

Second Language Autonomy

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Development of the second-language lexicon was investigated in two on-line experiments. In both experiments, priming was examined within the second language under automatic conditions and for nonnative speakers of two different levels of performance. Experiment 1 showed second-language priming for various lexical relationships for proficient nonnative speakers. Moreover, the results found for the proficient bilinguals were highly similar to those found for a group of native control subjects. Experiment 2 examined priming of the dominant and subordinate meanings of biased homographs such as “seal.” Priming was found for both meanings, for proficient bilinguals working in their second language, and for native control subjects, but only for the dominant meanings for a group of intermediate nonnative speakers. Again, the pattern of results found for the proficient bilinguals and native controls was highly similar. The ensemble of these results provides evidence for second-language autonomy, which is determined, however, by both level of expertise and type of lexical relationship. The autonomy postulated here is limited, moreover, to exploiting the second-language lexicon for the purposes of recognition and cannot at present be said to extend to production. © 1997 Academic Press

Acquiring a second language involves not only forming representations for words in isolation but continually enriching those representations with knowledge of how the words are used and how they are related to other words. To take the example of gun, a complete representation of this word will comprise knowledge of the various relationships, both semantic and associative, that link it to other words, such as rifle, weapon, knife, and barrel. Added to these are collocational links which illustrate typical uses of the word in discourse, either with verbs (carry, shoot, fire) or with adjectives (powerful, dangerous). Building a functionally adequate second-language lexicon requires the gradual consolidation and extension of the network that ramifies from each word known (Miller & Fellbaum, 1991; Nation, 1993).

Previous studies have examined whether beginning and proficient nonnative speakers

engage in qualitatively different processes when accessing their second-language lexicon (Chen & Leung, 1989; Kroll & Curley, 1988; Potter, So, Von Eckardt, & Feldman, 1984). The results of Potter et al. (1984) led them to provide a negative response to this question. These authors concluded that both proficient and nonproficient second-language users access meaning in the second language directly rather than via a translation link through the native language. This conclusion was called into question, however, by subsequent studies (Chen & Leung, 1989; Kroll & Curley, 1988) showing that in very early stages of adult second-language acquisition, the native language may serve as a type of crutch when accessing the second language. However, for adults this “critical stage,” beyond which the second language is no longer mediated via translation links, appears to be attained within 2 or 3 years of formal study of the second language (Kroll & Curley, 1988).

From these studies, one can conclude that adults develop a functionally independent second language (L2) lexicon rather rapidly. They provide little information, however,

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about the actual development of this lexicon and how, if at all, it differs in structure from the native-language (L1) lexicon. The majority of studies on the structure of the bilingual lexicon have centered, in fact, on establishing whether the lexical entries corresponding to the subject's native and second language are stored separately or in a single interdependent lexicon (cf. De Groot & Nas, 1991; Durgunoglu & Roediger, 1987; Frenck & Pynte, 1987a; Keatley, Spinks, & De Gelder, 1994; Kirsner, Smith, Lockhart, King, & Jain, 1984; Macnamara, 1967; Snodgrass, 1984). The present study is less concerned with the types of links or demarcation lines that exist between the first and second language than with the degree of autonomy attained within the second language, where autonomy is defined as performance that does not involve L1 lexical representations. The rationale behind this is that it is more profitable to build up a view of how bilinguals operate in their second language, within a single task, before attempting to develop a general theory about the organization of their lexicon(s).

We chose to examine second-language performance as revealed by the primed lexical decision task. This task, introduced by Meyer and Schvaneveldt (1971), requires subjects to distinguish target words from nonlexical letter strings (e.g., shark vs narse), the targets themselves being preceded by prime words that are or are not related to the targets (e.g., jaws vs doctor). The general finding from this task is that related prime words accelerate the correct identification of lexical targets, although exactly why this occurs is subject to debate (cf. Neely, 1991), as indeed are the factors underlying the response in the lexical-decision task itself (Balota & Chumbley, 1984; Monsell, 1991). By examining patterns of facilitation in this task, it is theoretically possible to trace the contours of second-language performance from both developmental and linguistic perspectives—with the caveat that the type of performance embodied in lexical decision should not be taken as necessarily indicative of performance in production tasks, such as

translation (cf. De Groot, Dannenburg, & van Hell, 1994).

It has been suggested that even in highly skilled nonnative speakers, the network of the L2 lexicon is both weaker and less furnished than that of the L1 lexicon (Keatley et al., 1994). This claim stems from the results of three cross-language priming experiments (Keatley et al., 1994). In all three, facilitation was asymmetrical, being greater from L1 to L2 than from L2 to L1, replicating the findings of various other studies (Jin, 1990; Prince, 1994). The authors attribute this asymmetry to the assumption that L1 representations are more richly interrelated both within and across memory systems and therefore provide a stronger priming context than L2 representations. While this assumption may be valid, a stronger argument could be made in the context of a within-language study of the second language. Though few experimental studies have adopted this approach specifically, the data available suggest that priming effects are greater within L1 than within L2 (Favreau & Segalowitz, 1983; Frenck & Pynte, 1987a). With bilinguals who are proficient in both languages, however, the difference in the effect appears to be minimal (Meyer & Ruddy, 1974; Schwanenflugel & Rey, 1986; but see Kirsner, Smith, Lockhart, King, & Jain, 1984, experiment 4).

At present, a systematic study of lexical attainment within the second language involving different levels of speakers and varied linguistic relationships is lacking. The second-language lexicon proper has been neglected, not only in mainstream literature, but in second-language acquisition research as well (cf. Gass, 1988; Meara, 1984). This gap is surprising, given the importance of the lexicon to communicative ability. To illustrate, grammatical errors such as "The book that wants Susan is expensive" are noted but nonetheless generally understood by a native speaker, whereas lexical errors often impede communication (Gass, 1988).

The experiments reported herein were intended to fill this void in the literature. Two

on-line experiments were run which compared the performance of native speakers to that of nonnative speakers in a primed lexical decision task. In Experiment 1, we examined priming for paradigmatic and syntagmatic links, i.e., antonyms and synonyms in the former case and collocations in the latter. Experiment 2 was designed to determine the extent of priming, within the second language, for words with multiple meanings.

Priming was investigated in both experiments under conditions reputed to be indicative of automatic processing. The term "automatic" is employed according to the criterion applied in the majority of monolingual studies: that is, although subjects could consciously process the prime, conditions were such that strategic use of the prime to generate expectancies was in principle precluded (cf. Masson, 1991; Neely, 1991). In fact, the question of exactly what generates priming effects in the lexical decision task, i.e., whether they are the product of an automatic spread of activation from the prime word to other semantically related words in the lexicon (Neely, 1977) or, rather, the product of some postlexical strategy based on either the familiarity of the combination of the prime and target (Ratcliff & McKoon, 1988) or on a semantic match between the two (Neely & Keefe, 1989) is not at issue here. What is of importance is whether the conditions of prime-target presentation were such that the nonnative subjects were induced to perform within their second language. In this aim, we employed short prime exposures coupled with forward masking, such that subjects had little opportunity to engage in strategic processing of the prime prior to the onset of the target. The assumption is made that in such conditions any facilitation observed within the second language will be a sign that L2 autonomy has been achieved. It is this aspect we wish to stress, rather than automaticity as such. Autonomous processing within L2 does not of course preclude a subject from also having highly accessible links with L1, nor from his/her L2 performance's being permeable to L1 influences in the case

of a different task or different materials. Of interest to the present study, however, was determining whether priming would be observed in conditions that can be said to reflect second-language autonomy and, if so, at what level of proficiency and for what types of linguistic relationships. It seems prudent to assume that autonomy develops gradually, most likely in a nonlinear fashion, and at different rates according to task and material. Any conclusions to emerge from the present study are thus not necessarily indicative of performance in other tasks; however, over and above the information this study provides, the concept of autonomy is itself of heuristic value, and its exploration is a fruitful way in which to approach the question of how the second-language lexicon is developed.

