language use and language input properties (MIND questionnaire, see Verhagen & Andringa, 2021). Specifically, this questionnaire assessed which language(s) parents spoke to their children, how often they spoke these languages, how well parents spoke and understood each of the languages, and how often they mixed their languages. It also assessed how many older siblings children had and the languages spoken by them. The questionnaire was based on a number of existing questionnaires (Bilingualism Language Exposure Calculator (BiLEC), Unsworth, 2013; Language Exposure Questionnaire, Cattani et al., 2014; Language Mixing Scale, Byers-Heinlein, 2013). Descriptions of the questions can be accessed at https://osf.io/n5tyd/?view_only=a9e01d617c674930b0842e5c532553b6. A subset of the questions was analyzed for the current study to obtain a series of estimates that reflected (i) family language patterns, (ii) input quantity in Dutch and the minority language, (iii) parents’ language proficiency in Dutch and the minority language, and (iv) degree of parents’ language mixing. Each of these will be described below.

Family language patterns.

Information about family language patterns was obtained from questions that addressed, for each of the main caregivers separately, which language(s) they spoke to their child, and how often they spoke each language, in percentages. Respondents indicated, for example, that parent 1 spoke 60% Dutch and 40% Italian to the child, whereas parent 2 spoke 100% Italian. Based on this information, families were classified into categories corresponding to those in De Houwer (2007) in which, for each parent, it was determined whether they spoke Dutch only, the minority language only, or both Dutch and the minority language to their child. The threshold was set at 5% such that a parent who spoke Dutch 95% of the time and the minority language 5% of the time was classified as speaking two languages, whereas a parent who spoke Dutch 96% of the time and the minority language 4% of the time was classified as speaking Dutch only. This cutoff was chosen because we noted that especially Dutch families in our sample indicated that they spoke Dutch 99% to 96% of the time and a little English 1% to 4% of the time. It is very likely that these families were practically monolingual, but incidentally used some words or short phrases in English, given that English is rather present in the Netherlands (through television, apps, and songs).

Input quantity.

Overall input quantity for both Dutch and the minority language from children's parents was calculated on the basis of two questions. First, parents were asked how often they used each language when speaking to their child, in percentages (see above). Second, they were asked to indicate for a typical week how often they looked after their child in a detailed breakdown of weekdays and weekend days per morning, afternoon, and evening. These time units were chosen to enable a fairly detailed measurement while still keeping the time needed for parents to complete the questionnaire to a minimum. Input quantity per language was then calculated with the following formula: relative amount of a language spoken by a parent × number of time units spent with the child by that parent, and summed for children's parents. Thus, if parent 1 indicated to speak Dutch 60% of the time and spend 12 mornings/afternoons/evenings with the child and parent 2 indicated to speak Dutch 80% of the time and spend 10 mornings/afternoons/evenings with the child, the resultant weighted estimate for input quantity in Dutch was calculated as $(60 \times 12) + (80 \times 10) = 1{,}520$ time units. Overlap in time units between parents was dealt with by dividing by two the time units that both parents spent together with the child. To make values better interpretable, they were divided by 100, yielding an estimate of 15.20 time units in the above example (with a maximum of 7 days $\times$ 3 time units $= 21$ time units). Input quantity in the minority language was calculated in the same way, using parents' estimates for the minority language instead of Dutch. Additionally, two input variables were calculated: input quantity at daycare and by siblings. These variables were calculated in the same way as the input quantity variable for parents: that is, the time a particular language was spoken at daycare/by siblings was multiplied with the number of time units a child spent at daycare/with their siblings.

Parental language proficiency.

Estimates of parents' language proficiency were derived from questions assessing for each parent separately how proficient they were in the language(s) spoken to their child. Specifically, for each language, parents indicated how well they spoke this language on a 6-point scale ranging from 1 ("absolute beginner") to 6 ("perfect mastery"). These levels roughly corresponded to the ability scales from the Common European Framework of Reference for Languages (Council of Europe, 2001). Separate variables for parents' language proficiency in Dutch and the minority language were derived from averaging the scores for both parents for Dutch and the minority language, respectively.

Parental mixing.

The degree to which parents mixed languages was assessed through two questions. Specifically, parents were asked to indicate how often they switched languages within a conversation (inter-sentential mixing) and within a sentence (intra-sentential mixing), in two separate questions for each parent separately. They provided their answers on a 5-point scale with 1 ("never"), 2 ("almost never"), 3 ("sometimes"), 4 ("regularly"), and 5 ("often") as its scale points. A total mixing score for this variable was computed by summing the scores on these questions for both parents.

Children's language use and proficiency

Children's language use.

Parents were asked to list all the languages their children understood (question 1) and spoke (question 2). Parents could mark any language they wanted, including languages that were not spoken at home, regardless of children's proficiency level. From their answers, four binary variables were created that represented whether or not a child (i) understood Dutch, (ii) spoke Dutch, (iii) understood the minority language, and (iv) spoke the minority language.

Children's language proficiency.

For all languages that parents reported their child to speak, they assessed their child's proficiency level through three questions that were adapted from the Alberta Language Development Questionnaire (ALDeQ, Paradis et al., 2010). These questions involved comparisons with monolingual peers, as follows: "Compared with monolingual children of the same age speaking language A, how do you think that your child [expresses him/herself/pronounces words/makes correct sentences] in language A?" Parents provided their answers on a 5-point scale, with 1 ("much less well"), 2 ("less well"), 3 ("similarly"), 4 ("better"), and 5 ("much better") as its scale points. An "I don't know" option was also provided. Mean scores were calculated for Dutch and the minority language separately.

Language proficiency in Dutch.

Children's proficiency in Dutch was assessed directly, through two language tests. The Dutch Peabody Picture Vocabulary Test (PPVT) (PPVT-III-NL, Dunn & Dunn, 2005) was used to assess receptive vocabulary. In this test, children choose one out of four pictures after an orally presented word. The test is adaptive such that testing is stopped if children make a certain number of errors. Raw scores rather than standard scores were used, because no standard scores for bilingual children are available. The Expressive Vocabulary subtest of the Dutch version of the Clinical Evaluation of Language Fundamentals (CELF) (Preschool-2-NL, CELF-Preschool-NL, Wigg et al., 2012) was used. In this test, children are instructed to label a picture through a prompt (e.g., What is this?). The test is adaptive such that testing is stopped when the child makes a certain number of consecutive errors. As with the PPVT, raw scores of the CELF were used, since norm scores are not available for bilingual children. Although the original starting age for the test is 36 months, children were administered the test if they were 30 months or older, following earlier work (e.g., Unsworth et al., 2019).

