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Sentence interpretation strategies in adult Dutch–English bilinguals

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ABSTRACT
This study is concerned with the probabilistic nature of processing strategies in bilingual speakers of Dutch and English. We used a sentence interpretation task designed to set up various "coalitions" and "competitions" among a restricted set of grammatical entities (i.e., word order, animacy, agreement). Performance in English paralleled that in Dutch in large measure, but where it diverged it approached performance on similar tasks by English monolinguals (Bates et al., 1982). These findings are interpreted on the basis of the "competition model," a probabilistic theory of grammatical processing which provides a formalism for explaining what it means for a second language user to be "between" languages.

In a series of studies of normal sentence interpretation strategies in adult and child speakers of a variety of languages, Bates and MacWhinney and their colleagues (1981, 1982, 1984, in press) have shown that native speakers depend on a particular set of probabilistic cues to assign formal surface devices in language to underlying functions. The notion that cues vary in strength has proven valuable in describing cross-linguistic processing differences even in typologically similar languages (e.g., English and Italian, both of which are SVO languages), and in charting the pattern of acquisition of grammatical "rules" in the first language.

A natural extension of this broad experimental effort is in a field that involves issues of both language learning and sentence processing in adults: late second language acquisition. Given the large volume of data already collected from monolingual speakers, we are now in a position to begin investigation of bilingual sentence processing strategies. This approach to studying bilingualism has the two-fold advantage of providing a window into the psycholinguistic properties of second language acquisition, and allowing cross-linguistic processing to be evaluated within single subjects, who provide their own control for

many of the extraneous factors that contribute to variance in studies of monolinguals.

The first and most obvious question we must ask is whether first language (L1) strategies "invade" into processing in the second language (L2). In other words, does an adult bilingual depend to some extent on L1 strategies in order to map surface form onto function in L2? If this kind of process proves to be available to skilled bilinguals, then we can address a further set of questions regarding the acquisition process at earlier stages (e.g., how does the balance between L1 and L2 processing strategies change as fluency increases?).

At least one piece of evidence exists which suggests that we may expect some strategic interference to occur in L2 processing. Bates and MacWhinney (1981) tested Italian and German speakers in their native languages and in English using a sentence interpretation paradigm. Subjects heard sentences containing two nouns and a verb, orthogonalized along the dimensions of order (NVN, NNV, VNN), agreement (first noun, second noun, or neither noun agrees with the verb in number), and animacy (both nouns animate, first animate and second inanimate, first inanimate and second animate, or both inanimate). The result is a 2 (language) × 3 (word order) × 3 (agreement) × 3 (animacy) design in which cues are set into competition and coalition with one another. The task was to simply identify the actor ("who did it?") in each sentence heard. From the pattern of responses to the test questions set up in this manner, a picture of the relative strength of different combinations of cues to sentence interpretation emerges. Although too few subjects participated for extensive statistical analyses, the results were very much in keeping with the idea that L1 strategies play a central role in early L2 processing. The performance of the Italian bilinguals in English paralleled results from monolingual Italians: agreement was stronger than animacy, which was stronger than word order. The German subjects used German processing strategies to interpret English sentences, except for one extremely fluent bilingual, whose performance was similar to native speakers in each language. These pilot results suggest that L1 strategies operate during processing in L2, and that use of language-appropriate strategies may interact with level of fluency.

In a recent study, Wulfeck et al. (1986) examined the performance of Spanish-English bilinguals on a sentence interpretation task. Individual subjects in this experiment did not employ distinct processing strategies for each language, but rather seemed to apply an amalgam of processing strategies drawn from Spanish and English. Subjects fell roughly into two groups. One group adopted word order, the dominant cue from their second language (English), followed to a lesser extent by agreement and animacy, which are generally the strongest cues in Spanish. These subjects seem to operate with the same merged hierarchy of strategies for both languages. The second group showed only slight sensitivity to word order cues, instead depending heavily on agreement, followed by animacy cues. This Spanish-dominant processing strategy was applied equally to both languages. The difference between merged-hierarchy and Spanish-dominant strategies could not be explained in terms of any obvious group factor (e.g., age of second language learning, fluency, educational level).

The purpose of the present study is to examine in greater detail the dynamic

balance of sentence interpretation strategies in first versus second language processing. We chose to test adult native speakers of Dutch whose primary second language is English (it is virtually impossible to locate adults in the Dutch-speaking countries of Europe who have not had at least some contact with other languages as well, usually German and/or French; this is unfortunate from a methodological point of view, but reflects the reality of the multilingual situation of our subjects). English and Dutch provide an interesting testing ground for investigating the functional characteristics of bilingual sentence interpretation strategies, since few distinct languages share as many linguistic features and differ on so few fronts. We will discuss some of the similarities and differences between English and Dutch which are relevant to this study shortly. For now we would simply like to note that, given the large degree of similarity between English and Dutch, an investigation of processing strategies within Dutch–English bilingual subjects can help us to understand in more detail the relation between specific linguistic facts and the processing system that responds to those facts.

