J. Child Lang. **29** (2002), 843–863. © 2002 Cambridge University Press
DOI: 10.1017/S0305000902005366 Printed in the United Kingdom

What's the difference between 'toilet paper' and 'paper toilet'? French-English bilingual children's crosslinguistic transfer in compound nouns*

ELENA NICOLADIS
University of Alberta

(*Received* 16 *May* 2000. *Revised* 7 *January* 2002)

ABSTRACT

Bilingual acquisition can shed light on the cues children use in acquiring language. The purpose of this paper was to examine whether frequency, ambiguity or language dominance could explain crosslinguistic transfer in compound nouns. Crosslinguistic transfer would appear in the form of compound reversals. 25 monolingual English children between the ages of three and four years and 25 age-matched French-English bilingual children were asked to create and indicate their understanding of novel compound nouns. In production, the bilingual children reversed compounds in English more often than the monolingual children but equally often in French and English. In comprehension, there were no differences between groups. These results cannot be explained by any previous explanation of transfer. Implications for the theory of language acquisition are discussed.

INTRODUCTION

Bilingual children who acquire two languages simultaneously usually code-mix, or use their two languages within a single unit of discourse, at some

[*] The author was supported by a SSHRC post-doctoral fellowship grant when this paper was written. Financial support for this study also came from a SSR grant from the University of Alberta, with the support of Dr. Lois Stanford. Many enthusiastic parents volunteered their children and helped me better understand the results. In addition, the following preschools, daycares, and play groups were helpful in finding children and allowing us to use their facilities for testing children: Bobino-Bobinette, La Boîte à Surprises, Centre d'Expérience préscolaire, Garneau/University Child Care Centre, Hospitals and Community Day Care, L'école enfantine, La Rimbamballe, Students' Union and Community Day Care Centre, Tournesols/Sunflowers Bilingual Montessori Centre, University and Community Daycare. Chris Westbury programmed the stimuli. Hélène Chouinard, Renée Kearney, Raydene Koch, and Liz Terlicher tracked down potential participants, tested them, and gave me useful feedback on methodology. Chris Westbury and Paula Marentette gave me feedback on an earlier version of this paper. Johanne Paradis had a better understanding of the significance of these results than I did and was kind enough to share her understanding with me. Address for correspondence: Elena Nicoladis, University of Alberta, Department of Psychology, P-220 Biological Sciences Building, Edmonton, AB, T6G 2E9, Canada. e-mail: elenan@ualberta.ca

point in development. Their code-mixing was once seen as evidence for an early stage when they confused their two languages (see Genesee, 1989). If bilingual children did confuse their languages, then at some point they would have to go through the process of differentiating their languages later in development. The very fact of differentiating languages would mean that their language acquisition is fundamentally and qualitatively different from that of monolingual children. However, careful documentation of when children code-mix shows that they can differentiate their languages early in development (see Nicoladis & Genesee, 1997, for a review of this literature). Early language differentiation points to the likelihood that bilingual and monolingual children use the same processes to acquire their languages.

While they can differentiate their languages, bilingual children still show signs of influence, interference or transfer from one language to another (e.g. Hulk & van der Linden, 1996; Hulk, 1997), sometimes called interaction between languages (Swain & Wesche, 1975). In this paper, I will refer to the phenomenon of structural influence of one language on another as cross-linguistic transfer, or simply transfer (Meisel, 1983). In recent years, researchers have become interested in identifying when exactly and why transfer can take place. The identification of linguistic structures that can show crosslinguistic influence may shed light on how all children acquire language (Döpke, 1998; Müller, 1998). For example, Döpke (1998) argued that by pinpointing when transfer can take place researchers will be able to identify the cues that children use to acquire language. Basing her argument on Bates & MacWhinney's (1989) competition model, Döpke suggested that ambiguous cues in the two languages to which bilingual children are exposed lead to crosslinguistic transfer. Where the two languages present unambiguous cues, no transfer should be seen. Döpke's argument supports the assumption from the competition model that children weigh the probabilities presented to them in the input. To see what kinds of cues children are using to acquire their language, it is important to know when crosslinguistic transfer is seen and when it is not.

When is crosslinguistic transfer seen in bilingual children?

Crosslinguistic transfer has been reported for a number of different structures, from syntax to phonology. In terms of syntax, a number of studies have pointed to structures that seem particularly vulnerable to transfer. Döpke (1998) found evidence of transfer from English verb phrases to German verb phrases in three German-English bilingual children, although very little evidence of transfer from the German structure to the English structure. In English the main verb always precedes its complement. In German, children encounter verbs in verb-second position to the left of the verb phrase and hence to the left of complements as well as to the right of their complements

in verb-end position. The German child therefore needs to figure out which of these patterns represents the basic VP and which is derived (see Gawlitzek-Maiwald, Tracy & Fritzenschaft, 1992, for a discussion of the cues children might use in the acquisition of German verb phrases). Müller (1998) reported similar findings with regard to subordinate clauses in German. She reviewed data from several bilingual children who spoke German as one of their languages and English, French or Italian as their other language, all of these languages do not allow finite verbs in the final position of subordinate clauses. She reported the bilingual children had more trouble with word order in subordinate clauses in German than did monolingual children, and little trouble in their other language. Hulk (1997) reported that a Dutch-French bilingual child showed more errors in placement of French object clitics than monolingual French children. She did not examine the child's use of Dutch object pronouns, so it is not known if the crosslinguistic influence is only from Dutch to French or whether it is bidirectional.

Children's crosslinguistic transfer is not limited to syntactic structures. Nicoladis (1999) found evidence of transfer in a French-English bilingual child's root + root compound nouns. While the child showed transfer in both languages, his French was particularly affected. French compound nouns are always left-headed and English compound nouns are always right-headed. Paradis (2001) found evidence of transfer in 17 French-English bilingual children's prosody. That is, the bilingual children were more likely than English monolingual children to delete the first strong syllable in English weak-strong-weak-strong syllabified words (e.g. *rhiNOceROS*, although her stimuli were non-words), treating these words as if they had the typical French weak-weak-weak-strong syllabification pattern (e.g. *rhinocéROS*).