Language proficiency in English.

Children's proficiency in English was assessed through English equivalents of the Dutch tests. This was done in the scope of the larger project, rather than the purposes of the current study. However, since the results from the English tests will be reported for validation purposes below, these tests are briefly described here. The following tests were administered: the English Peabody Picture Vocabulary Test (PPVT-4, Dunn & Dunn, 2007) and the Expressive Vocabulary subtest of the English CELF (CELF-Preschool-2, Wigg et al., 2004). As with the Dutch tests, the standard adaptive protocol was followed and raw scores were used for the analyses.

Procedure

Parents completed the questionnaire online through the survey software *Easion* (Parantion, 2017) in Dutch or English, depending on their preference. Children were assessed in a quiet room at their daycare centers in two separate sessions by trained assessors who were (near-)native speakers of Dutch (Dutch tests) or English (English tests). Tests within a session were intermixed with other tests not reported here and administered in a fixed order in which the receptive vocabulary test (PPVT) preceded the expressive vocabulary test (CELF). The ordering of the Dutch and English sessions varied, such that about half of the children (48%) completed the Dutch session first. Children received a sticker after each test and a small gift at the end of each session. Parents received a children's book upon completion of the questionnaire.

Data screening and analyses

Our first research question addressed which family language patterns occurred. For this analysis, frequencies were calculated. Our second question asked whether these patterns differed in terms of the input properties parental input quantity, parental language proficiency, and parental language mixing. To address this question, one-way ANOVAs with "pattern" as the independent variable and the input properties (i.e., Dutch input quantity, parental language proficiency in Dutch, etc.) as the dependent variables were run. Our third question asked how family language patterns related to children's use of the minority and majority languages as well as to their proficiency in these languages, once differences in input properties across patterns were included in the analyses. To address this last question, three analyses were performed. First, we conducted AN(C)OVAs on children's language outcomes with "pattern" as the independent variable and "age in months" as a covariate (for

Table 1. Frequencies per family language pattern (Classification based on De Houwer, 2007)

Pattern	Parent 1	Parent 2	*N*	(%)
1	Dutch + ML	Dutch + ML	15	(11.03 %)
2	Dutch + ML	Dutch	23	(16.91%)
3	Dutch + ML	ML	11	(8.09%)
4	ML	Dutch	34	(25.00%)
5	ML	ML	53	(38.97%)
		Total group	136	–

Note. ML = minority language.

the language tests). Second, we assessed whether any effects of family language pattern remained after differences in parental input properties were taken into account. Prior to investigating this, we checked all correlations between the predictor variables to see whether there were indications of multicollinearity in our data. Last, we performed a series of multiple linear regression analyses with children's proficiency scores as the dependent variables, using the *lm* function in the *lme4* package (Bates et al., 2015) in *R* (R Core Team, 2019). Regarding these regression analyses, four separate models were run on each of the proficiency scores that were available: receptive vocabulary in Dutch (PPVT scores), expressive vocabulary in Dutch (CELF scores), parent-reported proficiency in Dutch (ALDeQ ratings), and parent-reported proficiency in the minority language (ALDeQ ratings). For each proficiency measure, we first entered two "baseline" predictors (age and gender) in the model. Subsequently, we added our predictors of interest in separate models. These were parental input quantity, parental proficiency, parental mixing, and family language pattern. We also added two additional variables to account for children's input quantity in a certain language as precisely as possible: daycare input quantity and sibling input quantity. For the parental input quantity variables, only the predictor based on Dutch was entered in the models with Dutch proficiency and only the predictor based on the minority language was entered in the model with minority language proficiency. This was because the cross-language parental input quantity variables were strongly correlated ($r = .86$, see Table 3). Parental proficiency was not included in the model for the other language either, because it was unlikely that parents' proficiency in the minority language would be associated with children's language abilities in Dutch, or vice versa. Each of the remaining variables was included in all the models. For each model, the following stepwise variable selection procedure was adopted: the baseline predictors age and gender were entered first, followed by the input properties (one by one), and, finally, family language patterns. After each step, non-significant predictors were removed to obtain the most parsimonious model. Model complexity was increased by including interaction effects between the predictors of interest and the baseline predictors and the predictors of interest. In order to compare models, likelihood ratio tests were performed using the *anova* function. If the *p*-value from the likelihood ratio test was significant, the larger model was selected; if not, the more parsimonious model was

Table 2. Descriptive statistics for the input properties per family language pattern

	MIX ($n = 49$)		OPOL ($n = 34$)		ML@H ($n = 55$)		
	M	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	Group differences (ANOVAs with Bonferroni tests)
Parental input quantity							
Input quantity in Dutch[a]	13.90	(7.55)	11.83	(2.84)	0.01	(0.01)	MIX > ML@H***	OPOL > ML@H***
Input quantity in ML	9.33	(7.95)	11.73	(2.88)	24.09	(3.80)	ML@H > MIX***	ML@H > OPOL***
Parental language proficiency[b]							
Self-rated proficiency in Dutch	5.42	(0.79)	5.79	(0.55)	–	–	OPOL > MIX*
Self-rated proficiency in ML	5.22	(0.86)	5.74	(0.66)	5.90	(0.36)	OPOL > MIX**	ML@H > MIX***
Parental mixing[c]							
Inter-sentential mixing	2.57	(1.85)	0.20	(0.54)	0.15	(0.64)	MIX > OPOL***	MIX > ML@H***
Intra-sentential mixing	1.76	(1.82)	0.15	(0.44)	0.12	(0.43)	MIX > OPOL***	MIX > ML@H***
Total mixing	4.33	(3.53)	0.35	(0.95)	0.27	(1.05)	MIX > OPOL***	MIX > ML@H***
Control variables[d]							
Input quantity in Dutch – daycare	3.96	(2.04)	3.18	(1.39)	4.14	(1.79)	No differences
Input quantity in Dutch – siblings	1.60	(3.62)	0.80	(2.50)	0.32	(1.02)	MIX > ML@H*
Input quantity in ML – siblings	0.76	(2.31)	0.80	(1.34)	3.14	(5.32)	ML@H > MIX**	ML@H > OPOL**