In this study we are interested in the probabilistic nature of processing strategies in bilingual individuals. We used a sentence interpretation task designed to set up various "coalitions" and "competitions" among a restricted set of grammatical entities (i.e., word order, animacy, agreement). Since the findings of this study are interpreted on the basis of the "competition model," a probabilistic theory of grammatical processing which developed out of a large body of cross-linguistic work by Bates and MacWhinney and their colleagues, we will first briefly describe the features of the model relevant to a study of bilingual sentence processing (a more complete discussion of the model and its application to cross-linguistic research in general can be found in MacWhinney, Bates & Kliegl, 1984; and in MacWhinney and Bates, in press).

THE COMPETITION MODEL

The competition model derives from a consideration of the functional aspects of mapping linguistic forms to underlying meaning. Since this is a performance model, which attempts to describe real world language behavior, the resolution of form-function relations during processing must take place in real time. The model adheres to functionalist tenets in that form-function mappings are made as directly as possible. However, the strong functionalist position which posits one form to one function is rejected in favor of a multiplicity of form-function mappings: natural languages rarely make use of one-to-one mappings; rather, a single form can map onto many functions, and a single function can map onto several forms. The probabilistic feature of the competition model leads to the treatment of statistical tendencies and obligatory rules as quantitatively rather than qualitatively different. This is important because relations between surface forms and functions can be described in terms of strength or degree of interaction. Particular instances within the system of many-to-many form-function mappings in a given language are assigned weights in this model. This is done according to the statistical distributions of certain constructions, e.g., how often or how reliably a given form is used to perform a given function. The sources of

information a listener uses to decide which function is meant to be expressed by a given form are referred to as "cues." The usefulness of a particular cue is determined by a combination of factors, including how reliable a cue is (i.e., whether it always maps the same form(s) to the same function(s)), and how often the cue is available (e.g., animacy may be heavily depended upon when an animate-inanimate distinction is present, as in "The boy broke the window," but not in "The ball broke the window").

Viewed from a cross-linguistic perspective, this approach to language processing has a number of implications when we compare Dutch and English. On the surface, Dutch and English, both Germanic languages, have many features in common. The two languages share many cognates, both make case distinctions only on personal pronouns (in contrast to German, another typologically similar language), both locate articles and other modifiers prenominally, and the canonical word order for simple, active declarative sentences is subject-verb-object (SVO). However, some important differences exist between Dutch and English, differences which, depending on what kind of model we choose to explain processing behavior, could lead to quite different predictions about how the two languages are processed. One such difference is the richer morphological system in Dutch, which, in contrast to English, provides a broadly available and regular set of markings, mainly on verbs, for tense and number agreement. Another such difference involves word order. The basic or canonical word order for Dutch, as well as English, has typically been considered to be SVO. Recently, however, Koster (1975) has shown that Dutch may fit the formal category of SOV better, due mainly to the fact that when an auxiliary (e.g., *zullen* "shall" to mark the future, *worden* "become" to mark the passive, or *hebben* "have" to mark the present perfect) is present the main verb in the form of the infinitive or a participle is obligatorily postposed:[1]

No auxiliary	Jan ziet de hond.
	John sees the dog
	"John sees the dog."
Auxiliary	Jan zal de hond zien.
	John will the dog see
	"John will see the dog."

If language processing is an essentially rule-based behavior, reflecting the same type of rules linguists use to describe the range of forms and their usage in a language, then we would not expect to find a difference between Dutch and English on SVO forms, which map onto the same functions in each language. However, the competition model predicts that processing in a particular language will be shaped by the *distribution* of form-function mappings in that language. In other words, sentence interpretation strategies do not reflect the application of rules per se; rather, an incoming sentence form activates all of the potential interpretations which are, to a greater or lesser degree, compatible with the input. The greater the degree of compatibility, the more a particular form is activated, and eventually only one interpretation "wins." If the presence of partially overlapping structures (e.g., SOV and SVO word orders in Dutch) in a language can

impinge on sentence interpretation, then we ought to find that Dutch, which allows much more word order variation than English, differs from English on this dimension. Specifically, Dutch listeners should "trust" the SVO configuration as a cue to meaning less than their English counterparts do. At the same time, Dutch listeners may also place more "trust" in verb morphology, a source of information that is considerably more reliable than verb morphology in English.

Viewed from a bilingual perspective, the competition model approach has a number of implications when we compare sentence processing within individuals who speak two languages. As we noted earlier, L1 strategies may strongly interfere or interact with appropriate L2 strategies. The competition model allows a test of at least three hypotheses of bilingual sentence processing: (1) first language (L1) strategies may be applied to both languages; (2) a second set of strategies is acquired and applied exclusively in the context of L2; and (3) new strategies may be adopted in the course of L2 learning, and become assimilated into one amalgamated set that is applied to processing in both languages. What is most likely is that each of these possibilities is true at some point in the progression from beginner to fluent bilingual. As anyone who has ever learned a second language knows, bilingualism itself is a matter of degree; the same may be true of the processing characteristics which define it at any given point during acquisition. What the competition model provides is a formalism for describing what it means to be "between languages"; rule-based models, which derive most of their explanatory power not from real-time processing considerations but from language-specific theoretical linguistic accounts, have a harder time accommodating such facts.