Some linguistic structures have been reportedly unaffected by transfer in bilingual children. That is, bilingual children acquire these structures as they are presented in the input and use them at the same rate as monolingual children. Paradis & Genesee (1996), for example, reported almost error-free use of pronouns and finite verbs and the placement of negative markers with regard to the verb in French-English bilingual children. Similarly, Hulk & Müller (1999) found no transfer in a French-Dutch bilingual child's and an Italian-German bilingual child's use of root infinitives. Finally, Nicoladis (1999) reported over 90% accuracy rate in the placement of adjectives in both languages in a French-English bilingual child's spontaneous speech (cf. Kielhöfer & Jonekeit, 1983, as cited in Müller, 1998).

In sum, transfer has been observed in the syntax, morphology and phonology of bilingual children. Some structures have not shown transfer in bilingual children and seem to be acquired as monolingual children do. Note that this discussion has been based simply on whether or not transfer occurs and if it does, in which direction. In order to figure out how children weigh

input cues, it would also be interesting to know how often transfer occurs. To date, most studies of transfer have focused on in-depth longitudinal analyses of a few bilingual children with scanty comparison with monolingual children (cf. Paradis, 2001) and thus do not allow much speculation on how frequent transfer is for a particular construction. With that caution in mind, we turn to the question: how might we explain when transfer is seen and when it is not seen?

Explaining crosslinguistic transfer in bilingual children

A number of explanations of when transfer occurs have been proposed. In this section, I briefly touch on four.

Müller (1998) and Hulk & Müller (1999) have argued that transfer occurs when structures are ambiguous at the syntax/pragmatics interface. According to their explanation, ambiguous structures would occur when a structure from one language overlaps with a structure from the other language (see also Döpke, 1998). This hypothesis predicts directionality of transfer: the language allowing two different structures would show effects from the language allowing only one structure. Some evidence has been found to support this position (e.g. Hulk, 1997; Döpke, 1998; Müller, 1998). However, this argument leaves much of bilingual children's transfer unexplained, notably the prosodic transfer reported in Paradis (2001) and the morphological transfer reported in Nicoladis (1999). This argument may be based on the assumption that syntax is acquired differently from other parts of language. While this may be true, this assumption begs the question of how children identify the structures that are to be acquired in different ways. Thus, if possible, it is desirable to have an explanation of transfer that is not limited to the syntax/pragmatics domain (see Döpke, 1998).

Another possible explanation of transfer is the frequency of the structures in the input. This explanation has not received much serious attention because even infrequent structures have been shown to influence frequent structures (Hulk & van der Linden, 1996; Nicoladis, 1999). To date, because studies of children generally include such small numbers, it has not been possible to adequately test if frequent structures influence infrequent structures more often than infrequent structures influence frequent structures. And yet, a mismatch in the frequency of compounds in French (infrequent) and English (frequent) could help explain why the French-English bilingual child in the Nicoladis (1999) study showed more errors in ordering his French compounds than his English compounds.

A third possible explanation of transfer is language dominance, or greater proficiency in one language. As bilingual children are often more proficient in one language than another (e.g. Genesee, Nicoladis & Paradis, 1995), their language dominance might explain when they transfer. For example, Döpke (1998) could not rule out English dominance in the three German-English

bilingual children in her study as an explanation for why the children's German verb phrases were affected by transfer but the English verb phrases were not. Similarly, Nicoladis (1999) could not rule out English dominance as an explanation for the directionality of transfer found in a French-English child's compound nouns. Paradis (2001) found evidence for dominance affecting children's prosodic structure, with French-dominant children more likely to show influence from typical French syllabification on English words. In contrast, Müller (1998) explicitly rules out the effects of language dominance on the word order in German subordinate clauses.

Finally, as an explanation for when transfer can occur, crosslinguistic ambiguity covers many of the findings to date. Ambiguity here refers to the same kind of structural overlap mentioned above, but is not limited to the syntax/pragmatics interface. Müller (1998) suggested 'the bilingual learner may be tempted to transfer features from the language presenting unambiguous input into the one which is ambiguous' (p. 152). Ambiguity can account for the directionality of transfer in Döpke (1998), Müller (1998) and Paradis (2001). Similarly, ambiguity can account for not finding crosslinguistic influences in Paradis & Genesee (1996) and Hulk & Müller (1999) because the structures examined present unambiguous input to learners of these two languages. However, ambiguity does not explain the use of adjectival phrases and compound nouns in the French-English bilingual child in Nicoladis (1999). Adjectival phrases in French and English present ambiguous input to children, since adjectives must appear prenominally in English but can appear pre- or postnominally in French. And yet, the child in Nicoladis (1999) was highly accurate with regard to placement of adjectives both pre- and postnominally. Conversely, root+root compound nouns in French and English present unambiguous input to children, since they are always right-headed in English and always left-headed in French. Yet, the child in Nicoladis (1999) showed evidence of transfer in compound nouns, in both directions, although more so in French. Because the Nicoladis (1999) study was based on a single child, it is important to test the generalizability of her finding before discarding the ambiguity hypothesis of transfer.

In sum, none of the four explanations of crosslinguistic transfer discussed here has as yet proved flawless. However, the only evidence against the ambiguity-of-structure explanation is a single case study on compounding. It is therefore important to see if French-English bilingual children generally show crosslinguistic transfer in compound nouns. Generalizability is an important factor in many of the studies discussed above. Many of the studies examining transfer have been in-depth longitudinal studies with few children (e.g. Paradis & Genesee, 1996; Döpke, 1998; Müller, 1998). It is important to complement this research with studies with a larger subject pool (e.g. Paradis, 2001) if we wish to know how frequently transfer occurs.

The purpose of the present study was to further examine when cross-linguistic transfer might occur. This study focused on children's root + root compound nouns in French-English bilingual children. These compounds are infrequent and always left-headed in French and frequent and always right-headed in English. If frequency affects when transfer takes place, then children should show greater rate of transfer from English to French than from French to English (as found in Nicoladis, 1999). If ambiguity affects when transfer takes place, then children should show no transfer in compound nouns. It is also possible to test language dominance, to see if this variable can explain when or how often transfer occurs. Before turning to the operationalizations of this study, it is important to have a more thorough understanding of compound nouns in the two languages under investigation.