[a]Weighted estimate: percentage of Dutch spoken by parent * time spent with child by parent, summed for both parents.
[b]Parents' ratings for speaking proficiency (scale: 1 "absolute beginner" to 6 "perfect mastery"), averaged over parents.
[c]Parents' ratings for inter- and intra-sentential switching (scale: 0 "never" to 4 "often"), summed for both parents.
[d]Weighted estimate: percentage of Dutch/ML spoken by siblings * time spent with child by siblings. Since not all children had siblings and zeros were entered for children without siblings, this variable was skewed towards lower scores ($n = 13$, 9, 10 for sibling input in Dutch; $n = 8$, 8, 22 for sibling input in ML).

Table 3. Parent-reported frequencies of children's understanding and speaking of Dutch and the minority language for MIX, OPOL, and ML@H families

	MIX ($n = 49$)		OPOL ($n = 34$)		ML@H ($n = 53$)	
	N	*(%)*	*N*	*(%)*	*N*	*(%)*
Dutch						
Understand ("yes" answers)	49	(100)	34	(100)	48	(91.00)
Speak ("yes" answers)	48	(98.00)	33	(97.06)	39	(73.58)
Minority language						
Understand ("yes" answers)	44	(89.80)	33	(97.06)	53	(100)
Speak ("yes" answers)	42	(85.71)	32	(94.12)	53	(100)

selected. In all models, sum-to-zero contrast coding was applied to our categorical fixed effects (family language pattern, gender) (Schad et al., 2020), and continuous variables were centered around zero. Data and scripts can be found at https://osf.io/n5tyd/?view_only=a9e01d617c674930b0842e5c532553b6.

Results

Types of family language patterns

To answer our first question, we examined which family language patterns occurred in our sample, following the classification in De Houwer (2007). Absolute and relative frequencies for each pattern are presented in Table 1.

Families in which both parents only spoke the minority language were most frequent, constituting over one-third of the sample (39%). The pattern in which one parent spoke Dutch and the other parent the minority language was less frequent (25%), followed by the three patterns in which one or both parents used both Dutch and the minority language (11%, 17%, 8%). Since numbers for these three latter groups were rather low and all these groups contained at least one parent who used both languages, we collapsed these groups in subsequent analyses. This resulted in a three-way classification, involving families in which one or both parents used both Dutch and the minority language when speaking to their child (henceforth called "MIX," $n = 49$), families in which one parent spoke Dutch and the other the minority language to their child (henceforth called OPOL, $n = 34$), families in which both parents spoke the minority language to their child (henceforth ML@H, $n = 53$). Note that these patterns correspond to the common three-partite classification that was discussed above (Barron-Hauwaert, 2004; Blom et al., 2018; Piller, 2001; Pearson, 2008). Children's mean age did not differ significantly across groups (MIX: $M = 39.96$, $SD = 7.77$, OPOL: $M = 37.85$, $SD = 7.04$; ML@H: $M = 38.28$, $SD = 8.93$), as indicated by a one-way ANOVA $F(2,135) = 0.350$, $p = .705$, partial $\eta^2 = .01$). There were more girls in the MIX group (26/49 = 53%) than in the OPOL (14/34 = 41%) and ML@H groups (23/53 = 43%), but this difference was not significant ($\chi^2(2,136) = 1.440$, $p = .487$).

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Family language patterns and input properties

Our second research question asked how the family language patterns could be characterized in terms of three input properties that have been found to be associated with children's language development: input quantity, parental proficiency, and parental language mixing. Table 2 presents descriptive statistics for these properties for each pattern. This table also presents descriptive statistics for the amount of input in Dutch at daycare and the amount of input in Dutch and the minority language through siblings, as these were control variables included in the statistical analyses presented below.

As can be seen from this table, there were differences between the family language patterns for all input properties. One-way ANOVAs with "group" (MIX, OPOL, and ML@H) as the independent variable and post hoc Bonferroni tests showed significant main effects for all properties, except for the amount of Dutch at daycare. Below, only the main outcomes are described. For more detailed results of the post hoc comparisons, see Table A in the Appendix. Dutch input quantity was significantly higher in the MIX and OPOL families than in the ML@H families. Note that standard deviations were high, particularly in the MIX group, signaling substantial variation across families. The reverse pattern was found for input quantity in the minority language, which was significantly higher in the ML@H families than MIX and OPOL families. Even though differences in parental proficiency in Dutch seemed small, proficiency in Dutch was significantly higher in the OPOL families than in the MIX families. For parents' proficiency in the minority language, lower proficiency was reported in the MIX families as opposed to the OPOL and ML@H families. As for mixing, the data showed – not surprisingly – that the highest degree of mixing, both inter- and intra-sententially, occurred in the MIX group. Finally, regarding the control variables, Dutch input quantity at daycare did not differ across the groups, but input in Dutch from siblings did, with higher amounts of Dutch sibling input in the MIX than in the ML@H families. The amount of sibling input in the minority language, in contrast, was lower in the MIX and OPOL families than in the ML@H families. These latter findings must be interpreted with caution, however, as not all the children in the sample had siblings (for more details, see Table note). Thus, there were clear differences across the three family language patterns for all input properties, albeit not always between all three groups. Depending on the input property looked at, family language patterns clustered together differently. With respect to parental input quantity in Dutch, for example, MIX and OPOL families clustered together, both showing higher amounts than ML@H families. With respect to language proficiency in the minority language, OPOL and ML@H families clustered together, reporting higher proficiency than MIX families. These findings indicate that each family language pattern exhibited its own profile, resembling the other patterns in some but not all respects.