Finally, from a developmental perspective, another important feature of the competition model for the study of bilingual sentence processing is that it predicts the gradual emergence of conventions or rules, via a continuous increase in the strength or "determining force" (MacWhinney, Bates & Kliegl, 1984) of statistical form-function assignments. The implication for L2 acquisition is a strong one: the application of cues in form-function mapping in L2 ought to approach distributionally predicted levels as fluency in L2 increases. Ideally, we would have liked to perform an experiment which included several groups of subjects who differ in their level of proficiency in L2, which would allow us a look through the developmental window onto second language acquisition. While this was not possible, we can at least start by describing bilingual sentence interpretation at one point on the continuum of second language acquisition.

METHOD

Subjects

Twenty university students (11 females, 9 males) in their early 20's participated in this experiment. All were native speakers of Dutch, and had studied English formally for about eight years. All subjects were in the third year of training to become English teachers, and in the last three years had attended the same courses as a group. Subjects were tested in a course called "Advanced English

Practice'' at the University of Antwerp. Although these students heard English daily (on radio, television, and in lectures), active use of the language was confined to the semi-formal environment of the classroom.

Design

The four factors manipulated as independent variables included language (Dutch and English), word order (NVN, NNV, and VNN), animacy contrasts (AA: both nouns are animate; AI: first noun animate and second noun inanimate; and IA: first noun inanimate and second noun animate), and agreement contrasts (ambiguous agreement (Ag0), in which the verb agrees with both nouns, first noun agreement (Ag1), and second noun agreement (Ag2)). Subjects were randomly assigned into two groups of 10 in order to counterbalance for order of presentation by language.

Materials

Each subject was given a total of 54 test sentences in each language containing two third person common nouns with a definite article and a verb in the third person. For each language five different protocols were created through random selection from a pool of verbs describing transitive activities requiring an animate agent/subject, 15 animal names, and 12 inanimate nouns. Every possible combination of the variables described above was presented twice: once with a singular and once with a plural verb. In each of the five protocols for both languages the order of the 54 sentences was randomly varied. In each language the five protocols were given twice to two different subjects. Table 1 gives the list of nouns and verbs and sample sentences for each language.

Procedure

Each subject received a written list of 54 test sentences for each language. Verbal instructions for the test were given in the language of the test sentences each time. Subjects were instructed to read the sentences at a normal speed and to indicate which of the nouns in the sentence they thought was the agent or the subject. Asking for both agent and subject prevents a potential bias for a semantic or syntactic strategy during sentence interpretation by the subject (see MacWhinney, Bates, & Kliegl, 1984). They were also told not to change their answers. There was a three hour interval between the sessions in each language and subjects were not informed in advance they would be tested in the other language.

RESULTS

All ANOVA's were conducted with subjects as random variables and the other contrasts of language, word order, animacy, and agreement as fixed variables within subjects and a group factor (i.e., order of language presented) between subjects. On the basis of the overall ANOVA summary in Table 2, we will first

Table 1. *Object names and verbs*

Animate nouns		Inanimate nouns		Verbs	
Dutch	English	Dutch	English	Dutch	English
schildpad	turtle	vork	fork	kussen	kiss
koe	cow	tang	—	grijpen	grab
merel	blackbird	—	saw	likken	lick
gans	goose	lamp	lamp	groeten	greet
hagedis	lizard	doos	box	bekijken	watch
gems	chamois	stang	pole	eten	eat
hen	hen	boek	book	bijten	bite
slang	snake	schaar	—	besnuffelen	sniff
eend	duck	—	hammer	aaien	stroke
muis	mouse	mes	knife		
giraf	giraffe	bal	ball		
zeug	sow	kaars	candle		
kat	cat	cigaret	cigarette		
hond	dog	—	—		

Sample Sentences

De cigaret de kat kust.	Bekijkt de muis de zeug.	De giraffen bijten de vork.
The cigarette the cat kisses.	Watches the mouse the sow.	The giraffes bite the fork.

Table 2. *ANOVA summary across all variables*

Effect	*F*	$p <$	% Variance accounted for
grp	2.317	0.145	—
lan	0.516	0.482	—
va	64.791	0.000***	55.35
an	30.032	0.000***	26.58
wo	10.783	0.000***	2.89
gl	0.370	0.551	—
gv	0.208	0.813	—
ga	2.037	0.145	—
gw	2.592	0.089	—
lv	8.072	0.001**	1.08
la	2.115	0.135	—
lw	20.900	0.000***	1.97
av	3.9815	0.000***	3.15
vw	4.502	0.003**	1.05
aw	3.986	0.006**	0.49
lav	3.998	0.006**	0.68
law	3.020	0.023*	0.37
avw	3.402	0.001**	0.62
gavw	2.705	0.008**	0.49

discuss the significant effects provided by the language (i.e., English versus Dutch) and the group factor (i.e., E1, the group which was first tested in English, versus D1, the group which was first tested in Dutch). Unless otherwise noted, all effects referred to are significant at $p < .05$ or less. Following MacWhinney, Bates, and Kliegl (1984), Table 2 also includes information about the percentage of experimental variance accounted for by significant main effects and interactions. Although it is not customary to report this statistic, at times the magnitude of an effect can be as informative as its reliability. Overall, verb agreement is the strongest factor (55.35% of the variance is accounted for by this factor), followed by animacy (26.58%), followed by word order (2.89%).