Root + root compound nouns

The order of the two nouns within root + root compound nouns differs across languages. French compound nouns are always left-headed, as in *homme-orchestre* 'man orchestra' for a man who plays a lot of musical instruments or *chapeau melon* 'hat melon' 'bowler hat'.[1] English compound nouns are always right-headed, as in *police man* or *straw hat*. Perhaps because of the lack of ambiguity of the ordering of nouns within compounds in both target languages, the order seems to pose very few problems for monolingual children. There are no reports of reversals in the little extant data on French-speaking children's compounds (Clark, 1998; see also Nicoladis, 1999). Similarly, in the production task of one study, less than 1% of English-speaking children's productions of novel compounds were considered order errors (Clark, Gelman & Lane, 1985, p. 89; see also Clark, 1981; although see Clark, Hecht & Mulford, 1986; Clark & Barron, 1988, for order reversals in synthetic compounds). In sum, the order of the elements within noun–noun compounds seems to be unproblematic for monolingual children.

Languages differ in how frequently compounds are used to create novel lexical items. Germanic languages frequently use compounding while Romance languages tend toward prepositional phrases for lexical creations (Clahsen, 1995; Clark, 1998). Low frequency or productivity may lead to late acquisition. One reason for Hebrew-speaking children's late acquisition of

[1] There has been some debate as to whether these N + N constructions such as *un camion-citerne* 'a truck-tanker' which is a kind of truck, are properly considered compounds, precisely because they are left-headed. Notably, Di Sciullo & Williams (1987) argued that French compounds do not obey the Right-hand Head Rule (RHR) they required of compounds and are therefore not compounds (see also Zwanenburg, 1992, who considers these constructions 'syntactic expressions which must be listed in the lexicon', p. 170). As a general rule, the RHR has been rejected as a defining feature of compounds (e.g. Selkirk, 1982; ten Hacken, 1994; Fabb, 1998). Following the majority opinion, left-headed N + N French constructions will be considered compounds.

compound nouns may be low frequency in spoken input (as well as complex morphology; see Clark & Berman, 1987; Berman & Clark, 1989). Similarly, high frequency in the input may explain English-speaking children's early acquisition of compound nouns. Compounds appear early in the speech of English-speaking children, as both observational studies (e.g. Clark, 1981) and experimental studies (e.g. Clark *et al.*, 1985) have demonstrated. Clark (1981) reported that compounding is one of the most common ways that English-speaking children coin lexical innovations. In contrast, Clark (1998) reported that French-speaking children rarely use compounds in novel lexical items.

The one study on a French-English bilingual child has suggested that the ordering of compound nouns poses a challenge. In a case study based on observations of spontaneous speech of a three-year old French-English bilingual child, Nicoladis (1999) reported that the child reversed French compounds about 60% of the time and English compounds about 20% of the time. The reversals are likely due to transfer from one language to another, since ordering errors have been reported to be practically non-existent in monolingual children.

This study

The purpose of this study is to explore how frequently French-English bilingual children reverse their compounds in their two languages. The children were given a compound production task, one designed to elicit their production of novel compounds to describe a combination of things they were unlikely to have seen before. The children were also given a compound comprehension task in which they were asked to point to the referent of a novel compound. Some of these compounds referred to objects that were inherently related, that is were both things at the same time (see Clark *et al.*, 1985) while others were semi-inherently related, that is were one thing decorated with another. Inherently related objects are named by compounds in both French and English, while semi-inherently related objects are usually named by compounds in English and nouns modified by prepositional phrases in French. To identify the target of the inherently related objects, children had to take into account the different ordering of the compounds in French and English.

The children were also given a standardized vocabulary test in order to estimate their proficiency in their language(s). In the preschool years, the average bilingual child seems to attain approximately half the score of monolingual children of the same age on standardized vocabulary tests (Doyle, Champagne & Segalowitz, 1978; Nicoladis & Genesee, 1996). If both languages are tested, however, bilingual children's scores are on a par with or greater than those of monolingual children.

The design of this study permits an examination of three different explanations of crosslinguistic transfer. Each of these explanations yields different predictions for this study, as discussed below.

Transfer due to frequency: Root + root compound nouns are infrequent in French and frequent in English. If transfer is due to frequency in the input, we would expect bilingual children to produce more reversed compounds in French than in English and approximately equal rates of reversed compounds in English as monolingual children. The bilingual children should score no differently from the monolingual children on comprehension of inherently related objects in English, although their comprehension scores in French should be lower than in English.

Transfer due to ambiguity: There is no ambiguity of structure in French and English compound nouns, as defined by Müller (1998). If transfer is due to ambiguity in structure, we would expect bilingual children to produce equal rates of reversed compounds in French and English and rates of reversed compounds in English which are equal to those produced by monolingual children.

Transfer due to language dominance: If transfer is due to language dominance, we would expect the bilingual children's rate of reversed compounds in English and French to be correlated with their proficiency in each language, measured here by a vocabulary test. Children's accuracy on the comprehension test should also correlate with their scores on the vocabulary test. In both cases, the lower the vocabulary score in either language, the more likely they should be to reverse compounds in that language.

Note that no French monolingual control group was included in this study, for the simple fact that there are few (if any) French monolingual children living in the area of Canada where this study was carried out. To get around the lack of a French monolingual control group, all the above predictions have been cast in terms of comparing the bilingual children's performance to English monolinguals and between two languages. Nevertheless, any conclusions based on these comparisons would be stronger if comparisons were made with French monolingual children.

METHOD

Participants

The participants consisted of 25 French-English bilingual children and 25 English monolingual children. All children lived in or near Edmonton, Alberta, a predominantly English-speaking part of Canada with a small and vibrant French-speaking community. Several children tested were excluded from the final sample. Ten monolingual children were excluded because their ages did not match those of the bilingual children closely enough. One child

who was originally identified as a bilingual child was excluded because she had a great deal of exposure to a third language, and three bilingual children were excluded because they did not score above chance on the French version of the vocabulary test.

To match the children on age, the English-speaking children were chosen to be as close as possible (within a month of age, if possible, and up to three months of age) to the bilingual children. The average age for the monolingual group was 4;0 (range: 3;3–4;11), for the bilingual group 4;0 (range: 3;3–4;11). As would be expected by having matched the ages, there were no significant differences in age between the two groups, $t(24) = 1{\cdot}87$, $p > 0{\cdot}05$.

Materials

Each child took part in three tasks: (1) the Peabody Picture Vocabulary Test-III (PPVT; Dunn & Dunn, 1997), (2) compound production and (3) compound comprehension. A brief description of each of these tasks follows.