Family language patterns and children's language use and proficiency

Our third question addressed how the family language patterns related to children's use of and proficiency in the minority and majority language. Table 3 presents for

Table 4. Descriptive statistics for children's language proficiency measures in Dutch and English

	Dutch				English			
	M	*SD*	min–max	*N*	*M*	*SD*	min–max	*N*
Parent ratings (ALDeQ)	2.76	0.96	1–5	116	2.46	0.90	1–5	70
Receptive vocabulary (PPVT)	30.11	13.36	2–64	95	22.81	19.21	1–89	101
Expressive vocabulary (CELF)	5.38	6.23	0–25	77	4.06	5.79	0–27	80

Note. ALDeQ = Alberta Language Development Questionnaire comparing children's language proficiency with that of monolingual peers (scale: 1 "much less well" to 5 "much better"). Note that sample sizes for the expressive vocabulary tests are smaller than for the receptive vocabulary tests, since the former was only administered to children aged 30 months or older.

Table 5. Correlations between parent-rated proficiency and children's test scores in Dutch and English

	Parent ratings (mean ALDeQ scores in the questionnaire)	
	Dutch (N)	English (N)
Zero-order correlations		
Receptive vocabulary (PPVT)	.34** (79)	.49*** (66)
Expressive vocabulary (CELF)	.50*** (63)	.39** (48)
Partial correlations (age at test controlled)		
Receptive vocabulary (PPVT)	.66*** (59)	.53*** (45)
Expressive vocabulary (CELF)	.70*** (59)	.44*** (45)

Note. ALDeQ = Alberta Language Development Questionnaire. * $p < .05$, ** $p < .01$, *** $p < .001$.

each of the three patterns how often parents reported that their child understood and spoke Dutch and the minority language.

Table 3 shows that children were more often reported to understand a language rather than speak it across patterns and across languages. For Dutch, parents in MIX and OPOL families reported their child to understand and speak Dutch more often than parents in ML@H families. For the minority language, in contrast, parents reported their child to understand and speak the minority language more often in the ML@H and OPOL families as opposed to the MIX families, although the difference for "understanding" with the OPOL families was small. The largest difference between speaking and understanding emerged for the ML@H families where 91% of the children were reported to understand the majority language and 74% of them to speak this language. Overall, numbers were high: the vast majority of children across groups and languages were reported to understand and speak Dutch and the minority language.

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Table 6. Descriptive statistics for children's language proficiency in Dutch and the minority language per family language pattern

	MIX			OPOL			ML@H		
	M	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*
Dutch									
Parent ratings (ALDeQ)	3.22	0.91	48	3.08	0.63	33	1.83	0.58	35
Receptive vocabulary (PPVT)	35.06	13.84	31	31.70	11.26	27	24.78	12.76	37
Expressive vocabulary (CELF)	9.32	6.65	22	6.96	6.79	23	1.53	2.06	32
Minority language									
Parent ratings (ALDeQ)	2.77	0.97	42	2.48	0.75	29	3.17	0.97	52

Note. ALDeQ = Alberta Language Development Questionnaire comparing children's language proficiency with that of monolingual peers (scale: 1 "much less well" to 5 "much better").

To investigate how family language patterns related to children's proficiency in Dutch and the minority language, we analyzed parents' ratings of children's proficiency, collected through three questions in the questionnaire adapted from the ALDeQ. Although earlier work has indicated that parent reports of language proficiency in young bilingual children are valid (Bedore et al., 2011; Gutiérrez-Clellen & Kreiter, 2003), we first correlated parents' ratings of children's proficiency with scores on language proficiency tests, to check the validity of the parent ratings in the current data. Since proficiency tests were administered in Dutch and English, correlations were computed for parents' evaluations of children's abilities in these languages only. Descriptive statistics for all measures are presented in Table 4; correlations are presented in Table 5. As shown in Table 5, correlations were positive and moderate for all measures and for both languages, and higher if variance due to differences in age was partialed out. Taken together, these data support the validity of the parent ratings in our study, suggesting that parents could reliably estimate their children's language proficiency at least to some extent.

To assess how children's language proficiency was related to children from MIX, OPOL, and ML@H families, mean parent ratings for Dutch and the minority language as well as mean proficiency scores on the language tests were calculated for the three groups separately – see Table 6. Note that less data are available per group than above where language use (speaking/understanding) was reported. For Dutch vocabulary, this was because only a subset of the children completed the Dutch receptive vocabulary test ($n = 95$). For the parent ratings, missing data were mainly due to the fact that parents who reported that their child did not speak a particular language were not administered the ALDeQ questions for this language. For the ML@H families, recall from above that only 39 families reported that their child spoke Dutch (see Table 2), yielding missing data points for the remaining 14 families in this group. Out of these, four parents were administered these questions but refrained from answering them, perhaps because they did not feel confident evaluating their children's proficiency level in a language not spoken at home. Hence, proficiency ratings were available for 35 out of all 53 children in the ML@H families.

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For Dutch, the highest scores were found for children from MIX families, followed by children from OPOL and ML@H families, respectively, regardless of the measure. ANCOVAs with "family language pattern" as the independent variable and age in months controlled confirmed that the OPOL and MIX children outperformed the ML@H children on Dutch vocabulary on both tests and had significantly higher parent-rated Dutch proficiency (all *p*s $< .001$). The differences between the OPOL and MIX groups were not significant (*p*s $> .261$). For the minority language, proficiency ratings for children in ML@H families were higher than for children in OPOL families ($p = .005$), but there were no differences between children from ML@H and MIX families or between children from MIX and OPOL families (*p*s $> .107$). For more detailed results of the post hoc comparisons, see Table B in the Appendix.

To test whether these effects of family language patterns on children's language proficiency remained after differences in input properties (e.g., input quantity, parental proficiency, parental mixing) were taken into analysis, a series of regressions were performed. Prior to these analyses, we checked all correlations between the predictors, to see whether there was multicollinearity in our data. This appeared not to be the case: correlations were weak to moderate, ranging between −.04 and .44, at least if within-language correlations were considered. See Table C in the Appendix for the full correlation matrix. Linear models were then run on children's proficiency ratings (for Dutch and the minority language) and proficiency test scores (for Dutch only), using a stepwise selection procedure. Predictors in these models were "family language pattern" and "age," and the input properties "parental input quantity," "parental proficiency," "parental mixing," "input quantity by siblings," and "input quantity at daycare." The most parsimonious regression models are presented in Table 7.