1. Main effects

Of the main effects in the overall ANOVA, Agreement, Animacy and Word Order reached significance. The main effects can be summarized as follows:

A. Main effect of agreement. Summing across languages, Dutch speakers consistently chose the noun, whether it was the first (87%) or second one (77%), which agreed in number with the verb (either singular or plural). When agreement was neutral or ambiguous, the first noun was chosen 68% of the time.

B. Main effect of animacy. When two animate nouns were presented in the same sentence, the first one was chosen 62% of the time. When an animacy contrast was available, the animate noun was selected most often (78% first noun choice for AI, 38% for IA).

C. Main effect of word order. There was a small but consistent tendency to choose the first noun as subject/agent in NVN (66%) and VNN (61%) orders, but selection in the NNV condition was random (50% first noun).

While there was no main effect of group, separate analyses for the D1 (Dutch first) and E1 (English first) groups showed that animacy and agreement accounted for different proportions of the variance in each group. In E1, animacy accounted for 50% of the variance and agreement 55%, while in D1 animacy accounted for 21% of the variance, and agreement 71%. This difference will figure prominently in our discussion of individual differences below. We obtained only one significant effect involving the group factor in the four-way interaction of Group × Animacy × Verb Agreement × Word Order. However, this effect was minute, contributing only 0.5% of the variance accounted for. We will return to this group difference later, after examining the patterns associated with the language variable.

2. Language

In this section we will describe the significant effects in which the language variable participated. Language interacted with two variables independently, word order (NVN, VNN, NNV) and agreement (AG0, AG1, AG2), and it also participated in one three-way interaction (Language × Animacy × Word Order).

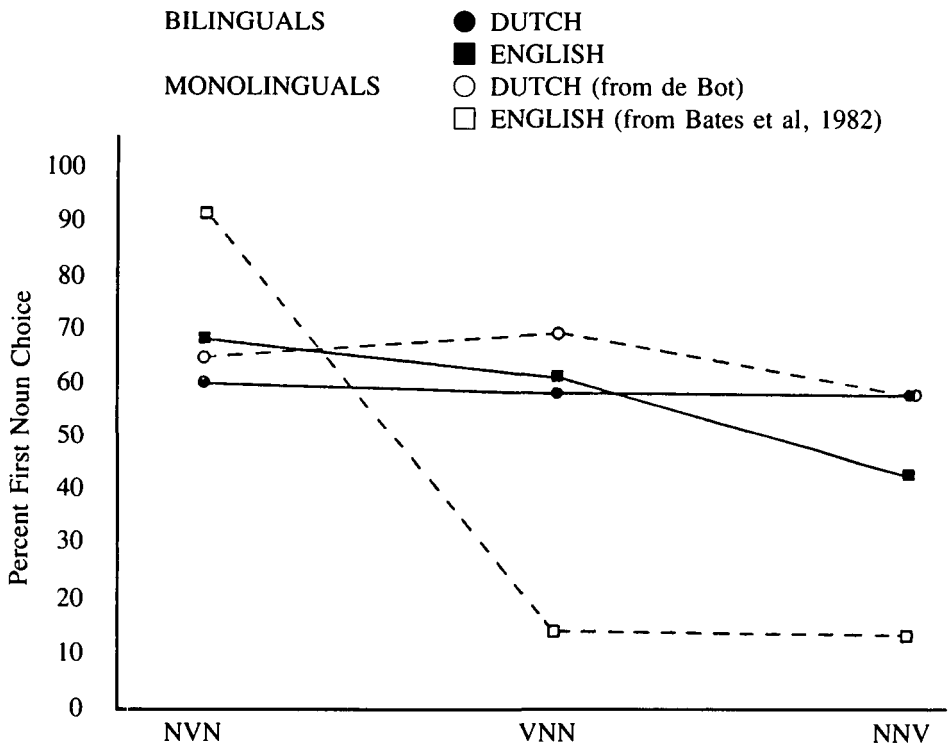

Figure 1. Percent choice of the first noun as actor: language by word order for bilinguals and monolinguals.

We will consider each of these in turn. We will then compare our data with results from two similar sentence processing studies involving monolingual English (from Bates et al., 1982) and monolingual Dutch (de Bot, personal communication) speakers.