The PPVT (Dunn & Dunn, 1997) is a standardized test of comprehension vocabulary. Children are asked to point to a named picture in an array of four pictures. Version A was administered to all children in English and version B was administered to the bilingual children in French translation. The PPVT was administered exactly as described in the experimenter's manual (Dunn & Dunn, 1997). Only raw scores are reported here, as no standardization for bilingual children was available.

The compound production task was administered on a portable computer. The children were asked to look at one picture of multiple things, then another picture of multiple things and finally to name the third picture (a combination of the previous two pictures). For example, they were shown a picture of cherries and then a picture of bowls and asked to name a picture of bowls decorated with cherries. The 10 test items were chosen on the basis of pilot-testing with English-speaking adults; the adults almost always named all of these items with compound nouns in the same order. To encourage the participants to create compounds, three practice items were given; these were named by the testers. The practice items were: *guitar bow* (a bow on a guitar), *present horse* (a present on a horse) and *clock balloon* (a clock on a balloon). The target test items were all compounds (*mice houses*, *teeth cups*, *feet rings*, *cherry bowls*, *dog stores*, *animal truck*, *eye plants*, *flower chairs*, *butterfly pillows*, and *fish shoes*). The three practice items were presented in random order. The test items were also presented in random order. Within each test item, the two named pictures were presented in random order so as not to bias the children to either the French and the English construction. An example of the stimuli can be seen in Figure 1.

The same task was used to test the children's French production, except that the target items were not compounds but nouns connected with prepositions. All target items were prepositional phrases (in the same order

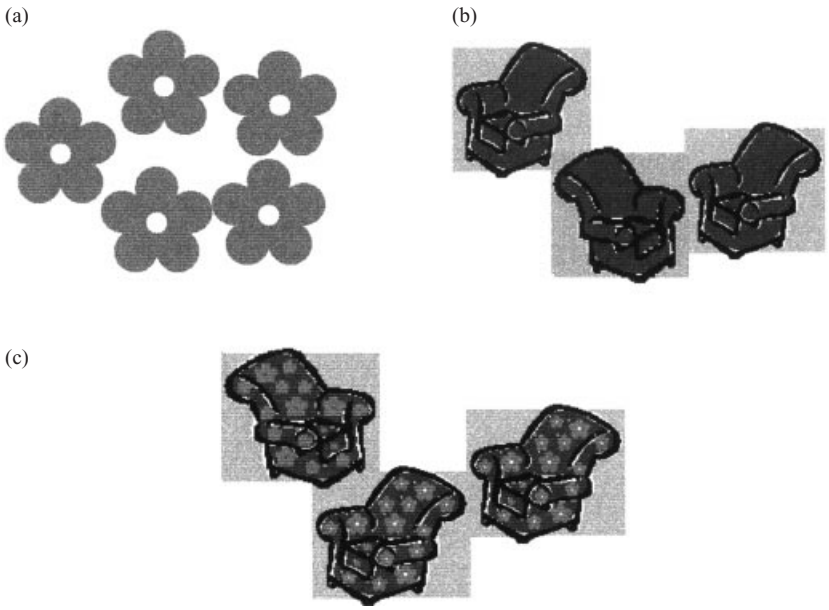

Fig. 1. Example of one test item shown to children to elicit production of compounds.

as the English items in the last paragraph: *des maisons de souris*, *des tasses à sourires*, *des bagues à pieds*, *des bols à cerises*, *des magasins de chiens*, *un camion à animaux*, *des plantes à yeux*, *des fauteuils à fleurs*, *des oreillers à papillons* and *des souliers à poissons*). The same three practice items were given as in English, only named by prepositional phrases.

The compound comprehension task was also administered on a portable computer. The children were shown an array of four different pictures, separated by lines. The pictures depicted each thing alone, the things combined in some way and the things next to each other (the composite picture). For example, for the target *rabbit car*, the pictures were of a rabbit, a car, a car next to a rabbit and a car with rabbit ears and tail. For each array, every effort was made to equate the pictures on size and colour. The child was asked to point to the named object in the array, as they had done for the PPVT. The target picture was in the upper-left hand for two arrays, the upper-right hand for two arrays, the lower-left for three arrays and the lower-right for three arrays. The items were presented in random order. No practice items were given for this task, as it was thought that the PPVT would have been sufficient preparation for this procedure. Three items on this test were inherently related (e.g. a balloon that was in the shape of a clown; see Clark *et al.*, 1985): *clown-balloon*, *banana-car*, and *rabbit-car*. These items were named by compounds in both French and English. Seven items were semi-inherently related (e.g. suns on a paper bag): *sun-bag*, *pig-book*, *flower-*

pail, *dragon-box*, *pea-ghost*, *star-ball*, and *heart-door*. These items were named by compounds in English and nouns modified by prepositional phrases in French.

Some responses on individual test items on the compound tests were not available for analysis, either because of computer error (i.e. one child's comprehension data in the French test) or because the child declined to respond to a particular item. On the production task, the bilingual children responded to an average of 9·4 (S.D. = 1·0) of the English items and 9·4 (S.D. = 1·8) of the French items. The monolingual children responded to an average of 9·9 (S.D. = 0·4) items on the production task. On the comprehension task, the bilingual children gave responses to an average of 9·6 (S.D. = 1·3) items in English and 9·6 (S.D. = 0·8) items in French. The monolingual children gave responses to an average of 9·6 (S.D. = 0·8) items on the comprehension task. There were no significant differences between rates of responses between groups. The following analyses will nevertheless be performed on the percentages of correct answers, rather than numbers, or in chi-square analyses based on cross-products.

Procedure

After obtaining permission from the parents for the children's participation in the study, the children were administered the three tests in the following order: (1) the PPVT, (2) compound production and (3) compound comprehension. Most of the bilingual children and all the monolingual children were tested in daycares in the area of Edmonton, Alberta, Canada. Some of the bilingual children did not attend daycare at the time of testing and were tested in their homes. The monolingual children and the bilingual children were tested in English by native speakers of English. The bilingual children were tested in French by a native or fluent speaker of Canadian French. The experimenters who tested the bilingual children understood enough French and English so they could recognize and note down any responses in the children's other language. The bilingual children were tested in their two languages on two different days, usually within a week.