Family language patterns predicted a significant portion in only one of the measures: parent-reported proficiency in Dutch. For this measure, children from MIX and OPOL families had higher scores than children from the ML@H families. The difference between children from MIX versus OPOL families was not significant. However, for Dutch receptive vocabulary, the result of the ANOVA comparing the models with and without family language patterns only approached significance ($F(2,87) = 2.928$, $p = .059$). In the less parsimonious model showing an effect of family language pattern, children from OPOL and MIX families obtained higher vocabulary scores than children from ML@H families.

Parental input quantity was a significant predictor in all models, such that children who were exposed to more input in a language were more likely to obtain higher scores in that language. Age was a significant predictor in the models for receptive and expressive vocabulary, but not in the models on parent-reported proficiency, which is not surprising, given that parents were instructed to rate their children's language proficiency irrespective of age. Input quantity at daycare (in Dutch) was a significant predictor of children's receptive and expressive vocabulary scores, but not of the ALDeQ ratings. Language mixing, input quantity by siblings, and parental language proficiency were not significant in any of the models. Taken together, these findings show that family language patterns predicted a significant portion of the variance of children's parent-reported proficiency in Dutch, even when differences in parental input and input at daycare were controlled, but not

Table 7. Final multiple regression models on children's language outcomes with input properties and family language patterns as predictors

	Estimate	SE	t	p
Predictors of parent-reported proficiency in Dutch (ALDeQ)				
Intercept	2.645	0.065	40.434	< .001
Parental input quantity (Dutch)	0.068	0.013	5.273	< .001
Daycare input quantity (Dutch)	0.094	0.036	2.611	.010
Family language pattern (MIX/OPOL vs. ML@H)	−0.527	0.213	−2.468	.015
Family language pattern (MIX vs. OPOL)	0.081	0.163	0.495	.622
$R^2 = 0.54$, adjusted $R^2 = .52$, $F(4,107) = 31.59$, $p < .001$				
Predictors of receptive vocabulary scores (PPVT)				
Intercept	29.480	0.961	30.685	< .001
Age	1.223	0.158	7.731	< .001
Parental input quantity (Dutch)	0.696	0.121	5.760	< .001
Daycare input quantity (Dutch)	1.275	0.557	2.290	.024
$R^2 = 0.53$, adjusted $R^2 = .52$, $F(3,89) = 33.86$, $p < .001$				
Predictors of expressive vocabulary scores (CELF)				
Intercept	4.409	0.506	8.719	< .001
Age	0.422	0.083	5.079	< .001
Parental input quantity (Dutch)	0.489	0.062	7.926	< .001
Daycare input quantity (Dutch)	0.632	0.251	2.522	.014
$R^2 = 0.57$, adjusted $R^2 = .55$, $F(3,71) = 31.00$, $p < .001$				
Predictors of parent-reported proficiency in the minority language (ALDeQ)				
Intercept	2.818	0.080	35.316	< .001
Parental input quantity (ML)	0.001	0.00001	5.640	< .001
$R^2 = 0.13$, adjusted $R^2 = .13$, $F(1,118) = 18.27$, $p < .001$				

for the other outcomes. Input quantity came out as a significant predictor in all models. The models explained 54% to 57% of the variance in children's scores for the Dutch measures and 13% of the minority language measure.

A closer look at the MIX families

A possible threat to our finding that there were no differences in language proficiency between children from MIX and OPOL families is that our MIX group was a mixed bag of various types of families: families in which both parents spoke two languages to the child, as well as families in which only one parent spoke two languages and the other parent spoke Dutch or the minority language only. Families in which one parent spoke two languages and the other spoke Dutch outnumbered

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Table 8. Descriptive statistics for the input properties per family language pattern

	MIX (*n* = 49)			OPOL (*n* = 34)	ML@H (*n* = 55)
	Dutch+ML/Dutch (*n* = 23)	Dutch+ML/Dutch+ML (*n* = 15)	Dutch+ML/ML (*n* = 11)	–	–
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Parental input quantity					
Input quantity in Dutch[a]	17.90 (6.81)	12.88 (6.62)	6.92 (4.23)	11.83 (2.84)	0.01 (0.01)
Input quantity in ML	4.25 (3.61)	11.47 (7.87)	17.02 (7.51)	11.73 (2.88)	24.09 (3.80)
Parental language proficiency[b]					
Self-rated proficiency in Dutch	5.70 (0.52)	5.11 (0.76)	5.25 (1.14)	5.79 (0.55)	–
Self-rated proficiency in ML	4.93 (1.00)	5.39 (0.68)	5.55 (0.61)	5.74 (0.66)	5.90 (0.36)
Parental mixing[c]					
Inter-sentential mixing	2.13 (1.39)	3.87 (2.17)	1.73 (1.35)	0.20 (0.54)	0.15 (0.64)
Intra-sentential mixing	1.26 (1.77)	3.07 (2.19)	1.00 (1.55)	0.15 (0.44)	0.12 (0.43)
Total mixing	3.39 (2.37)	6.93 (4.22)	2.73 (2.72)	0.35 (0.95)	0.27 (1.05)
Control variables[d]					
Input quantity in Dutch – daycare	3.61 (1.58)	4.07 (2.78)	4.52 (1.70)	3.18 (1.39)	4.14 (1.79)
Input quantity in Dutch – siblings	1.88 (4.19)	1.57 (3.77)	1.07 (1.92)	0.80 (2.50)	0.32 (1.02)
Input quantity in ML – siblings	–	–	–	0.80 (1.34)	3.14 (5.32)

[a]Weighted estimate: percentage of Dutch spoken by parent × time spent with child by parent, summed for both parents.
[b]Parents' ratings for speaking proficiency (scale: 1 "absolute beginner" to 6 "perfect mastery"), averaged over parents.
[c]Parents' ratings for inter- and intra-sentential switching (scale: 0 "never" to 4 "often"), summed for both parents.
[d]Weighted estimate: percentage of Dutch/ML spoken by siblings × time spent with child by siblings. Since not all children had siblings and zeros were entered for children without siblings, this variable was skewed towards lower scores.