A. Language × word order. This interaction is illustrated in Figure 1. Three word order permutations were possible: NVN, VNN, and NNV. In both Dutch and English, SVO is the basic or canonical word order, which corresponds to NVN. A difference in percent choice of first noun as actor emerged across languages in the canonical NVN word order: subjects chose the first noun as actor 61% of the time in Dutch, in contrast to 68% choice in English. In the non-canonical order conditions, subjects chose the first noun 59% and 58% of the time in Dutch for VNN and NNV, respectively. In English a different picture emerges: first noun choice rate was 62% in VNN, but dropped to 44% in NNV orders.

Planned comparisons, which treated each of the variables as though they were separate experiments (omitting the group variable) revealed the source of the interaction to be in the different interpretations given NVN and NNV orders for

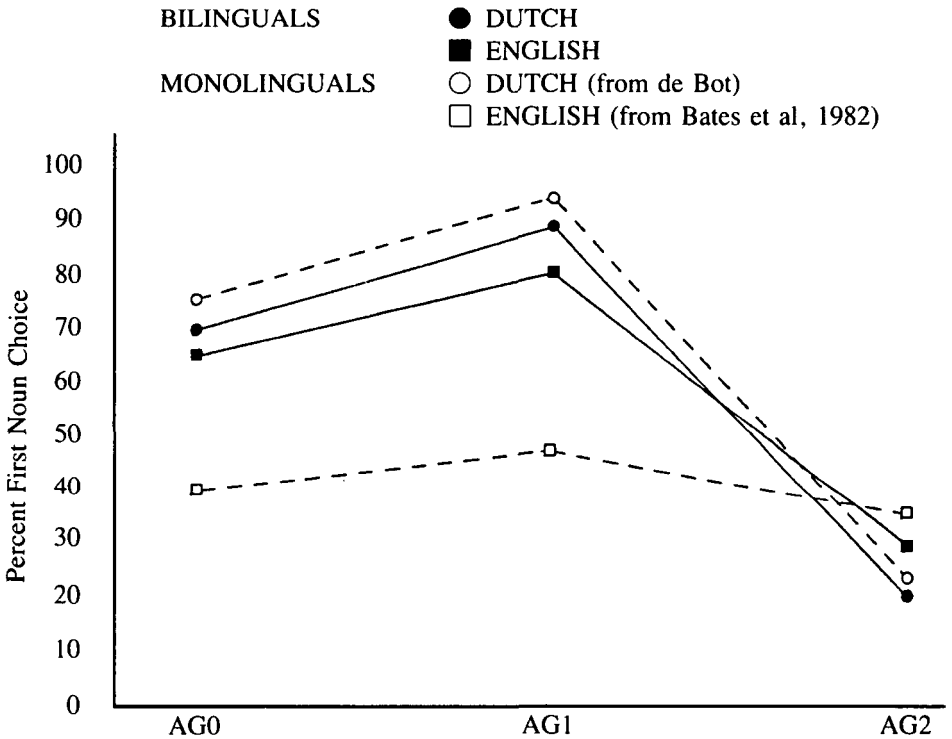

Figure 2. Percent choice of the first noun as actor: language by agreement for bilinguals and monolinguals.

English as compared with Dutch. Significant differences emerged between languages for NVN ($F(1,18) = 7.438, p < 0.014$) and NNV ($F(1,18) = 21.633, p < 0.000$), but none for VNN. We will return to these results shortly when we consider how structural differences between English and Dutch can explain these findings, and compare strategies employed by native English speakers on a similar task from a study by Bates et al. (1982).

B. Language × agreement. Figure 2 illustrates this interaction in the choice ANOVA. When agreement between the verb and the two nouns in a sentence was neutral or ambiguous (AG0), subjects chose the first noun in Dutch 70% of the time, compared with 66% of the time in English. Agreement with the first constituent (AG1) led to 91% first noun choice rate in Dutch, compared with 83% in English. Agreement with the second item (AG2) led to 19% first noun choice in Dutch, compared with 29% in English. Overall, while agreement played a similar role for these native Dutch speakers in Dutch and in English, Dutch was affected to a greater degree.

Planned comparisons of language differences on each of the agreement conditions showed that the source of the interaction was in the two conditions where an