The production task was then introduced as: 'I am going to show you some funny pictures and ask you to think of new names for them. First, there will be a picture of one thing and then a picture of another thing and finally a picture of both things together. I'll ask you what we could call that last thing. I'll give you some examples at first'. Then the practice items were given while saying: 'Here is a —. Here is a —. We could call this a —.' So, for the practice item 'guitar bow' for example, the experimenter said 'Here is a guitar. Here is a bow. We could call this a guitar bow.' For each test item, the experimenter named the two pictures and then asked what to call the resulting combination, as in: 'Here are some —. Here are some —. What

could we call these?' So for the test item 'flower chairs' (in Figure 1), for example, the experimenter said 'Here are some chairs [Figure 1B]. Here are some flowers [Figure 1A]. What could we call these [Figure 1C]?' If the child did not provide an answer with the names of both parts of the picture (so, for the example above, a name with both 'flower' and 'chair' in it), the experimenter asked 'Can you think of another name for these?' Regardless of the child's answer to the second question, the experimenter then proceeded with the task. If the child gave two answers, then only the answer deemed closer to the target was counted for analysis. For example, for the target 'teeth cups' one child first said 'cup faces'; when asked for a second answer, she said 'ten'. The first answer was considered closer to the target. Since we only asked for a second answer if the first answer did not include both picture names, we never had to choose between a reversed and non-reversed compound. Note that no explicit instructions to form compounds were provided.

The compound comprehension task was introduced as 'Now I'm going to show you four pictures of things and ask you to point to the one I name, just like we did in the book [*indicating the PPVT test book*]'.

RESULTS

The children's average number of compounds and nouns modified by prepositional phrases for the compound production task by language is shown in Figure 2. There was no significant difference between groups in rate of compound or nouns modified by prepositional phrase production on

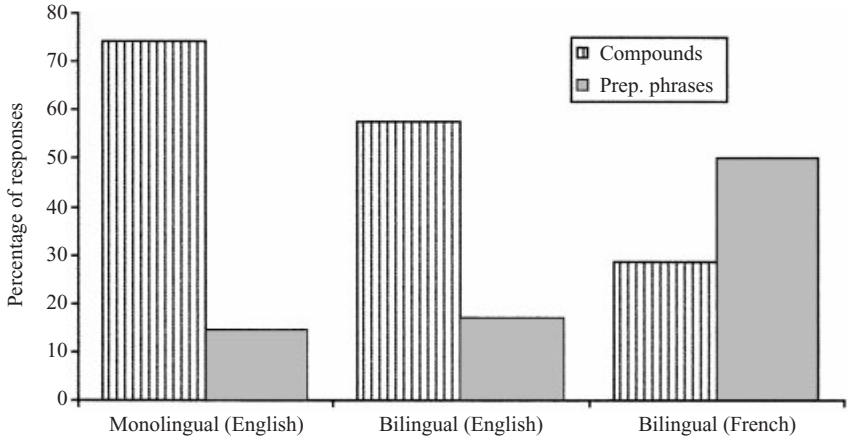

Fig. 2. Average percentage responses to compound production task, by group.

https://doi.org/10.1017/S0305000902005366 Published online by Cambridge University Press

the English version of this task. The bilingual children used significantly more prepositional phrases in French than in English and significantly more compounds in English than in French, as we expected.[2]

The average rate of reversal of compounds (i.e. noun + noun constructions) in French and English is summarized in Figure 3. An example of a reversal

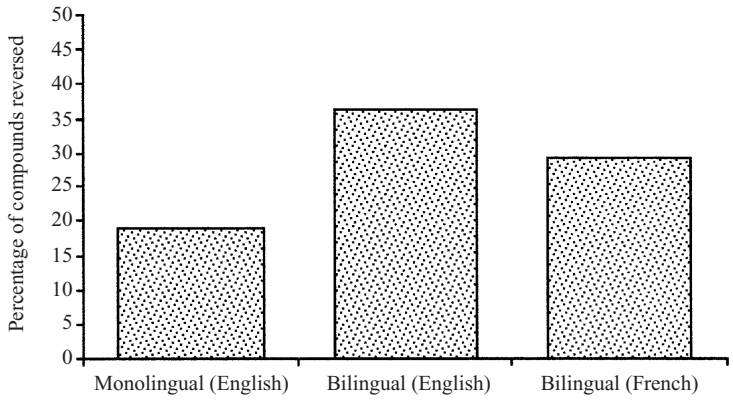

Fig. 3. Average percentage of reversed N + N compounds.

in English would be *chair flowers*, for French *fleurs-fauteuils* 'flowers-chairs' (for the item in Figure 1). Non-reversals would be *flower chairs* in English and *fauteuils-fleurs* 'chairs-flowers' in French. The difference between the rate of reversals in English by language group was significant, $t(24) = 2{\cdot}19$, $p < 0{\cdot}05$. Comparing the rate of reversals in the bilingual children's French and English compounds yielded no significant differences, $t(24) = 0{\cdot}96$, $p > 0{\cdot}05$.

On the comprehension task, the monolinguals scored an average of 64·1 % correct (S.D. = 27·3), the bilinguals in English 67·3 % correct (S.D. = 23·0) and in French 65·0 % correct (S.D. = 22·8). There was no significant difference between monolinguals and bilinguals in English, $t(24) = 0{\cdot}46$, $p > 0{\cdot}05$, and no significant difference between the bilinguals' performance in their two languages, $t(23) = 0{\cdot}23$, $p > 0{\cdot}05$.

[2] While only the noun–noun compounds are under consideration here for reversals, it is possible that the children were better at ordering noun–preposition–noun constructions in French than they were at ordering noun–noun compounds. In other words, by including a preposition in the construction, the correct order might be clearer to the children. This was not, in fact, the case. The bilingual children were equally likely to reverse noun–preposition–noun and noun–noun constructions. A complete analysis and possible implications of this finding are presented in Nicoladis (2002).

TABLE 1. *Number of responses on comprehension task*

	Monolingual English	Bilingual	
		English	French
Inherent (e.g. clown-balloon)			
Target (e.g. a balloon in the shape of a clown)	48	56	52
Composite (e.g. clown holding a balloon)	21	15	13
Modifying noun (e.g. a clown)	4	2	3
Head noun (e.g. a balloon)	0	0	1
Semi-inherent (e.g. dragon box)			
Target (e.g. a box decorated with dragons)	106	113	99
Composite (e.g. a dragon next to a box)	51	49	50
Modifying noun (e.g. a dragon)	6	5	9
Head noun (e.g. a box)	5	10	3

Inherent refers to pictures that were inherently part of each other (e.g. a balloon in the shape of a clown). Semi-inherent refers to pictures where one object was clearly part of the other (e.g. a box decorated with dragons).