Table 9. Descriptive statistics for language proficiency in Dutch and the minority language for children from MIX and OPOL families

	MIX (Dutch+ML/Dutch+ML)			OPOL		
	M	*SD*	*N*	*M*	*SD*	*N*
Dutch						
Parent ratings (ALDeQ)	3.34	1.04	15	3.08	0.63	33
Receptive vocabulary (PPVT)	37.00	14.09	9	31.70	11.26	27
Expressive vocabulary (CELF)	8.00	6.11	7	6.96	6.79	23
Minority language						
Parent ratings (ALDeQ)	3.05	0.95	14	2.48	0.75	29

the other two types of families ($n = 23$ vs. $n = 15/11$). The relatively high amount of Dutch exposure in these families may have impacted positively on children's language proficiency in Dutch and, consequently, masked the effects of family language pattern in our comparison between MIX and OPOL families above. In fact, in the study by De Houwer (2007) that did distinguish between families with different mixing patterns, language use differed depending on whether one or both parents mixed: minority language transmission was most likely in families in which one parent mixed and the other only spoke the minority language (93%), followed, in turn, by families in which both parents mixed (78%) and families in which one parent mixed and the other spoke Dutch (34%).

To check whether it was likely that collapsing all MIX families had an effect on our results, we first looked at the parental input properties for the three types of MIX families separately. Table 8 presents descriptive statistics for these input properties for the three types of MIX families, as well as for the OPOL and ML@H families, to facilitate comparison across all types.

As expected, most Dutch input was provided in families in which only one parent mixed languages and the other spoke only Dutch, followed by families in which both parents mixed languages and, finally, families in which one parent mixed and the other spoke the minority language. Input in the minority language presented the mirror image of this pattern. Not very surprisingly, language mixing was most frequent in families in which both parents spoke both languages. No clear differences in parental language proficiency and the control measures were observed.

We then compared children's language proficiency between (i) MIX families in which *both* parents used both languages and (ii) OPOL families, to focus on families that exposed children to Dutch and the minority language about equally. Descriptive statistics for children's language proficiency are given in Table 9 for these two groups separately. Note that sample size is low in the former group. This was because the already small subgroup of families in which parents both spoke two languages ($n = 15$) became even smaller due to missing data on the language proficiency tests.

These data show that there are no prominent differences in scores between the two groups. In fact, children whose parents mixed languages obtained even slightly higher scores on all measures, which should, however, interpreted cautiously due to the very low sample sizes.

Discussion

The aims of this study were to characterize family language patterns in bilingual families in the Netherlands in which a minority language was spoken in addition to or instead of Dutch and see how these patterns related to children's language outcomes. The term "family language patterns" referred to which home languages were spoken by each of the child's parents, yielding configurations such as "OPOL" and "ML@H." We addressed three questions: (i) Which family language patterns occur in our sample of bilingual families? (ii) Do these patterns differ in terms of three input properties that have been shown to predict children's language development: input quantity, parental language proficiency, and parental mixing? and (iii) How do the family language patterns relate to children's use of and proficiency in Dutch and the minority language when the input properties are also taken into analysis?

As for the first question, we attested three family language patterns in our data: OPOL, MIX, and ML@H. The same tripartite distinction has been used in earlier studies (Barron-Hauwaert, 2004; Pearson, 2008) and incorporates elements of which language is spoken (e.g., minority language) and whether parents consistently speak one language or alternate between languages (e.g., OPOL vs. MIX). The current patterns were different from those in De Houwer (2007) in which further subdivisions were made as to whether one or both parents used both languages. In our study, low numbers did not enable us to make more fine-grained distinctions within the MIX group.

Regarding our second question on how the attested patterns could be characterized in terms of language input properties, we observed clear differences among the three family language patterns for all properties investigated: input quantity, parents' self-rated proficiency, and parents' mixing. Specifically, we found that Dutch input quantity was higher in the MIX than OPOL families and – not very surprisingly – ML@H families. The reverse was true for input quantity in the minority language, which was higher in the ML@H families than MIX and OPOL families. Self-rated parental proficiency in Dutch was higher in the MIX than OPOL families (no data were available for the ML@H group). Self-rated parental proficiency in the minority language was higher in the ML@H families than in the MIX and OPOL families. As for mixing, we found – not very surprisingly – that mixing was more frequent in the MIX families than in OPOL and ML@H families. Taken together, these findings showed that the groups clustered together in different ways depending on the input property looked at, yielding distinct profiles for each of the patterns. Also, our data showed substantial variation within groups for some of the properties looked at. This was most notable for the MIX group, where the amount of input in the Dutch and the minority language hugely varied across families.

As for our last question of how the patterns related to children's language outcomes, we analyzed parents' reports of children's language use (i.e., whether their child spoke and understood a language) as well as children's proficiency in these languages, in two separate analyses. As for language use, we found that most parents reported their child to understand and speak Dutch (understand: 91–100%/speak: 74–98%), the lowest percentage being for children from ML@H families (74%). Similarly, the vast majority of parents reported their child to understand and speak the minority language (understand: 90–100%/speak: 86–100%), the lowest percentage being for children from MIX families (86%). These percentages are comparable to those reported by De Houwer (2007) for children's active use of a minority language in Belgium, except children from OPOL families were more often reported to speak the minority language in our study (94%) than in De Houwer's (74%). This difference could be due to the younger age of the current participants (six- to ten-year-olds were included in De Houwer, 2007) or to the fact that, in our study, parents were instructed to mark any language their child knew *irrespective of proficiency level*, while no such instruction seemed to be part of De Houwer's questionnaire.