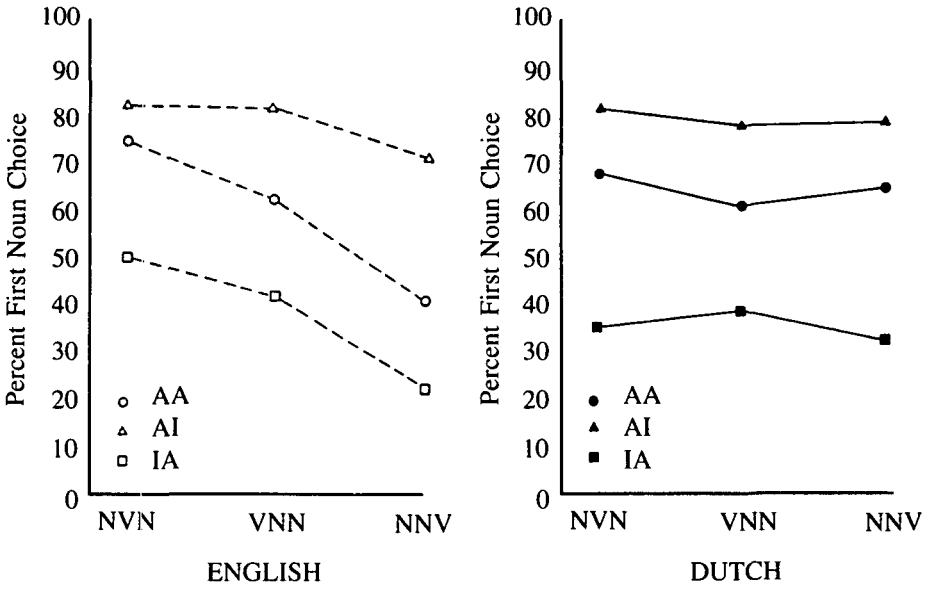

Figure 3. Percent choice of the first noun as actor: language by word order by animacy for bilinguals.

agreement contrast was available: the first noun was chosen significantly more often in Dutch than in English in AG1 ($F(1,18) = 7.835$, $p < .012$), and significantly less often in Dutch in AG2 ($F(1,18) = 6.325$, $p < .022$). When no agreement cue was present (AG0), there was no significant difference in noun choice between languages.

C. Language × animacy × word order. This three way interaction is illustrated in Figure 3. We can summarize this interaction in one sentence: the effects of animacy were mediated by word order in English, but not in Dutch. This is consistent with the notion that word order is a relatively strong cue to thematic role in English, but a somewhat weaker one in Dutch. We can see the direction this difference takes clearly if we compare the percent of the time the first noun was chosen as subject/agent in NVN versus NNV conditions for the two languages: in each of the animacy conditions, the first noun was chosen more often in English than in Dutch NVN sentences, but just the opposite relationship occurs in NNV.

E. Comparison with monolinguals

The broken lines in Figures 1 and 2 illustrate data from similar sentence interpretation tasks carried out in a monolingual setting with native speakers of Dutch (De Bot, personal communication) and English (Bates et al., 1982; MacWhinney et al., 1984). These results provide a useful reference point against

which we can compare the performance of bilingual subjects in each of the languages in question.[2] Overall, our subjects' performance in Dutch closely parallels the results reported by De Bot for native Dutch speakers in a Dutch-only version of the sentence interpretation task. Monolingual Dutch speakers chose the first noun as subject/actor in the following percentages for the different word orders (bilingual data for Dutch from the current study are in parentheses): NVN, 66% (61%), VNN, 59% (59%), NNV, 70% (58%). Turning to the agreement condition, we see a similar pattern: AG0, 76% (70%), AG1, 95% (91%), AG2, 24% (19%). The monolingual English data shown have been replicated a number of times; the effects of WO, AN and AG in English are surprisingly consistent across studies (MacWhinney and Bates, in press; MacWhinney et al., 1984).

A first impression of the bilingual subjects' performance in English is that their second language processing strategy more closely resembles that observed in their first language. However, a closer look reveals that, when the results in English do diverge from those in Dutch, it is in the direction predicted by monolingual English findings. In Figure 1, native English speakers are shown to choose the first noun 92% of the time in the canonical NVN condition; in VNN and NNV, this tendency is reversed, and a strong second noun strategy is observed. The Dutch–English bilinguals also chose the first noun in English NVN sentences in the relatively highest proportion, 68% of the time. The bilingual subjects also exhibited a second noun strategy in the NNV condition (45% first noun choice rate), albeit not to the same extent as native English speakers. The main difference between the native and non-native English speakers in English is in the VNN condition: the bilingual subjects chose the first noun 62% of the time, in contrast to 15% first noun choice by the monolinguals. We will consider shortly why this should be so in terms of structural differences between Dutch and English.

Figure 2 also illustrate a small but consistent trend for processing strategies in English as a second language to move away from Dutch strategies in the direction of monolingual English ones. We can see from the Bates et al. data, agreement has little effect in English monolingual processing; there is only a slight bias toward assigning the subject to the noun which agrees in number with the verb. In contrast, agreement and animacy are strong cues in Dutch compared to word order.

A brief survey of some structural characteristics of English vis-a-vis Dutch suggests a source for the language differences reported here. NVN corresponds to SVO, the canonical word order for simple, active sentences, in both Dutch and English. However, native speakers of Dutch (de Bot, personal communication) and their English counterparts (as reported by MacWhinney et al., 1984) are not equally likely to interpret an NVN string as SVO (i.e., assign subject/agent status to the first constituent). In general, native English speakers are not much affected by variations of animacy and agreement; word order is by far the "winner" in situations in which other cues point to the second noun as subject/agent. Native English speakers in the Bates et al. study chose the first noun in NVN sentences an average of 92% of the time. This contrasted strongly with the findings from NNV and VNN orders, where subjects chose the second noun as subject/agent an average of 85% of the time. In order of relative strength, processing cues in English line up as follows: word order > agreement, animacy.