EXPERIMENT 1

Experiment 1 examined, via the primed lexical decision task, whether beginning as well as proficient bilinguals would benefit from various types of lexical relationships when identifying words in their second language. The objectives of the experiment were twofold. First, the comparison of the two groups of nonnative speakers to each other and to a group of native speakers provided a cross-longitudinal study of lexical attainment. Second, by investigating performance under conditions of reputedly automatic processing, we could determine at what stage of proficiency subjects are able to work efficiently within their second language without necessary recourse to the native language.

To address the question of how a complete lexical network is established in the second language, a wide range of lexical relationships across grammatical categories was included in the materials. Specifically, three types of relationships were considered: antonyms, synonyms, and collocations (e.g., comb hair). This choice was based on the premise that, for a native speaker, all three types of relationship are involved in establishing the meaning of a word, and it would therefore be of interest to see to what extent they also structure the

second-language lexicon. Work in the field of lexical semantics has indeed stressed the need for a large lexical database in any realistic study of the lexicon (Miller & Fellbaum, 1991). Previous monolingual studies using the primed lexical decision task have shown that both antonyms and synonyms give rise to significant priming effects (Beauvillain & Segui, 1983; Scampa, 1986; Warren, 1977). Antonym primes have also been shown to produce facilitation in the second language of bilinguals in a primed lexical decision task (Frenck & Pynte, 1987b). The collocational relationship was included because it is syntagmatic, whereas the other two are paradigmatic, and it therefore provided a supplementary insight into L2 lexical development. Monolingual research has shown significant effects of syntactic priming with word pairs (Goodman, McClelland, & Gibbs, 1981) even under conditions of masked priming (Sereno, 1991), although it appears that the effect is restricted to the lexical decision task and is not produced reliably in naming (Seidenberg, Waters, Sanders, & Langer, 1984; Sereno, 1991).

Our intention in examining priming in the second language for various lexico-semantic relationships was not to demonstrate qualitatively different effects for these relationships. It is of interest, nonetheless, to examine priming for the three relationships we included, given that each has distinct lexical properties. Antonyms are both highly salient (Clark, 1969) and often reinforced in second-language learning by formal instruction. Synonymy is also a powerful organizing principle for learners; these latter may in fact initially group words of similar meaning together as if they were equivalent (Carter & McCarthy, 1988, pp. 16–17). Collocations are relatively flexible compared to the other two relationships, as they consist of various types of combinations of words: verb + adverb, verb + noun, adjective + noun, adjective + preposition, etc. Moreover, the collocational relationship is rarely formalized during the learning process. It has been suggested that collocations are of a highly associative nature and can often be

understood with only a minimal analysis of the words that compose them (Firth, 1957). Nonetheless, Yorio (1980) has suggested that the knowledge of collocations demonstrates a certain level of automaticity of language use and, as such, is a good indication of the speaker's linguistic competence.

Previous studies have provided evidence that, depending upon the relationship subtended by the prime and target words, both the amount and pattern of priming can vary substantially. This was clearly shown by Becker (1980) in the framework of an early model of lexical access (Becker & Killion, 1977). Results of that monolingual study demonstrated that, in relation to a neutral prime, antonym primes produced strong facilitation for related targets but little inhibition for unrelated ones, whereas category-name primes produced the opposite pattern. This pattern of results can easily be accounted for if one assumes that subjects develop expectancies about the target from the prime and are all the more able to make (and quickly discard) predictions the tighter the relationship between the prime and target (cf. Becker, 1980; Neely, 1991). There is also some evidence, from a bilingual study, that the amount of priming facilitation produced by category-names in the lexical decision task varies as a function of the typicality of the target (Schwanenflugel & Rey, 1986), although this result has not been systematically found in monolinguals (cf. Neely, 1991).

Priming was examined under conditions reputed to be indicative of automatic processing, specifically, rapid presentation of the prime (67 ms) with forward masking. From the results of monolingual studies (cf. Neely, 1991), we can predict priming effects in the native control group under these conditions. Of interest was whether automatic priming would occur in the second language within the group of proficient nonnative speakers and possibly within the group of less skilled nonnative speakers, under the assumption that such would be a sign that L2 autonomy had been achieved.

Method

Subjects. Sixty subjects voluntarily participated in the experiment which lasted approximately 15 min. The subjects were evenly distributed across three groups: native speakers of English, proficient nonnative speakers, and nonproficient learners of English. For both groups of nonnative speakers, the native language was French. The three groups comprised men and women and were in the same age range (20–28 years). The native speakers were college students of either American or British nationality, having resided in France for an average of 8 months at the time of participation. The group of proficient bilinguals was comprised of French graduate students who were studying to become English instructors (fifth year of university studies in English) and who had recently lived for 9 to 12 months in the United States or Great Britain. All considered themselves fluent in the English language. The nonproficient subjects were training to be primary-school teachers in France and had studied English at secondary school for a minimum of 5 years (average length of study: 7.8 years); however, none considered themselves to be at all fluent in this language. In the nonproficient group, self-assessment scores on a 9-point scale, with 9 being the highest degree of fluency, resulted in average scores of 3.04, 4.14, and 3.19 for speaking, reading and oral comprehension, respectively.

Materials and design. Sixty prime–target pairs were employed. The prime and target words were all of high frequency (all greater than 50 occurrences and most greater than 100 occurrences per million, according to Thorndike & Lorge, 1944; with mean (and median) frequency being 199 (119) per million for primes and 203 (131) per million for targets, according to Kucera & Francis, 1967). The primes and targets ranged in length between 3 and 8 letters, inclusive. Both prime and target words were presented in English. The prime and target bore no substantial physical resemblance to each other and never shared more

than two letters in common. The 60 pairs were composed of 3 groups of 20 pairs, defined by the type of relationship between the prime and target word, either antonyms, synonyms, or collocations (see Appendix).

The prime and target were considered to be antonyms if they were situated at the opposite end of a reference scale or if they were contradictory, where the affirmation of the one necessarily entailed the negation of the other (e.g., “empty–full” and “open–shut,” but not “husband–wife” or “buy–sell”). All but one pair of antonyms (i.e., “day–night”) met these criteria. Of the 20 antonym pairs, 15 were adjectives, and the others were distributed across 5 categories. All pairs were presented in English only. It can be noted, however, that all of the words had a single unambiguous translation in French, and the relationship of antonymy was as strong in French for these pairs as it was in English. That is, the same antonyms were given as responses to these targets in both languages (Boussinot, 1981; Collins, 1995).