As for children's language proficiency, regression analyses showed that, once differences in input properties (including input from siblings and daycare) were accounted for, family language patterns significantly predicted children's language outcomes for one out of the four measures: children's proficiency in Dutch, assessed through parent reports. Specifically, we found that children in MIX and OPOL families obtained significantly higher proficiency ratings for Dutch than children in ML@H families, after differences in Dutch input quantity were accounted for. One possible explanation of this effect is that parents in the ML@H families had trouble estimating their children's abilities in Dutch, because Dutch was not spoken in their homes. To check this possibility, correlations between parent-rated proficiency in Dutch and children's Dutch receptive vocabulary scores were calculated for the three groups separately, yielding *r*s of .74, 34, 59 for the MIX, OPOL, and ML@H groups, respectively. This correlation of .59 for the ML@H group makes it unlikely that the effect of family language pattern on parent-rated proficiency in Dutch was due to ML@H parents being unable to rate their children's proficiency in Dutch. A further finding that lends support to the effect of family language pattern is that a similar result was obtained for Dutch receptive vocabulary. However, for this measure, the model in which family language patterns were included did not surpass the 0.5 alpha level in our model comparison and thus was not the preferred model. Consequently, it was only for parent-reported proficiency in Dutch that our data showed a clear effect of family language pattern: children from MIX and OPOL families had higher levels than children in ML@H families – a difference that persisted after differences in Dutch input quantity (at home and at daycare) were controlled and properties relating to type of input (i.e., parental proficiency in Dutch, language mixing) were taken into consideration.

A second, possible explanation of children's lower proficiency in Dutch in ML@H as opposed to MIX and OPOL families relates to socio-linguistic factors. First, socio-economic status may have played a role. Earlier research has shown clear associations between family socio-economic status and language development in both monolingual and bilingual children (Hoff, 2003; Huttenlocher et al., 2010). However, in our study, parents' educational level was generally high, and even highest in the ML@H families, with 78%, 79%, and 90% of the children being from families in which both parents had completed higher education in the MIX, OPOL, and ML@H groups, respectively. This makes it unlikely that differences in parental education, as a proxy for family SES, can explain the effect of family language pattern found. A second factor that could explain why the effects of family language pattern remained after controlling for input properties relates to prestige. Perhaps, high

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prestige languages were more often used by OPOL and MIX families as opposed to ML@H families. Such differences in prestige might correlate with the ways in which parents may consciously or subconsciously stimulate their children's attitudes towards certain languages, and, in turn, children's willingness to speak and their proficiency in these languages. In our study, we did not look into prestige of the languages spoken, and it was beyond the scope of the current study to see how this factor would relate to our findings. Future work could assess how socio-linguistic factors such as language prestige, parents' attitudes, and the ways in which parents react to their children's language choices (Lanza. 2007) might account for effects of family language patterns beyond the input properties here investigated.

Crucially, family language patterns did not explain significant additional variance for three out of our four measures, once differences in amount and type of input were controlled. These findings are important and, at first sight, run counter the results by Unsworth and colleagues (2019). In this previous study, effects of family patterns – operationalized in terms of whether each parent mostly spoke Dutch or mostly the minority language – were found for two out of five proficiency measures investigated, such that children whose parents mostly spoke Dutch or whose parents each mostly spoke a different language had higher receptive and expressive vocabulary scores than children whose parents mostly spoke the minority language. More precise differences in input quantity across the groups were not controlled in this study, because the focus was on quality-oriented variables such as nativeness and input richness. Hence, it is an open question whether effects of family language pattern in the study by Unsworth et al. (2019) would remain if more precise estimates of children's input quantity had been included.

The current results raise the question as to the extent to which the effects reported in earlier work on transmission of the minority language were due to differences in input quantity between family language patterns. In these studies, transmission was least likely in cases where only one parent spoke the minority language and this parent also spoke the majority language (De Houwer, 2007; Sirèn, 1995; Yamamoto, 2001). Families adopting this pattern likely provide their children with little input in the minority language. The fact that input quantity seems to underlie the effects of family language pattern is important in light of frequent claims that some patterns are "better for bilingual development" than others. Especially, OPOL has been advocated as the optimal or even necessary strategy for children to become proficient bilinguals (Barron-Hauwaert, 2004). Very few studies have empirically investigated this issue, and the available studies have failed to provide evidence that children from OPOL families advance their language skills more quickly than children from families in which parents mix their languages (Blom et al., 2018; De Houwer, 2007). The current study adds to these earlier studies by showing that there were no differences in proficiency between children from OPOL and MIX families, neither for Dutch nor for the minority language. Moreover, our results showed that the amount of inter- and intra-sentential language mixing by parents, which sets apart OPOL and MIX families and has been claimed to negatively affect children's language development in earlier work (Byers-Heinlein, 2013), did not have an effect on children's language proficiency in either language, in line with earlier results by Bail and colleagues (2015).

A possibility worth exploring in future research, however, is that differences across families adopting family language input patterns – or families differing in relative input quantity in general – are correlated with qualitative differences in the type of input, which, in turn, may be related to children's language skills. Specifically, future work could address whether certain family language patterns are more likely than others to involve interactions that are especially beneficial for language acquisition. Kremin et al. (2021) showed that parents' most common motivations to code-switch were to foster their young children's understanding and teach them vocabulary. Assuming that these switches indeed benefit children's learning, these findings might suggest that children growing up in MIX families receive the type of input beneficial for learning. However, Byers-Heinlein et al. (2017) found that children processed code-switches at sentence boundaries more easily than switches with sentences, which might put OPOL families at an advantage, provided that switching can be across speakers. In investigating these issues further, it would be worthwhile to conduct in-depth analyses of the types of interactions that occur in families adopting different patterns, as well as closely examine children's ability to learn from these interactions beyond mere vocabulary or syntax, for example, by looking at measures of attention or processing speed.