In contrast, agreement and animacy appear to command more attention than word order in Dutch; cues to sentence processing we tested line up as follows: agreement > animacy > word order. This is consistent with the fact that Dutch, which has a relatively rich verb agreement system, allows more word order variation than English. For example, a very frequent form for questions in Dutch is VSO (e.g., *Trapte de jongen de bal?* 'Kicked the boy the ball?'). In English, however, VSO is not a possible configuration.[3] This offers one plausible explanation for why Dutch bilinguals tended to choose the first noun in VNN, in strong contrast with native English speakers, who rely heavily on a second noun strategy in both VNN (VOS) and NNV (OSV) orders. For these subjects, the relative strength of the Dutch question form VSO may "win" in competition with other potential interpretations, including the English VOS.

On the other hand, Dutch speakers tended in the same direction as English monolinguals in adopting a second noun strategy for NNV orders. Finite main verbs do occur in verb-final position in Dutch, but only in subordinate clauses, such as sentential complements and relative clauses (the latter of which requires an obligatory relative pronoun (e.g., *De man, die de vrouw sag was* 'The man (whom) the woman saw was'). Despite competing Dutch-based SOV interpretations, which would in any case require an auxiliary or a past participle to be interpretable, the small but reliable second-noun tendency in English may reflect some sensitivity to the integrity of SV units in English, which are maintained in subordinate clauses (SV-O in sentential complements, O-SV in relative clauses) as well as in the basic English word order.[4]

It may be the case, then, that in interpreting English sentences, the Dutch bilinguals appear to lean toward English strategies due to language-specific factors of the following type: although order information is normally not attended to in any large degree in their first language, the general lack of morphological distinctions in English may force subjects into a processing strategy that uses the few cues it has at its disposal. In other words, the "in-between" status of L2 processing may be due to a combination of "exportable" L1 cues (e.g., VSO question forms in Dutch), and L2 cues that represent the only likely (or available) solutions to the problem of mapping a surface string of items into "who-did-what-to-whom" relations. This is consistent with the observation that subjects in this study "tuned in" to OSV, but, in contrast with monolingual English speakers, not to VOS.

4. Post hoc reanalysis of subgroup patterns: individual differences

Despite the absence of a major group (i.e., order of language presentation) effect, the overall ANOVA revealed a difference in the percent of variance accounted for by agreement and animacy for the two groups (i.e., E1 received the English sentences before Dutch, while D1 received the Dutch sentences first). In E1, both verb agreement and animacy accounted for almost the same amount of variance in the ANOVA, i.e., 55% and 50% respectively. In contrast, the relative contribution of these factors in D1 was quite different, i.e., 72% for verb agreement as opposed to only 21% for animacy. This difference in percent variance accounted for did not translate into an order of presentation difference, since agreement was the overall "winner," followed by animacy, regardless of

which language was presented first. However, this tendency was somewhat more pronounced in the D1 group, resulting in the observed difference in variance accounted for.

These observations led us to carry out post hoc analyses of individual performances. These analyses revealed that subjects could be categorized according to the processing strategy used most during the sentence interpretation task. Three subgroups of subjects emerged. Subgroup 1, consisting of 6 subjects, clearly used a semantic strategy, preferring the animate noun as the subject of the clause, while Subgroup 2, consisting of 7 subjects, used a morphological strategy, making their selection based on verb agreement. Subgroup 3, which also contained 7 subjects, intermixed these two strategies in one or both languages. We examined these group differences in more detail by using them as blocking variables in a second statistical analysis. The frequencies of first noun selection were entered in a $3 \times 2 \times 3 \times 3 \times 3$ analysis of variance (Group $\times$ Language $\times$ Animacy $\times$ Verb Agreement $\times$ Word Order). This post hoc analysis revealed significant effects in two two-way interactions of Group by Animacy and Group by Verb Agreement. In addition, there were some smaller, but also significant three- and four-way effects involving Group.

These differences were not due to variables such as fluency, educational background, experimenter, or differences in sentence lists, so we have to seek some less obvious explanation. It may be that due to the way testing was carried out, and the constrained nature of the test itself, subjects were encouraged to adopt a particular processing strategy in the first session that simply perseverated into the next. While this may have been true for some subjects, it is also true that 7 of our 20 subjects did not settle on one uniform strategy for both languages, and instead shifted strategies in one direction or another across (and even within) sessions. While we cannot dismiss the possibility of task-induced variation, task constraints were apparently not so strong as to cause the application of a set of rigid strategies across the board. What these data indicate is that if the task structure did have an effect, it interacted with individual tendencies to solve the processing problem in different ways.