Synonym pairs were selected from *Webster’s Dictionary of Synonyms* (1951). The two terms in a pair were defined as being synonymous if they were interchangeable in most contexts; however, it is obvious that two terms are never completely synonymous, and the pairs we used ranged to a certain degree as concerns their contextual overlap. Moreover, synonym pairs often have the property of having one term that is more frequent than the other (e.g., “follow” is more frequent than “pursue”). This was true of our material, which meant that, overall, the target for this set of items was slightly less frequent than that for antonyms and collocations (median Kucera and Francis (1967) frequencies were 70, 173, and 151 per million, respectively). Of the 20 pairs of synonyms, 10 were verbs, 5 were adjectives, and the others were distributed across 5 grammatical categories. Most of the synonym pairs had only a single translation in French (e.g., “speak” and “talk” are both normally translated as *parler*; “small” and “little” as *petit*, etc.). There were a few

cases, however, where the two words of a pair in English were also distinguished in French.

Collocations (also known as co-occurrences) consist of two or more words that often co-occur in speech. In contrast to synonyms and antonyms, collocations are built upon a syntagmatic rather than a paradigmatic axis. We chose collocations consisting of a verb and a noun, to comply with the criterion that both the prime and target words be of high frequency. This type of collocation is, in fact, much less constrained than are others because a verb can be followed by countless words from a wide range of grammatical classes. Despite this, it is likely that only the most frequent complements of a verb are activated in memory by the occurrence of the verb. For the collocations that we employed, less than half a dozen complements frequently co-occurred with the verb (Benson, Benson, & Ilson, *The BBI Combinatory Dictionary of English*, 1986). Collocational frequency was determined from COBUILD Direct, an interactive English-language data bank, which provides numerous statistics relative to the frequency of occurrence of a given lexical item in the neighborhood of another lexical item. The statistic we employed was the *t*-score, which takes into account the number of times two items co-occur in the corpus and weights its value. The higher the *t*-score, the higher the probability that the two items co-occur frequently. The average *t*-score of our collocations was 8.9, which is relatively high on the scale. Moreover, as stated, both the prime and target were high-frequency words. Collocations which resembled compound nouns (e.g., "cross road") were avoided. Finally, almost half of the collocations had no direct translation in French.

The 60 prime–target pairs were presented in two lists. In each list, 30 of these pairs were related prime–target pairs (10 of each type of lexical link in each case), and 30 were unrelated pairs. Unrelated primes were matched in length and frequency to the related primes but bore no relationship to the target word. All target words were thus seen in both prime

conditions, but only once by a given subject. In addition to the lexical trials, 60 nonword trials, composed of a lexical prime and a nonword target, were presented. The primes preceding nonwords were selected from various grammatical classes and, in most cases, did not have either a strong antonym or a synonym. The nonwords were derived from English words in the usual manner, by changing one or two letters of a word while obeying the phonological and orthographic rules of the language. Both of the primes preceding nonwords and the words transformed into nonwords were in the same frequency range and of the same length as the words used in lexical pairs.

Apparatus and procedure. Display of stimuli and response recording were controlled by a microcomputer. Stimuli were displayed in uppercase in the center of the screen. A trial began with a center fixation point, followed by an alphabetic mask (10 alternating Xs and Ws), which was presented for 500 ms. The prime was then presented for 4 screen refreshments, i.e., 67 ms, and was replaced immediately by the target. The target remained displayed until the subject's response. The intertrial interval was 2 s. Subjects received a single block of 120 trials, presented in random order, preceded by a block of 6 practice trials. Subjects were not informed of the presence of the prime. They were instructed to make a lexical decision to the target, as a function of the target only, and responded positively with their right hand.

Results

The error data and median response times for correct lexical trials are presented in Table 1, as is the data obtained for nonword trials. Error data and response times for correct lexical trials were subjected to independent 3 (Level: learners, bilinguals, native speakers) \times 2 (Prime: related vs unrelated) \times 3 (Link: antonyms, synonyms, collocations) analyses of variance.

The analysis of response-time data for correct lexical trials revealed significant effects

TABLE 1

MEDIAN LEXICAL DECISION TIMES (MS) AND ERROR RATE FOR WORD AND NONWORD STIMULI
AS A FUNCTION OF LEVEL OF SPEAKER AND PRIME DURATION

Group	Lexical relationship						Priming	Nonwords
	Antonym		Synonym		Collocation			
	Rel	Unr	Rel	Unr	Rel	Unr		
Learners								
RT	707	721	746	750	668	677	12 ms	971
%E	3.0	5.0	5.0	5.0	0	2.0		10.6
Bilinguals								
RT	669	708	711	748	675	685	29 ms	942
%E	0.5	2.5	0.5	0.5	0	0		7.5
Natives								
RT	630	658	659	686	621	648	27 ms	787
%E	0.5	2.5	3.0	2.5	1.0	3.0		5.3

Note. Data for word stimuli are presented as a function of status of homograph meaning (dominant versus subordinate) and prime relatedness.

of Prime [$F(1,54) = 29.17, p < .001$; $F(2,108) = 40.16, p < .001$] of Link [$F(1,54) = 12.93, p < .001$; $F(2,108) = 6.79, p < .002$], and of Level [$F(1,54) = 4.89, p < .01$; $F(2,108) = 48.40, p < .001$]. Tukey HSD tests of the effect of Level revealed that the group of native speakers correctly identified words faster than the group of beginning nonnative speakers (650 vs 713 ms, respectively; $p < .01$ by subjects and items) and somewhat faster than proficient nonnative speakers (650 vs 699 ms, respectively; $p < .06$ by subjects, $p < .01$ by items), whereas the two nonnative groups differed significantly from each other only in the item analysis (ns by subjects, $p < .01$ by items). The effect of Link reflected the slight difference in frequency for the three classes of words; response times were roughly equivalent for antonyms and collocations and were, overall, slower for synonyms (682, 662, and 718 ms, respectively; $p < .05$ by items and by subjects, as revealed by Tukey HSD tests). More importantly, the effect of Prime revealed a significant advantage in response time for targets preceded by related than by unrelated primes (676 vs 699 ms, respectively). The ef-

fect of Prime was not modified by either Level of speaker ($F(1,54) = 1.54, ns$; $F(2,108) < 1$) or by Link ($F(1,54) < 1$).