TABLE 2. *Correlation coefficients between percentage of compound reversals in production and PPVT scores and age by group*

	Monolingual English	Bilingual	
		English	French
PPVT	−0·067	0·035	−0·075
Age (in months)	−0·089	0·111	0·027

Table 1 summarizes the number of responses with the target item, the composite item, the modifying noun or the head noun in the comprehension task by group. This table presents the results of the inherently related objects separately from the semi-inherently related ones, because it was thought the former might prove more difficult for the bilingual children. Inherently related means that the pictures were inherently part of each other (e.g. a balloon in the shape of a clown). Semi-inherently related refers to pictures where one object was clearly part of the other (e.g. a box decorated with dragons). Recall that the inherently related objects were named by compounds in both English and French, so differed only by the order of the elements of the compounds (e.g. *clown-balloon* vs. *baloune-clown*).[3] Here is

[3] Note that the spelling of 'clown' is the same in both French and English but they are pronounced quite differently (i.e. 'clown' in French rhymes with 'baloune'). Since these children are preliterate, it is unlikely that they would have confused the English and French words.

https://doi.org/10.1017/S0305000902005366 Published online by Cambridge University Press

where the children might be most distracted by composite pictures (e.g. pictures showing the two objects next to each other, rather than interacting).

Comparing the groups' number of target responses vs. their number of composite responses on the inherently related objects showed no significant differences between the bilinguals and the monolinguals, χ^2 (1) = 1·59, $p > 0{\cdot}05$. There was also no significant difference between the bilingual children's choices of target and composite for the inherent or the semi-inherent objects, χ^2 (1) = 2·06, $p > 0{\cdot}05$. There was no significant difference for the bilingual children's target or composite responses in English and French, χ^2 (1) = 0·03, $p > 0{\cdot}05$. These findings suggest that in comprehension, the inherently related objects posed no difficulty for the bilingual children.

Table 2 summarizes the Pearson product-moment correlations between the percentage or reversals on compound production task and the raw PPVT scores and age. As can be seen in this table, all correlations were low and none was significant. This suggests that the children's rate of reversals is not related to either their proficiency (as measured by the PPVT) or cognitive development (as estimated by age).

For the comprehension task, the percentage correct was positively and significantly correlated with the PPVT scores for the monolingual children, $r(22) = 0{\cdot}523$, $p < 0{\cdot}01$ and for the bilingual children in English, $r(22) = 0{\cdot}456$, $p < 0{\cdot}05$. There was no significant correlation between the percentage correct and PPVT scores in French, $r(21) = 0{\cdot}179$, $p > 0{\cdot}05$.

The lack of correlations on the production task (in Table 2) might be due to low denominators for compounds in the compound production task, particularly in French where children produced few compounds. To present an alternative way of looking at the effect of language dominance, the children were divided up into three groups based on the difference of their English and French PPVT scores: French dominant, English dominant and balanced. The French dominant group was composed of children having a French PPVT score 15 points or higher than their English score (N = 9). The English dominant group was composed of children having an English PPVT score 15 points or higher than their French score (N = 8). The balanced group had less than a 15-point difference in their vocabulary scores in their two languages (N = 8). The average and standard deviation of the reversals of each of these language dominance groups was calculated and is presented in Table 3. If language dominance affects children's ordering of compounds, we might expect the French dominant group to reverse more English compounds than the English dominant group and the English dominant group to reverse more French compounds than the French dominant group. This was not, however, the case. Both the French dominant and the English dominant groups reversed more English compounds than French compounds while the balanced group reversed more French com-

https://doi.org/10.1017/S0305000902005366 Published online by Cambridge University Press

TABLE 3. *Average* (*standard deviation*) *reversal rates on production task by language dominance*

	French dominant	Balanced	English dominant
French reversals	27·7 (29·5)	32·1 (46·2)	24·1 (37·2)
English reversals	48·1 (32·1)	23·7 (24·5)	35·8 (31·3)

pounds than English compounds. There was no significant difference between the two dominant groups on either rate of French reversals, $t(7) = 0{\cdot}21$, $p > 0{\cdot}05$, or on rate of English reversals, $t(7) = 0{\cdot}55$, $p > 0{\cdot}05$.

DISCUSSION

The results of this study suggest that three- and four-year-old bilingual children have no trouble differentiating their two languages with regard to this aspect of morphology. The bilingual children's production was in line with expectations from both of their input languages. That is, they produced more prepositional phrases in French and more compounds in English. Their rate of compound production in English did not differ from that of monolingual English speaking children. Furthermore, the majority of the N+N compounds were produced in the correct order in French (about 70%) and in English (about 65%). Taken together, these results suggest that the bilingual children of this age can clearly differentiate the morphology of their two languages and are in no way delayed with regard to this aspect of language at this age. Similar results have been reported for syntactic acquisition (e.g. Paradis & Genesee, 1996).

While the bilingual children could clearly differentiate their languages, they showed signs of crosslinguistic transfer in production of N+N compounds. Compared to English monolinguals, the bilingual children reversed almost twice as many of their English compounds relative to target. There was no difference in the rate of reversals in French and English by the bilingual children. No French monolingual children were included in this study so it is not possible to say conclusively that the reversals in French compounds were due to transfer. The results nonetheless suggest that reversals in both languages by the bilingual children were due to the influence of the other language.

It should be noted that the monolingual English-speaking children also reversed their compounds in the production task used in this study, although at a significantly lower rate than that of the bilinguals. There are at least two possible explanations of this finding. One, it is possible that previous research reporting few errors in ordering by monolingual children have been misleading (e.g. Clark *et al.*, 1985). To my knowledge, no study of monolingual

children has directly addressed the question of whether or not their ordering is generally correct. By presenting monolingual children with pictures that corresponded half the time with the French ordering and half the time with the English ordering, we may have revealed the fact that they are not entirely certain which way compounds are to be ordered in English. Another possible explanation is that the particular stimuli used in this study allowed children to produce the reversed order. For example, in Figure 1C, it is possible to call this a picture of *chair flowers*. While no adult in our pilot-testing did so, it is a correct answer. If so, then children might conceive of different figure-ground relationships in pictures than adults. Future studies will determine whether one or both of these explanations is correct. For the present purposes, the monolingual children's data served as a control for the bilingual children's performance. Whatever the explanation for the monolingual children's reversals, it cannot be attributed to bilingualism. And, the fact remains that the bilingual children reversed their compounds almost twice as often as the monolingual children. As Hulk & Müller (1999) have pointed out, transfer is probably rarely manifested as something done only by bilingual children; instead it is probably usually manifested as something done more (or possibly less) frequently than monolingual children.