The potential importance of individual differences in language processing has been pointed out in previous studies with both monolingual and bilingual subjects. Bates et al. (1982) observed patterns of individual differences within groups of monolingual native speakers of Italian and of English, but subsidiary analyses showed that the direction of language-specific differences remained the same as for the language groups at large. It is interesting to note that in the present study, most subjects tended to consistently apply the particular strategy they adopted from the outset to both Dutch and English. Bates et al. (1982) suggest several possible sources for such differences: an agreement versus animacy bias may have independent psychological status; or subjects may simply choose one of several possibilities and stick with that one.

Similar individual difference findings with bilinguals have been reported by Harrington (this issue) for Japanese–English bilinguals, and by Wulfeck et al. (1986), who observed similar subgroup differentiation in their study of Spanish-English bilinguals. Taken together, these findings suggest that this effect is not accidental or due to language-specific factors. Moreover, it sounds a cautionary

note by indicating that individual differences may be an important factor in any language processing study, and especially in within-subject comparisons of bilingual language use.

DISCUSSION

In interpreting the language differences, it is important to keep in mind the fact that these are within-subject differences; the three interactions involving the language factor reflect strategic variations adopted by bilingual subjects as a function of which of their two languages was presented. It is in this context that we can identify whether and to what extent (1) strategies appropriate to first language processing are applied to the second language; (2) strategies appropriate to the first language are adopted; or (3) an amalgam of L1 and L2 processing strategies leading to an "in-between" stage in interpreting L1 sentence cues exists.

As suggested earlier, it is possible that all of these options are observable at some point, and that individuals will differ in the particular path they take to fluency in a second language. Both of these latter possibilities were supported by our findings: native Dutch speakers differed in the extent to which they applied L1 and L2 strategies separately and in combination in interpreting sentences in English; there were also differences in the way individuals interpreted sentences in Dutch, but the particular approach carried over from L1 to L2. The bottom line here is that we have gained some understanding of what it means to be "in-between" languages.

Adding to our understanding is a model that provides an account of how various cues to assigning formal surface devices in language to underlying functions can operate. The notion that cues can vary in strength suggests a straightforward way to account for the findings reported here; in conjunction with this, the competition or convergence of cues helps explain how different strategies may be adopted at different times in the course of acquisition. Cues may be "tuned" according to various factors, some under learner control (e.g., vocabulary size in L2, attention to particular elements in discourse, etc.), some in the language/structural domain (e.g., absolute frequency of lexical items, of particular grammatical constructions (see Bock, in press), specific global constraints on WO, subject-topic cohesion, etc.). This has obvious implications for any situation in which languages come into contact. For example, a foreign language teaching program that emphasizes aspects of the language-to-be-learned which are likely to encounter interference from the "linguistic underground" of the native language may facilitate learning.

In summary, it is fairly clear that when faced with conflicting cues in English, Dutch-English bilinguals opted for those that are also "good" cues to sentence interpretation in Dutch, at times going against the grain of English. In this regard, it does indeed appear that under some conditions L1 strategies "invade" into processing in L2. This statement is necessarily qualified, however, since when all other factors were held constant, some sensitivity to the structural properties of English was displayed, as illustrated in the "lean" toward the English monolingual findings. Both the more "English-looking" and the more "Dutch-looking" outcomes in English are consistent with the idea that cues

which are strong in Dutch (and are obviously more prominent in the everyday language use of our subjects) are more likely to influence processing in English, even to the extent that some cues which are functionally deterministic for native English speakers are, to a lesser or greater extent, "over-ruled." It is an empirical question whether the extent to which particular L1 strategies suppress or influence L2 processing cues is a function of the relative strength of competing cues in L1 and L2 in general, in combination with the individual speaker's own (ever-changing) level of competence in L2 (MacWhinney et al., 1984).

NOTES

1. While subjects in this experiment heard only active, declarative verb forms, and no auxiliaries or past participle forms were used, the data suggest that potential SOV interpretations do play a role in the sentence interpretation strategies of these subjects in Dutch, which lends indirect psychological validity to the description of Dutch as an SOV language.
2. Direct comparisons between the monolingual English and Dutch data and the English and Dutch components in this experiment are not possible due to unknown differences in materials and procedures. Nevertheless, many variations of this paradigm (e.g., verbal response, written response, acting out the sentence with small objects) have been employed often and in a wide variety of languages (i.e., Hungarian, Serbo-Croatian, Chinese, German, Japanese, Tagalog, Italian, and others). Despite such differences, the task has proved to be remarkably robust.
3. The English translation "Did the boy kick the ball?" offers a partial VSO structure via the mechanism of auxiliary-fronting, as in (V-did) S-V-O. However, these data suggest that the main verb plays the most important role in the development of word order strategies.
4. It has been argued that Dutch subjects may differ in their performance on English NNV sentences for another reason: if the "SOV-ness" of Dutch persists even during the processing of English sentences, it may be because in actual usage N-N strings are never encountered in English. Obviously, if learners are never exposed to such combinations, they cannot discover language-appropriate strategies to deal with them. However, in informal speech and in various relative constructions, English *does* provide N-N pairs. Left dislocations are one example: "Homework(N) John(N) hates(V), but he loves to party."

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