Both the statistical results and inspection of Table 1 indicate that the effect of priming was present in all three subject groups. Nonetheless, a separate analysis was run on the RT data obtained for correct lexical trials in the two groups of nonnative speakers, to examine priming specifically within the second language. Results of this analysis showed, as above, significant effects of Prime [$F(1,36) = 14.05, p < .001$; $F(2,108) = 7.15, p < .01$] and of Link [$F(1,36) = 30.29, p < .001$; $F(2,108) = 5.76, p < .01$], and no interaction between the two ($F(1,36) < 1$). Words were identified in the second language faster when preceded by related than by unrelated primes (699 vs 717 ms), and synonym targets were identified more slowly than either antonym or collocational targets (741, 701, and 676 ms, respectively). The effect of Prime was not modified by Level of bilingual [$F(1,36) = 2.01, ns$; $F(2,108) < 1$] and the factor Level of bilingual reached significance in the item analysis only [$F(1,36) < 1$; $F(2,108) = 7.73, p < .01$]. However, a power analysis (Cohen, 1977) re-

vealed that our design provided relatively weak statistical power to test for this interaction ($d = 0.374$, $a^2 = .05$, $n = 20$, power = 0.21). Hence, to ascertain the effects of priming within each of the two bilingual groups, separate analyses were run on the data for each group. In the fluent bilingual group, related primes produced a significant 29-ms effect of facilitation [$F(1,18) = 11.44$, $p < .01$; $F(1,54) = 4.44$, $p < .05$]. In the learner group, the 12-ms effect of facilitation produced by related primes approached standard levels of significance [$F(1,18) = 3.62$, $p < .07$; $F(1,54) = 3.39$, $p < .07$].

Error rate for lexical trials was low across all conditions and was less than 5% overall. There were main effects of Level [$F(1,18) = 7.31$, $p < .01$; $F(2,108) = 4.48$, $p < .01$], and, in the subject analysis, of Prime [$F(1,54) = 6.36$, $p < .01$; $F(2,108) = 2.08$, ns] and of Link [$F(1,18) = 5.07$, $p < .01$; $F(2,108) = 2.08$, ns]. The group of L2 learners made more errors (3.3%) than either the proficient bilinguals (0.7%) or the native speakers of the language (2.1%), who did not differ between themselves. Error rate was slightly lower for related trials (1.5%) than for unrelated trials (2.6%) and for collocational targets than for antonym or synonym targets (1, 3.3, and 3.7%, respectively).

The data obtained for nonword trials (see Table 1) revealed that, in line with the literature, subjects were slower to correctly reject nonwords than to identify words. Moreover, although the nonnative subjects rejected nonwords both more slowly and less accurately than native speakers, their false positive rate did not exceed 10% overall.

Discussion

A primary objective of this study was to determine whether autonomous second-language processing, i.e., that which does not depend on the subject's native language, is restricted to highly proficient bilinguals. In this light, we compared the second-language performance of a group of skilled bilinguals to that of a group of nonproficient learners. Our

data provide a somewhat equivocal response to this question. While it can be said that both groups contributed to the effect of priming we observed in the second language, the effect obtained in the nonproficient group was numerically much smaller and, despite that absence of an interaction, statistically weaker than that found in the proficient group of bilinguals. Moreover, as reported in the results, a power analysis of our design indicated that the absence of an interaction may simply be due to insufficient power. It is thus important to examine the effects obtained for each group independently.

In the proficient group of bilinguals, there was clear evidence of priming facilitation within the second language. This finding corroborates previous findings and provides new information in two aspects. The first of these concerns the variety of lexical relationships that we examined. The majority of experimental studies of bilingual lexical processing has investigated a rather narrow section of the lexicon, focusing primarily on strong associative relationships between common nouns. An exception to this is the study by Schwanenflugel and Rey (1986), which looked at priming as a function of the typicality of category exemplars. Our own material included not only various lexical relationships, but words from several grammatical categories, as well. The second issue is that of the availability of the prime word prior to the presentation of the target. A survey of the literature shows that priming within the second language has been found using either the lexical decision task or a naming task when subjects had 150 ms or more to process the prime word (Beauvillain & Grainger, 1987; De Groot & Nas, 1991; Frenck & Pynte, 1987a; Keatley, Spinks, & De Gelder, 1994; Kirsner et al., 1984; Schwanenflugel & Rey, 1986; Tzlegov & Eben-Ezra, 1992). In one of these studies (De Groot & Nas, 1991), associative priming was examined within the second language under masked priming conditions similar to those of Experiment 1. While associative priming facilitation was found in that study, it was not reliable by

items, and, moreover, it is not clear from the discussion of the results whether or not the effect was reliable within the second language considered independently of between-language conditions. To our knowledge, no study prior to ours has demonstrated priming within the second language when the prime was both forward masked and presented for less than 100 ms prior to target-word onset. The combination of the rapid presentation of the prime and the various lexical relationships that were tested provides a rather strong case for second-language processing that is not dependent upon links with the subjects' native language.

The pattern of results obtained in the group of nonproficient learners clearly differs from that found in the proficient group. Although there was a trend for priming in the learner group, the effect was weak at best. As such, it is difficult to conclude that these subjects enjoy the same degree of second-language autonomy as their more proficient cohorts. The fragility of the priming effect in the learner group is, in itself, intriguing given the amount of time these subjects had been studying their second language (over 7 years in secondary school). Yet this fragility is coherent with the overall weakness of this group in the second language, at least inasmuch as productive capacities are concerned. Indeed, the particular makeup of this group provided a stringent test of L2 autonomy. The reasons why the foundations for L2 autonomy are present, yet remain so frail after 7 years, need to be elucidated.

Previous studies of nonproficient bilinguals which have evidenced facilitated performance within L2 provide helpful comparisons, but have differed from the present study in a number of respects. Notably, these studies, of both adults and children, have examined subjects who were either more proficient in their second language, allotted more time for the processing of the prime than in the present study, or both (Chen & Ng, 1989; Frenck & Pynte, 1987a, 1987b; Keatley et al., 1994; Kirsner et al., 1984; Schwanenflugel & Rey, 1986; Goodman, Haith, Guttentag, & Rao, 1985).

The pattern of results we report here needs

also to be set against data obtained from cross-language studies if a comprehensive theory of the bilingual lexicon is to be developed. Such studies have shown that whereas L1 primes L2, the reverse is not the case (cf. Altarriba, 1992; Keatley et al., 1994; Kroll & Scholl, 1992), although this is not systematically true (Tzelgov & Eben-Ezra, 1992). One reason for the reported lack of priming from the second to the native language may lie in the generally slower identification times for L2 words. To identify an L2 target, subjects may rely more upon contextual information than when identifying an L1 target, the latter being accessed rapidly and largely without the benefit of an L2 priming context.

The above explanation is valid where, as is often the case, words are identified more slowly in the second than in the native language. However, Keatley et al. (1994) found asymmetrical priming even when identification times for L2 words and L1 words were similar. Keatley et al. argue that L1 provides a greater priming context than L2. This could be due to there being fewer within-language links in the second than in the native language, and hence a greater reliance on translation links (i.e., from L1 to L2) during the identification of L2 words. Our data suggest, however, that numerous and varied links are formed within the second language, along semantic and associative lines similar to those that structure the first-language lexicon, as has been suggested by both neurolinguistic and experimental studies (Cristoffanini, Kirsner, & Milech, 1986; Dalrymple-Alford, 1985; Kirsner, Lalor, & Hird, 1993; Paradis & Lebrun, 1983). Nonetheless, it may be that successful consolidation of L2 autonomy is attained only in those learners who are willing, or have been induced by appropriate teaching methods, to abandon their reliance on L1. The pattern of results obtained for the weaker bilinguals indicates that although their L2 network may exhibit a structure similar to that of native speakers, they are not yet able to exploit it with any degree of confidence. The second-language lexicon may thus be con-

ceived of as a network over which subjects gradually exert a more precise control as learning develops (Frenck-Mestre, 1993; Green, 1993; Mägiste, 1984).