This study has several limitations. First, children's proficiency in Dutch was assessed through direct child assessments and parent report, whereas proficiency in the minority language was only assessed through parental report. This made it difficult to compare the results for the two languages and, in fact, draw firm conclusions about children's proficiency in the minority language. Assessing children's proficiency in the minority language through language proficiency tests was not feasible, because of the wide set of languages spoken. Although there is evidence that parents can reliably estimate their children's language skills (Mancilla-Martinez et al., 2016; Marchman & Martine-Sussmann, 2002) and our own results showed moderate to strong correlations between parent-reported proficiency and children's scores on language tests (rs = .44 to .70), parents may find it difficult to accurately estimate children's language skills or give socially desirable answers. Future work could investigate relationships between family language patterns and children's language outcomes through direct child assessments in all languages. Furthermore, more detailed input assessments may be used, such as parent diaries or observations, to capture more closely the amount and type of input children are exposed to on an hour-by-hour basis, as well as assess aspects ignored in the current study such as parents' talkativeness, overheard speech, and input richness. A further limitation is that our sample contained mainly children from high-educated families and thus was not representative of the population at large. Both amount and type of input have been shown to be subject to the effects of parental educational level (Hart & Risley, 1995). Future work could examine to what extent the current results generalize to bilingual families with lower-educated parents. Such research could also take into account the specific minority language spoken, to test for effects of language prestige and typological proximity on children's language proficiency. A final limitation of our study was that the three types of families in which parents used more than one language when addressing their child were collapsed and referred to as MIX families. While earlier studies have used the same categorization (Blom et al., 2018; Pearson, 2008; Slavkov, 2017) and a post hoc comparison suggested no major consequences for our results, this was not ideal. Future work could investigate separately the input profiles of families in which only one parent or two parents mix(es) languages, also in relation to which languages are mixed. Such research could also take into account more fine-grained dimensions of language mixing, such as parents' mixing behaviors (e.g., do they switch within sentences, turns, conversations?) as well as analyze the socio-linguistic goals of parents' language mixes, to see how these relate to language transmission. Ideally, such research would assess mixing directly through observations. Although research has shown positive and significant correlations (rs = .37/.35) between the frequency of mixing assessed through a parent questionnaire and day-long at-home audio recordings of parent-toddler interactions (Kremin et al., 2021), the moderate size of this correlation suggests that questionnaire data do not capture all variation in parents' mixing behaviors.

To conclude, this study found that three family language patterns (MIX, OPOL, and ML@H) characterized over a hundred families in the Netherlands in which a minority language was spoken in addition to or instead of Dutch. Children from MIX and OPOL families had significantly higher proficiency in Dutch, as assessed through tests and parent report, than children from ML@H families. Children from ML@H families, in contrast, had significantly higher proficiency in the minority language than children from MIX and OPOL families. However, when differences in input properties across patterns (e.g., input quantity) were controlled, family language pattern no longer predicted children's language proficiency for three of the four proficiency measures investigated. The one effect of family language pattern that remained was that Dutch proficiency was higher for children from MIX and OPOL families than ML@H families. Across analyses, input quantity came out as the major factor. These results suggest that differences in input quantity might underlie the effects of family language patterns found in earlier work (Unsworth et al., 2019) and provide further support for the idea that there is no need for parents to separate their languages through OPOL to increase their chances of upbringing a bilingual child (Blom et al., 2018; De Houwer, 2007).

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Appendix. Results of the AN(C)OVAs and Correlation Analyses

Table A. Results of ANOVAs Comparing Parental Input Properties Across Family Language Patterns

	Group differences	Bonferroni tests
Parental input quantity		
Input quantity in Dutch[a]	MIX > ML@H*** OPOL > ML@H***	95% CI, 11.59 to 16.19, $p < .001$ 95% CI, 9.19 to 14.44, $p < .001$
Input quantity in ML	ML@H > MIX*** ML@H > OPOL***	95% CI, 11.64 to 17.15, $p < .001$ 95% CI, 8.84 to 15.13, $p < .001$
Parental language proficiency[b]		
Self-rated proficiency in Dutch	OPOL > MIX*	$F(1,78) = 5.224$, $p = .025$
Self-rated proficiency in ML	OPOL > MIX** ML@H > MIX***	95% CI, 0.16 to 0.89, $p = .002$ 95% CI, 0.36 to 1.01, $p < .001$
Parental mixing[c]		
Total mixing	MIX > OPOL*** MIX > ML@H***	95% CI, 2.74 to 5.20, $p < .001$ 95% CI, 2.96 to 5.16, $p < .001$
Control variables		
Input quantity in Dutch - daycare	No significant differences	
Input quantity in Dutch - siblings	MIX > ML@H*	95% CI, 0.05 to 2.53, $p = .040$
Input quantity in ML - siblings	ML@H > MIX** ML@H > OPOL**	95% CI, 0.62 to 4.14, $p = .004$ 95% CI, 0.80 to 4.71, $p = .002$

Note. [a]Weighted estimate: percentage of Dutch spoken by parent * time spent with child by parent, summed for both parents, in time units (mornings, afternoons, evenings), [b]Parents' ratings for speaking proficiency (scale: 1 'absolute beginner' to 6 'perfect mastery'), averaged over parents, [c]Parents' ratings for inter- and intra-sentential switching (scale: 0 'never' to 4 'often'), summed for both parents.

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Table B. Results of AN(C)OVAs with Family Language Patterns as the Independent Variable

	Group differences	Bonferroni tests
Dutch		
Parent ratings (ALDeQ)	MIX > ML@H*** OPOL > ML@H***	95% CI, 0.99 to 1.79, $p < .001$ 95% CI, 0.81 to 1.69, $p < .001$
Receptive vocabulary (PPVT)	MIX > ML@H*** OPOL > ML@H***	95% CI, 6.60 to 18.00, $p < .001$ 95% CI, 4.31 to 16.26, $p < .001$
Expressive vocabulary (CELF)	MIX > ML@H*** OPOL > ML@H***	95% CI, 4.89 to 11.10, $p < .001$ 95% CI, 3.53 to 9.76, $p < .001$
Minority language		
Parent ratings (ALDeQ)	ML@H > OPOL**	95% CI, 0.17 to 1.21, $p = .005$

Note. For the language tests, ANCOVAs were performed with age as a covariate; for the ALDeQ ratings, ANOVAs were performed.

Table C. Bivariate Correlations Among all Predictor Variables in the Multiple Regression Models

	1	2	3	4	5	6	7	8
Dutch								
1. Parental input quantity	–	–	–	–	–	–	–	–
2. Daycare input quantity	-.19*	–	–	–	–	–	–	–
3. Sibling input quantity	.24**	.16	–	–	–	–	–	–
4. Self-rated proficiency	.26*	-.17	-.10	–	–	–	–	–
Minority Language								
5. Parental input quantity	-.86***	.11	-.27**	-.20	–	–	–	–
6. Sibling input quantity	-.30***	.12	.09	-.04	.38***	–	–	–
7. Self-rated proficiency	-.50***	.05	-.09	.12	.44**	.09	–	–
8. Language mixing (total)	.34**	-.003	.16	-.19	-.32***	-.10	-.28**	–

Note. Sample sizes differed across measures, with n ranging between 77 and 136.

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