In contrast to the production data, the bilingual children scored on par with monolingual children in comprehension. Even with the potentially confusable inherently related objects that differed only by word order between languages, the bilingual children scored no differently than the monolingual children and no differently by language.

Explaining the crosslinguistic transfer in compound nouns

Recall that three explanations of transfer were considered in the present study: frequency, ambiguity, and language dominance. As elaborated below, the present results cannot be accounted for by any previous explanation of transfer alone.

If frequency in the input could explain transfer, we would predict unidirectional transfer, from English to French. Specifically, French compounds should be reversed more than English compounds by bilingual children and there should be no difference in rate of reversals between the monolingual children and the bilingual children's English performance. In fact, we found that the bilingual children reversed English compounds more often than the monolingual children and there was no difference between French and English. Also contrary to the prediction, no transfer was observed in comprehension.

If transfer were due to ambiguity of structure, then there should be no transfer with regard to compound nouns. This seemed to be true in comprehension. Yet, in production, the bilingual children were almost twice

as likely to reverse compound nouns in English when compared to monolingual children. While no French monolingual children were available for this study, there was no difference in the rate of reversals in French and English for the bilingual children. This finding suggests that the transfer of compound nouns was, in general, equal in both languages or bidirectional. This finding contradicts the Nicoladis (1999) finding that French compounds were more influenced by English compounds than the reverse in the single bilingual child in her study.

Finally, the present results cannot be accounted for by language dominance. There were no correlations between rate of reversals in either French or English and PPVT scores. Likewise there were no differences between rate of reversals in either French or English when the children were divided up into language dominance groups. Language dominance, as measured by the vocabulary test given here, cannot explain how often bilingual children reverse their compound nouns.

In sum, the only prediction that was upheld from any explanation was that bilingual children's lack of transfer in comprehension might be due to lack of ambiguity in the input. Interpreting this finding as support for the ambiguity hypothesis is problematic, in light of other studies that have found transfer in children's productions (Döpke, 1998; Müller, 1998; Paradis, 2001). An alternative possibility, unattested elsewhere to my knowledge, is that cross-linguistic transfer may be a language production phenomenon and not a comprehension phenomenon.[4] As a general rule researchers have not stated explicitly whether transfer might be equally manifested in production and comprehension. For example, when discussing the possibility of transfer in second language learners, Meisel (1983) gives a model of speech production as an attempt toward explaining transfer and all his examples of transfer come from production. In other places in his article, however, he implies that transfer is applicable to 'the speaker's (listener's) way of intended meaning to uttered sounds, or vice versa' (p. 22) and to 'language production and comprehension' (p. 24). While the literature on transfer has not yet addressed the question of modality dependence, it should also be pointed out that the literature on compound processing has not typically considered this possibility either (e.g. Libben, 1998). To test the possibility that transfer is a production phenomenon, further research looking at both production and comprehension data in other aspects of children's language performance would confirm this possibility. If it proves to be generally true, then aspects of language processing that involve recall memory (such as production) may

[4] The title of this paper comes from a report by an adult French-English bilingual. After hearing me talk about these data, he said that he had always had a hard time remembering the correct order for compound nouns in English, as in 'toilet paper' or 'paper toilet'. He then paused and deadpanned, 'And it makes a difference'.

result in a more imperfect realization of the target structure than aspects of language processing that involve recognition memory (such as comprehension).

As for the present study, even if we were to focus only on the production data, none of these explanations provides an adequate account. It is, however, possible that some combination of these explanations might prove more fruitful. For example, ambiguity and frequency in the input may interact with children's dominant language to produce the results observed here. As Meisel (1983) pointed out: 'In most cases, convergence of strategies, apparently, is the most adequate explanation [of crosslinguistic transfer]' (p. 44). Detailed studies of input to children in French and English might provide clues as to the kinds of structures children actually hear and how frequently they hear them.

Another (entirely compatible) variable that may play a role in children's language acquisition is their perspective on what counts as ambiguous. In previous studies of ambiguity, the examined structures have been assumed to be identified by the children (Döpke, 1998; Müller, 1998; Paradis, 2001; see also Gawlitzek-Maiwald *et al*., 1992, for discussion). However, it is possible that in this case, I have not identified what it is that children find ambiguous. In other words, it is possible that children are not using only compound-specific cues to acquire compounds. Another source of information for the ordering of compounds may come from compounds with prepositions (a more common French construction as in *tasse à café* 'cup with coffee' 'coffee cup' or *voiture de police* 'car of police' 'police car') – in spoken French, the prepositions are not always salient and children may think constructions with PPs are equivalent to root+root compounds. In English, this construction would be marked and the prepositions usually quite salient, but bilingual children might see this English form as equivalent to compounds and order their English compounds according to the appropriate English noun–preposition–noun ordering (i.e. reversed). Adjectival phrases may also be another source of ambiguity for children. In all languages that have been examined, compound nouns follow the same order as adjectival phrases, with the modifying noun of a compound in the same place relative to the head noun as the adjective relative to a modified noun (Beard, 1995; Sadock, 1998). English is no exception to the general rule: English compound nouns are right-headed (so an *ink pen* is a kind of pen) and in adjectival phrases the adjective always appears to the left of the modified noun (e.g. *blue pen*). The situation is more complex in French. The general rule holds true: French compounds are always left-headed (e.g. a *stylo-feutre* 'pen felt') and the default position for adjectives is to the right of the noun (e.g. *stylo bleu* 'pen blue'). However, many frequent French adjectives usually appear to the left of the noun (e.g. *grand* 'big', *petit* 'little', *gros* 'fat', *nouveau* 'new', *vieux* 'old', etc.). If children use the position of adjectival phrases to help learn the

order of compounds (and/or vice versa), then we might expect to see bilingual children showing similar ordering difficulties with adjectival phrases as their ordering difficulties with compound nouns (cf. Nicoladis, 1999).