As we have stressed, the finding that activation spreads rapidly within the second-language lexicon does not mean that cross-language links are not also highly accessible (De Groot, 1992; De Groot & Nas, 1991; Frenck & Pynte, 1987a; Meyer & Ruddy, 1974; Schwanenflugel & Rey, 1986; Tzelgov & Eben-Ezra, 1992). Nonetheless, effects are generally stronger when material is presented in the same language (Grainger & Beauvillain, 1988; Keatley & De Gelder, 1992; Tzelgov, Henik, & Leiser, 1990; Tzelgov & Eben-Ezra, 1992). This makes sense if one considers that word forms are rapidly integrated into an existing network on the basis of language identity. The bilinguals in our experiments were all the more able to exploit that network as they were operating in monolingual mode, albeit in their weaker language (Soares & Grosjean, 1984). It remains to be seen how a bilingual processing mode and different task requirements might affect the L2 autonomy we have highlighted here (cf. Grosjean, 1994).

EXPERIMENT 2

Experiment 2 further explored the functioning of the L2 lexicon by examining the pattern of priming effects produced by words with multiple meanings, or homographs. As in Experiment 1, the performance of a highly proficient group of bilinguals and that of a less-skilled group were compared, to determine the boundaries of second-language autonomy.

To our knowledge, the processing of homographs within the second language has not been previously studied. This is undoubtedly tied to the fact that, as outlined in the introductory section, more attention has been given to the links existing between the bilingual's two languages than to the development of the second language itself. Indeed, bilingual studies (Beauvillain & Grainger, 1987; Gerard & Scarborough, 1989) have examined whether bilinguals are able to selectively access one or

the other of two meanings of cross-language homographs, such as "four" which forms a word in English and in French (meaning "oven") or "red" which forms a word in English and in Spanish (meaning "net"), although a clear answer has yet to be provided (Grainger, 1993).

Extensive monolingual research has been conducted, however, on accessing the meaning of homographs (cf. MacDonald, Pearlmutter, & Seidenberg, 1994; Marquer, Lebreton, Léveillé, & Dionso, 1990; Simpson, 1994; Simpson & Burgess, 1985; for reviews). From this research, it would appear that, for biased homographs, that is, words such as "pen" which have one clearly dominant meaning (writing utensil) and a subordinate meaning (an enclosure for animals), access is frequency ordered. When presented in isolation, the homograph's dominant meaning is accessed immediately and its subordinate meaning some 100 ms there following (Marquer et al., 1990; Simpson & Burgess, 1985). Moreover, unless specifically attended to, the subordinate meaning is subsequently inhibited by the dominant meaning (Simpson & Burgess, 1985).

Given the particularities of biased homographs, this material is especially interesting for the study of second-language attainment. It provides a further test of the autonomy of the second-language lexicon and indeed a more stringent one than that used in Experiment 1. In the material employed therein, roughly half of the prime-target pairs were subtended by relationships that existed in our bilingual subjects' native language. Hence, by means of positive transfer (i.e., transfer of knowledge from the native to the second language), these relationships may have facilitated the establishment of links within the second language. Otherwise stated, learning the relationships "young-old," or "brush-teeth" in English would be facilitated for a native speaker of French by the existence of the same relationships in the French language. This is not the case for words which have multiple meanings within the second language. First, it is infrequent that a word which

is ambiguous in one language is also ambiguous in the person's other language. That is, a word such as "nail" in English is translated by two distinct words in the French language ("clou" and "ongle," for the meanings related to "hammer" and "finger"), and, inversely, the French word "bière" corresponds to two distinct words in English ("beer" and "coffin"). Hence, lexical ambiguity generally does not provide a case for positive transfer across languages. Moreover, in the rare instance that it does, second-language learners apparently do not profit from it; Kellerman (1983) has shown that second-language learners are inclined to search for more than one translation equivalent of words which are polysemous in their own language, even when they know that only one translation exists, because they are unwilling to admit the same degree of polysemy in their second language.

By examining the time course of facilitation produced for the dominant and subordinate meanings of homographs within the second language, one can chart the progress of L2 lexical attainment. From the results of Experiment 1, we can expect that nonnative speakers will access the dominant meaning immediately, in much the same way that native speakers of the language do. Whether nonnative speakers will access the subordinate meaning, however, especially within the same time frame as native speakers, is open to question. Evidence that bilinguals have rapid access to the subordinate meaning of homographs would extend the results of Experiment 1 by showing that bilinguals store not only unequivocal lexical relationships within their second language in ways similar to monolinguals, but also store ambiguous L2 lexical entries in like manner to native speakers. It is of interest, moreover, to determine whether the nonnative speaker can retrieve subordinate meanings as quickly as native speakers, as this would be further proof of L2 autonomy. Note that a lack of facilitation of subordinate meanings could also be attributed to the fact that the nonnative speaker simply did not know that meaning of the word. Not only are some

subordinate meanings rarely encountered, but the nature of the material used meant that the average frequency, both of homograph primes and target words, was considerably lower than that of the material used in Experiment 1. For this reason, while we examined the performance of two groups of second-language users in comparison to a group of native speakers, the less-skilled bilinguals were at an intermediate rather than a "beginner" level.

Method

Subjects. Forty-eight college age men and women voluntarily participated in the experiment which lasted approximately 20 min. Sixteen subjects were American college students, all native speakers of English, residing in France. The other 32 subjects were native French university students. Half of these French subjects had studied English as their college major for 4 years, had recently lived for 9 to 12 months in the United States or the United Kingdom and considered themselves fluent in English. The other half were English majors entering into their third year of university, thus having completed 2 full years of study of the English language. None of these latter had resided for more than 4 consecutive weeks in an English-speaking country, or more than 4 months total. All subjects were naive as to the purpose of the experiment, and none had participated in Experiment 1.

Stimulus materials and design. Sixty-four biased English homographs, ranging in length between three and eight letters inclusive, were selected from various normative sources (Geis & Winograd, 1974; Gorfein, Viviani, & Leddo, 1982; Nelson, McEvoy, Walling, & Wheeler, 1980; Wollen, Cox, Cochran, Shea, & Kirby, 1980). Homographs were chosen which had a clearly dominant and subordinate meaning (dominant meanings accounted for at least 75% of the total associations). The target words which instantiated the two meanings of a homograph were comparable as concerns both their length and printed frequency (mean (median) Kucera and Francis (1967) frequencies were 110 (70) and 106 (47) per

million for dominant and subordinate targets, respectively). All words were presented in English and did not resemble either their French translations nor any other word in the French language. Moreover, all of the homographs corresponded to two distinct words in French (i.e., "hide" is translated by "cacher" and "peau"), neither of which was ambiguous in the French language.

The 64 homographs were divided into two sets of 32, and each set of items was seen at one of two SOAs. For each SOA, four lists were prepared according to a 2×2 factorial, with dominance of the target in relation to the homograph and relatedness of the homograph prime to the target word as factors. Across lists, each homograph was followed by its dominant and subordinate associate, and each of these associates was preceded by either the related homograph or by an unrelated word which was matched for length and frequency to the homograph (mean (median) Kucera and Francis (1967) frequencies were 66 (28) and 61 (28) per million, for homograph and unrelated primes). The distinction between dominant and subordinate targets was maintained for unrelated stimuli simply to ensure that comparisons between related and unrelated targets (at each level of dominance) would be based on the same stimulus items. Each subject received one of the four stimulus lists (which included eight items per condition) at each of the two SOAs. In addition to the 32 test trials within a list, there were 28 filler trials and 60 nonword trials, for a total of 120 trials per list. Nonwords were derived from English words by changing one letter while respecting the constraints of the language. The filler trials consisted of word pairs, half of which were related and half unrelated. Related filler trials were based on links such as antonymy, synonymy, and collocations. Unrelated filler trials had a homograph as prime, followed by an unrelated target word. The nonword trials consisted of an initial prime word, half of which were homographs and half of which were nonhomographic, followed by a nonword. Hence, subjects could not predict

the type of target from the prime. All filler words and words transformed into nonwords were in the same frequency range and same mean length as target words.

Apparatus and procedure. Display of stimuli and response recording were controlled by a microcomputer. Stimuli were displayed in lowercase in the center of the screen. A trial began with a center fixation point, followed by an alphabetic forward mask, in lowercase letters, which was presented for 500 ms. The prime was then presented in lowercase for either 100 ms (6 screen refreshments) or 300 ms, depending upon the SOA block, and was replaced immediately by the target. The target remained displayed until the subject's response. The intertrial interval was 2 s. Subjects were tested individually or in pairs in a well-lit room. Subjects received two blocks of 120 trials, presented in random order, preceded by a block of 6 practice trials, one block for each SOA. Subjects were instructed to make a lexical decision to the target, as a function of the target only, and responded positively with their dominant hand.

Results

The response-time data for correct lexical trials and error data for lexical trials were entered into separate analyses of variance, with SOA (100 vs 300), Dominance (dominant vs subordinate), and Relatedness (related vs unrelated prime) as within-subject factors, and Level of speaker (native, fluent bilingual, intermediate bilingual) as a between-subjects factor. The data are summarized in Table 2.

The analysis of response times revealed effects of Prime Relatedness [$F(1,36) = 29.80, p < .001$; $F(2,56) = 22.95, p < .001$], of SOA [$F(1,36) = 5.96, p < .02$; $F(2,56) = 3.94, p < .05$], and of Level of speaker [$F(1,2,36) = 8.15, p < .001$; $F(2,112) = 70.21, p < .001$]. Words were identified faster following a homograph prime (731 ms) than following an unrelated prime (768 ms), and at the 100 ms SOA than at the 300 ms SOA (735 and 765 ms, respectively). Somewhat surprisingly, the means for the three levels of

TABLE 2
 MEDIAN LEXICAL DECISION TIMES (MS) AND ERROR RATE FOR WORD AND NONWORD STIMULI
 AS A FUNCTION OF LEVEL OF SPEAKER

Group	Dominant		Subordinate		Nonwords
	Rel	Unr	Rel	Unr	
100-ms SOA					
Intermediate bilinguals					
RT	675	716	688	707	856
%E	3.9	5.5	5.5	4.7	11.0
Fluent bilinguals					
RT	780	826	778	831	1019
%E	4.7	5.5	3.9	3.9	6.5
Natives					
RT	678	728	680	733	853
%E	3.9	5.5	5.5	4.7	6.1
300-ms SOA					
Intermediate bilinguals					
RT	694	747	736	704	907
%E	3.2	3.9	6.3	7.8	10.1
Fluent bilinguals					
RT	793	837	826	884	1059
%E	3.9	3.9	5.5	7.1	7.7
Natives					
RT	702	734	745	775	882
%E	3.1	3.9	6.3	7.8	7.4

Note. Data for word stimuli are presented as a function of lexical relationship and prime relatedness.

speakers revealed that fluent bilinguals responded to words in the second language more slowly than both the intermediate bilinguals and native speakers (819, 708, and 721 ms, respectively; $p < .01$ by items and by subjects, as revealed by a Tukey HSD test), who did not differ significantly from each other.

As can be seen in Table 2, the pattern of priming facilitation was similar for the fluent bilinguals and native speakers, but differed in the group of intermediate bilinguals. This was borne out in the statistical analyses, which revealed an interaction between Level of Speaker \times Prime Relatedness \times Dominance of meaning, in the subject analysis [$F(1,2,36) = 3.88, p < .03$; $F(2,112) = 1.81, ns$]. To better grasp the effect of priming within each group, independent analyses were performed on the data for each group.

In the native control group, homograph primes produced a significant 42 ms facilitation effect on response times to related target words [$F(1,12) = 10.43, p < .01$; $F(2,1,56) = 14.17, p < .001$]. The effect of Dominance of meaning was significant in the subject analysis [$F(1,12) = 7.56, p < .02$; $F(2,1,56) = 2.82, p < .10$], while SOA reached significance in the item analysis [$F(1,12) = 3.31, p < .09$; $F(2,1,56) = 4.60, p < .05$]. Native readers tended to identify words that instantiated the dominant meanings of homographs faster than those instantiating the subordinate meanings, and they tended also to be faster in the shorter of the two SOA conditions (see Table 2). Neither Dominance of meaning nor SOA interacted with the effect of Prime relatedness [$F(1,12) < 1$; $F(1,12) = 1.36, ns$; $F(2,1,56) = 2.16, p > .15$, respectively].

In the group of fluent bilinguals, homograph primes also produced a robust 51 ms facilitation effect on response times to related target words [$F(1,12) = 15.15, p < .002$; $F(1,56) = 12.55, p < .001$]. The effect of prime was not qualified by either SOA ($F(1,12) < 1$) or Dominance of meaning ($F(1,12) < 1$). Neither SOA [$F(1,12) = 1.61, ns$; $F(1,56) = 1.44, ns$] nor Dominance of meaning [$F(1,12) = 1.97, ns$; $F(1,56) < 1$] affected lexical decision times significantly.

The intermediate bilingual group revealed a different pattern of priming from that found in the above two groups. The effect of Prime [$F(1,12) = 15.15, p < .002$; $F(1,56) = 12.55, p < .001$] was qualified by Dominance of meaning [$F(1,12) = 10.55, p < .002$; $F(1,56) = 3.99, p < .05$]. Homograph primes facilitated response times to their dominant meanings (47 ms effect; $p < .01$ by subjects, $p < .03$ by items, as revealed by a Tukey HSD test) but not to their subordinate meanings (-7 ms effect; ns). The Prime \times Dominance interaction was not significantly qualified by SOA [$F(1,12) = 3.99, p < .07$; $F(1,56) = 1.01, ns$] despite apparent differences in means.

Mean error rate was 5.1, 4.8, and 6.2% in the native control, fluent bilingual, and intermediate bilingual group, respectively. Error rate did not differ significantly as a function of Level of speaker ($F(1,12) < 1$) or of Prime relatedness [$F(1,36) = 1.66, ns$; $F(1,56) = 1.41, ns$]. The effect of Dominance was significant by subjects [$F(1,36) = 5.00, p < .03$; $F(1,56) < 1$] and was qualified in the subject analysis by the interaction with SOA [$F(1,36) = 11.64, p < .001$; $F(1,56) = 2.01, ns$]. Error rate was slightly higher at the 100-ms than at the 300-ms SOA for words used to instantiate the dominant meanings of homographs (6.1% vs 3.3%, respectively), whereas the opposite was true for those that instantiated subordinate meanings (5.3% vs 6.4%, respectively). No other factors or their interactions approached significance.