In sum, the present study suggests that children do not necessarily learn a linguistic structure simply on the basis of how that structure is presented in the input. They may attend to a variety of cues, possibly from semantically similar constructions, in acquiring a single linguistic construction. Further research should focus on identifying the relevant cues and how children use them.

REFERENCES

Bates, E. & MacWhinney, B. (1989). Functionalism and the Competition Model. In B. MacWhinney & E. Bates (eds), *The crosslinguistic study of sentence processing*. Cambridge: CUP.

Beard, R. (1995). *Lexeme-morpheme base morphology*. Albany, NY: State University of New York Press.

Berman, R. A. & Clark, E. V. (1989). Learning to use compounds for contrast: data from Hebrew. *First Language* **9**, 247–70.

Clahsen, H. (1995). German plurals in adult second language development: evidence for a dual mechanism model of inflection. In L. Eubank, L. Selinker & M. Sharwood Smith (eds), *The current state of interlanguage*. Amsterdam: John Benjamins.

Clark, E. V. (1998). Lexical creativity in French-speaking children. *Cahiers de Psychologie Cognitive* **17**, 513–30.

Clark, E. V. (1981). Lexical innovations: how children learn to create new words. In W. Deutsch (ed.), *The child's construction of language*. New York: Academic Press.

Clark, E. V. & Barron, B. J. S. (1988). A thrower button or a button thrower? Children's judgments of grammatical and ungrammatical compound nouns. *Linguistics* **26**, 3–19.

Clark, E. V. & Berman, R. A. (1987). Types of linguistic knowledge: interpreting and producing compound nouns. *Journal of Child Language* **14**, 547–67.

Clark, E. V., Gelman, S. A. & Lane, N. M. (1985). Compound nouns and category structure in young children. *Child Development* **56**, 84–94.

Clark, E. V., Hecht, B. F. & Mulford, R. C. (1986). Coining complex compounds in English: affixes and word order in acquisition. *Linguistics* **24**, 7–29.

Di Sciullo, A. M. & Williams, E. (1987). *On the definition of word*. Cambridge, MA: MIT Press.

Döpke, S. (1998). Competing language structures: the acquisition of verb placement by bilingual German-English children. *Journal of Child Language* **25**, 555–84.

Doyle, A.-B., Champagne, M. & Segalowitz, N. (1978). Some issues in the assessment of linguistic consequences of early bilingualism. In M. Paradis (ed.), *Aspects of bilingualism*. Columbia, SC: Hornbeam Press, Inc.

Dunn, L. M. & Dunn, L. M. (1997). *Peabody Picture Vocabulary Test, third edition*. Circle Pines, MN: American Guidance Service.

Fabb, N. (1998). Compounding. In A. Spencer & A. M. Zwicky (eds), *The handbook of morphology*. Oxford: Blackwell.

Gawlitzek-Maiwald, I., Tracy, R. & Fritzenschaft, A. (1992). Language acquisition and competing linguistic representations: the child as arbiter. In J. M. Meisel (ed.), *The acquistion of verb placement*. Dordrecht: Kluwer Academic Publishers.

Genesee, F. (1989). Early bilingual development: one language or two? *Journal of Child Language* **16**, 161–79.

Genesee, F., Nicoladis, E. & Paradis, J. (1995). Language differentiation in early bilingual development. *Journal of Child Language* **22**, 611–31.

Hulk, A. (1997). The acquisition of French object pronouns by a Dutch/French bilingual child. GALA Proceedings.
Hulk, A. & Müller, N. (1999). Crosslinguistic influence at the interface between syntax and pragmatics. Talk presented at GALA.
Hulk, A. & van der Linden, E. (1996). Language mixing in a French-Dutch bilingual child. *Eurosla VI : a selection of papers. Toegepaste Taalwetenshap in Artikelen* **55**, 89–101.
Kielhöfer, B. & Jonekeit, S. (1983). *Zweisprachige Kindererziehung*. Tübingen: Stauffenberg.
Libben, G. (1998). Semantic transparency in the processing of compounds: consequences for representation, processing, and impairment. *Brain and Language* **61**, 30–44.
Meisel, J. M. (1983). Transfer as a second-language strategy. *Language and Communication* **3**, 11–46.
Müller, N. (1998). Transfer in bilingual first language acquisition. *Bilingualism : Language and Cognition* **1**, 151–71.
Nicoladis, E. (2002). When is a preposition a linking element? Bilingual children's acquisition of French compound nouns. *Folia Linguistica* **36**, 45–63.
Nicoladis, E. (1999). 'Where is my brush-teeth?' Acquisition of compound nouns in a bilingual child. *Bilingualism : Language and Cognition* **2**, 245–56.
Nicoladis, E. & Genesee, F. (1997). Language Development in Preschool Bilingual Children. *Journal of Speech-Language Pathology and Audiology* **21**, 258–70.
Nicoladis, E. & Genesee, F. (1996). Word awareness in second language learners and bilingual children. *Language Awareness* **5**, 80–90.
Paradis, J. (2001). Do bilingual two-year-olds have separate phonological systems? *International Journal of Bilingualism* **5**, 19–38.
Paradis, J. & Genesee, F. (1996). Syntactic acquisition in bilingual children: autonomous or interdependent? *Studies in Second Language Acquisition* **18**, 1–25.
Sadock, J. M. (1998). On the autonomy of compounding morphology. In S. G. Lapointe, D. K. Brentari & P. M. Farrell (eds), *Morphology and its relation to phonology and syntax*. Stanford, CA: Center for the Study of Language and Information.
Selkirk, E. O. (1982). *The syntax of words*. Cambridge, MA: MIT Press.
Swain, M. & Wesche, M. (1975). Linguistic interaction: case study of a bilingual child. *Language Sciences* **37**, 17–22.
ten Hacken, P. (1994). *Defining morphology : a principled approach to determining the boundaries of compounding, derivation and inflection*. Hildesheim: Georg Olms Verlag.
Zwanenburg, W. (1992). Morphological heads, French 'compounding' and Germanic 'prefixation'. In C. Laeufer & T. A. Morgan (eds), *Theoretical analyses in Romance linguistics*. Amsterdam: John Benjamins.