The data obtained for nonword trials (see Table 2) revealed that for all groups, subjects took longer to correctly reject nonwords than

to identify words. The false positive rate did not exceed 10% overall.

Discussion

Our results clearly show that fluent bilinguals access both the dominant and subordinate meanings of homographs when reading in their second language. This result is of some importance as it qualifies conclusions derived from off-line studies which have shown that nonnative speakers are hesitant to accept lexical ambiguity in their second language (Kellerman, 1983). We find no evidence of this. The pattern of facilitation we observed in the second language of fluent bilinguals mirrored both that found for the group of native control subjects and that obtained in previous monolingual studies (Marquer et al., 1990; Simpson & Burgess, 1985).

The performance of less proficient second-language learners when faced with processing ambiguous words in their L2 differs markedly from that of fluent bilinguals. Our data suggest that, despite their knowing the subordinate meanings of the ambiguous words, the less proficient bilinguals did not show a clear benefit from a "preview" of this meaning (i.e., the prime) when required to identify words in a lexical decision task. This is in contrast to the strong facilitation that was found for the dominant meanings of the ambiguous primes. The absence of a clear effect of priming for the subordinate meanings in this group of subjects may reveal their lesser grasp of this meaning. Whereas their performance on a recognition task, performed several weeks after the experiment, showed that they were capable of recognizing the subordinate meanings, their access to these meanings was apparently not rapid enough to be facilitated by the brief presentation of a homograph prime. This finding may be interpreted in a fashion similar to the data for Experiment 1; that is, the second-language lexical network of nonfluent bilinguals displays a structure similar to that of native speakers, but the activation of links within the network is more transient and weaker.

Further studies are warranted to elucidate

how nonnative speakers actually use their second-language lexicon, particularly concerning ambiguous lexical entries such as those studied here. Various authors have underlined the distinction to be made between nonnative speakers' active and passive vocabulary (cf. Gass & Selinker, 1994). Furthermore, Hudson (1989), in the light of theories of lexical semantics, has argued that nonnative speakers may properly use words for which they nonetheless do not yet have complete lexical representations. In this vein, it is possible that while proficient bilinguals have access to the various meanings of ambiguous lexical entries in their second language, they may only actively produce the more frequent meanings of these words. This merits further investigation.

One immediate extension of the present study would be to examine lexical ambiguity within the framework of second-language sentence processing. Monolingual studies have shown that sufficiently strong sentential contexts can constrain lexical access, such that only the dominant meaning of biased homographs becomes available (Serenio, 1995; Simpson & Krueger, 1991; Tabossi & Zardon, 1993; but see Swinney, 1979; Onifer & Swinney, 1981; Tanenhaus & Donnenwerth-Nolan, 1984). It would be of interest to determine whether lexical access in the second language can be constrained in similar fashion and at what stage of second-language attainment such occurs.

GENERAL DISCUSSION

Two principal findings emerge from the present experiments. First, nonnative speakers are able to exploit lexical information in their second language in a manner which indicates a certain degree of autonomy. In both experiments, priming was obtained in the second language under conditions which are reputed to reveal automatic processing. Moreover, given the types of relationships that produced priming within the second language, our results cannot be readily explained in terms of translation strategies or transfer of knowledge from the native language of subjects. Second,

our results clearly demonstrate that the degree of second-language autonomy is influenced not only by the level of proficiency of nonnative speakers but, in the less proficient speakers, by the type of lexical relationships that are examined.

Experiment 1 revealed priming in the second language under nonstrategic conditions for three distinct lexical relationships: antonymy, synonymy, and collocations. Many of these pairs did not, in fact, translate across our subjects' two languages. Notably, for synonym pairs, the two words were often translated by a single lexical entry in the other language. As concerns collocations (e.g., brush teeth), although this syntagmatic link exists in both of our subjects' languages, at least half of the collocations employed did not have a direct translation in our subjects' native language (French). Experiment 2 demonstrated priming for both the dominant and subordinate meanings of frequency biased homographs, such as hide. Here again, while lexical ambiguity is by no means restricted to the English language, the items employed were ambiguous in English but not in French. The nature of the material used therefore argues against the possibility that the facilitation we observed in the second language was due to preexisting associations in the subjects' native language. To the contrary, these results suggest that links have been formed within the second language according to principles similar to those that structure the native-language lexicon. Our results demonstrate that fluent bilinguals efficiently access the gamut of lexical relationships that were examined in the second language, even under conditions of masked, very rapid priming. Intermediate bilinguals demonstrated rapid access to their second-language lexicon as well, but only for the dominant meanings of ambiguous words. For the rather unique group of nonproficient second-language learners that we examined, priming facilitation in the second language was limited to a trend.

These results help to clarify an important issue that as yet remains unresolved regard-

ing the second-language lexicon. Namely, at what stage of learning do nonnative speakers begin to attain autonomy in their second language? Kroll and Curley (1988) suggest that three to four years of formal instruction may suffice to lay down the foundation of the second-language lexicon, such that the nonnative reader can benefit from various sorts of lexical ramifications within the second language, without necessarily having recourse to the native language. Our results support this conclusion, with the following reserves. First, our results show this to be true for strong lexical relationships. Facilitated processing of less prominent relationships was observed only in a group of highly fluent bilinguals. Second, consolidation of the second-language lexicon does not appear to occur simply as a result of a certain number of years of study. Indeed, for some learners, it may be the case that after the initial stages of second-language learning, level of proficiency and length of study are no longer closely correlated. Our weakest group of subjects, who had studied their second language throughout secondary school, showed only a trend for facilitated processing within the second language. Had these subjects been allotted more time for processing, they may have shown quite different performance, in line with previous studies. Provided with less than 100 ms to access the second language, however, these subjects did not show a clear effect of facilitation within this language.

We have argued from our results for autonomy of processing within the second language. It should be noted that autonomy does not necessarily mean rapidity. In both experiments, autonomous second-language performance was observed for nonnative speakers despite their being slower to identify words than native readers. Dufour and Kroll (1995) report, as well, autonomous L2 processing for bilinguals who performed slower than more proficient bilinguals. Further evidence that speed is not all is provided by the results of Experiment 2, in which the fluent bilinguals

actually responded more slowly than the intermediate group, but showed a pattern of priming facilitation that was virtually indistinguishable from that of native readers. Thus, it emerges that the decision stage, whether it concern category membership or word/nonword status, may remain hesitant in the second language, despite apparent ease of access.

The results of Experiment 2 differ from those obtained by Favreau & Segalowitz (1983), who found that automatic priming within the second language was restricted to highly fluent bilinguals. This apparent discrepancy may be attributable to differences in task demands. Favreau and Segalowitz's study was a bilingual replication of Neely's (1977) study, where subjects are induced to expect a novel relationship between the prime and target word (e.g., "bird" followed by "truck"), but are occasionally given catch trials where unexpected but semantically related pairs (e.g., "bird-sparrow") are presented. Favreau and Segalowitz found that, whereas highly fluent bilinguals showed facilitation for the unexpected but related targets, less fluent bilinguals did not. It is conceivable that the generation of expectancies is a more effortful process for less proficient subjects, who therefore have fewer resources available for the processing of other, unexpected relationships. This explanation holds if one assumes that automatic processing itself is not entirely cost-free, but may be affected by the deliberate setting up (and upsetting) of expectancies. In general, the manipulation of expectancies may create patterns of activation very different from those that obtain in less biased conditions. Indeed, Favreau and Segalowitz found that less fluent bilinguals did show automatic priming in the second language for related targets which were expected.

A similar account of expectancy effects has been put forward by Balota, Black, and Cheney (1992), who provide data to suggest that the time course of attentional resources is different according to whether the material to be processed corresponds to a previously learned relationship or one that is newly estab-

lished. The material used in our experiments could clearly be processed according to preexisting pathways. This could explain why we found priming effects in the second language at short prime exposures.

We have argued, based on the conditions of presentation, that the effects we observed in both experiments were due to automatic procedures rather than to strategic use of the prime. Note, nonetheless, that the question of automaticity of priming remains controversial, even in monolingual literature. On the one hand, it can be reasonably assumed that SOAs of 67 and 100 ms with forward masking would prevent the use of an expectancy generation strategy; however, it would not necessarily preclude postlexical checking (Shelton & Martin, 1992). In addition, it is possible that when little processing time is available for the prime word, processing may continue upon presentation of the prime and may be aided in the instance that the two subtend a relationship (Koriat, 1981). When questioned after their participation about the presence of a priming word, our subjects generally claimed not to have detected one, but this only shows that the prime did not receive sufficient attention to be available for later report, and not that it, in fact, went undetected at the time (Holender, 1986). It is important to underline, however, that the possibility that subjects used postlexical checking does not run counter to the contention that processing within the second language was autonomous; in other words, that subjects were not making use of L1 representations in order to aid their decisions. Despite the difference in response times between the monolingual and bilingual subjects, it seems unlikely that the bilinguals were engaging in translation of both prime and target. On the one hand, this would lead to even longer response times and, on the other, the search for a relationship between prime and target in the native language would, in most cases, be unsuccessful. We therefore submit that the present data clearly reveal autonomous processing within the second-language lexicon.

The results reported here belong to a line

of research that has received little attention, namely, the examination of performance within the second language, with a view to discovering the stages by which a second-language learner reaches autonomy. It is assumed, along with most current theories of second-language acquisition, that L2 learning involves at least two concomitant processes. One relates to the gradual lessening of reliance upon the native language while the other involves the gradual development of autonomy within the second language. These two processes have received ample attention as far as grammatical competence is concerned (Selinker, 1992). We believe that the investigation of L2 lexical development requires a similar combination of approaches, all the more necessary as the processes of diminishing reliance on L1 and increasing autonomy in L2 are only partially reciprocal. The development of L2 autonomy does not cause translation links to disappear, and conversely, learners may display L2 autonomy in certain areas while continuing to rely on L1 in others. The precise development of lexical competence in a second language, from the initial exposure to words to their use in time-constrained production, and how that development varies according to the task and material under consideration, raise many questions that still remain to be answered before the various pieces of the puzzle can be assembled. We believe, however, that the data and the approach presented here provide a step in the right direction.

APPENDIX

Lexical Stimuli Presented in Experiment 1

Only related pairs of lexical stimuli are shown. Unrelated pairs were formed by replacing the prime with a word matched in length and frequency to the prime but which bore no relationship to the target.

Antonyms Prime–target	Synonyms Prime–target	Collocations Prime–target
wet–dry	small–little	climb–stairs
day–night	fast–quick	throw–ball

dead–alive	wide–broad	cook–meal
young–old	kill–murder	play–game
open–shut	happy–glad	sweep–floor
always–never	rush–hurry	paint–picture
soft–hard	under–below	lock–door
black–white	speak–talk	build–house
hot–cold	almost–nearly	eat–food
dirty–clean	start–begin	break–window
high–low	answer–reply	wash–hair
strong–weak	stay–remain	read–book
early–late	harm–hurt	save–money
empty–full	coast–shore	wear–hat
pretty–ugly	dozen–twelve	waste–time
better–worse	follow–pursue	pick–flower
thick–thin	fame–glory	greet–friend
before–after	delight–pleasure	raise–child
more–less	purchase–buy	boil–egg
love–hate	attempt–try	believe–story

Lexical stimuli presented in Experiment 2. Each homograph prime is presented with the target word which instantiated the dominant meaning and the subordinate meaning, in that order. All words were presented in lowercase. The word presented in parentheses is the frequency-matched unrelated prime. The first 32 trials were seen at the 300-ms SOA and the last 32 at the 100-ms SOA.

300 ms SOA

Game (hair): winner, shoot
 Cross (teacher): street, worship
 Glasses (swing): eyes, drink
 Fire (late): hot, gun
 Book (floor): read, seat
 Wake (coat): sleep, funeral
 Chop (sofa): meat, wood
 Cold (student): temperature, disease
 Pen (tail): write, sheep
 Litter (pillow): rubbish, puppies
 Lean (swim): thin, tilt
 Ring (sweet): circle, bell
 Stalk (disk): follow, stem
 Yard (clock): measure, garden
 Racket (oven): tennis, noisy
 Novel (shell): read, new
 Scale (travel): climb, fish
 Ruler (squeak): king, measure
 Quarry (pony): stone, hunt

Board (mother): wood, embark
 Duck (hook): fowl, dodge
 Watch (desk): time, look
 Snap (leaf): finger, break
 Strike (wedding): hit, work
 Slide (nest): picture, playground
 Sister (needle): brother, nun
 Swallow (frost): gulp, bird
 Dash (elbow): run, dot
 Mug (weed): container, assault
 Calf (sleeve): cow, leg
 Bill (floor): invoice, beak
 Count (crowd): add, nobility

100 ms SOA

Nail (knot): finger, hammer
 Pick (lake): choose, tool
 Rash (kite): spots, foolish
 Slug (dock): fist, snail
 Flight (weather): airplane, escape
 Light (door): dark, heavy
 Row (cash): oar, line
 Sink (guilt): kitchen, ship
 Arm (heat): leg, weapon
 Company (window): business, guests
 Kid (sea): child, goat
 Limp (trick): hobble, soft
 Bolt (cliff): lock, run
 Drop (wonder): fall, water
 Deck (cat): boat, cards
 Yarn (kick): thread, story
 Hide (lane): conceal, skin
 Key (sky): lock, typewriter
 Blow (gown): air, hit
 Jam (dime): jelly, traffic
 Fence (bread): hedge, sword
 Spring (weight): season, bounce
 Land (wife): earth, airplane
 Tip (mild): waiter, edge
 Bark (doll): tree, dog
 Beam (push): ray, ceiling
 Bunk (hunt): bed, nonsense
 Cover (knife): blanket, shelter
 Skirt (fever): dress, circumvent
 Steer (shoe): drive, cattle
 Bear (cloth): animal, carry
 Right (house): correct, left

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