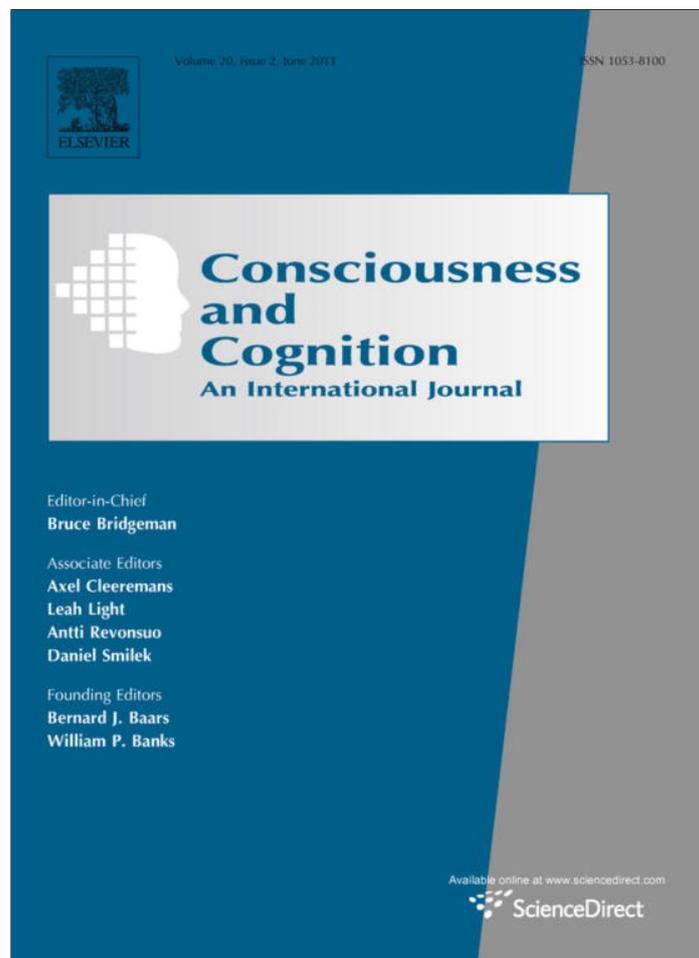


Provided for non-commercial research and education use.  
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/copyright>



Contents lists available at ScienceDirect

# Consciousness and Cognition

journal homepage: [www.elsevier.com/locate/concog](http://www.elsevier.com/locate/concog)

## Short Communication

# Acquisition of conscious and unconscious knowledge of semantic prosody

Xiuyan Guo<sup>a,b</sup>, Li Zheng<sup>a</sup>, Lei Zhu<sup>b</sup>, Zhiliang Yang<sup>a</sup>, Chao Chen<sup>a</sup>, Lei Zhang<sup>a</sup>, Wendy Ma<sup>c</sup>, Zoltan Dienes<sup>d,\*</sup>

<sup>a</sup> School of Psychology and Cognitive Science, East China Normal University, No.3663 North Zhongshan Road, Shanghai 200062, China

<sup>b</sup> Department of Psychology, Fudan University, No. 220 Handan Road, Shanghai 200433, China

<sup>c</sup> Shanghai Residence Office, National Audit Office of the People's Republic of China, China No. 100, Fahuazheng Road, Shanghai 200052, China

<sup>d</sup> School of Psychology, University of Sussex, UK

## ARTICLE INFO

### Article history:

Received 4 February 2010

Available online 16 July 2010

### Keywords:

Semantic prosody

Implicit learning

Unconscious knowledge

Incidental learning

Intentional learning

## ABSTRACT

An experiment explored the acquisition of conscious and unconscious knowledge of semantic prosody in a second language under incidental and intentional learning conditions. Semantic prosody is the conotational coloring of the semantics of a word, largely uncaptured by dictionary definitions. Contrary to some claims in the literature, we revealed that both conscious and unconscious knowledge were involved in the acquisition of semantic prosody. Intentional learning resulted in similar unconscious but more conscious knowledge than incidental learning. The results are discussed in terms of second language learning and the nature of unconscious knowledge.

© 2010 Elsevier Inc. All rights reserved.

## 1. Introduction

A key issue in understanding how people learn a second language is the relative role of conscious and unconscious learning (e.g. DeKeyser, 2003; Ellis, 1994a, 1994b; Ellis et al., 2009; Hulstijn, 2005; Krashen, 1981, 1985; Rieder, 2003; Schmidt, 1990, 1995; Williams, 2004, 2005, 2009). We will consider in particular the relevance of the conscious–unconscious distinction to the acquisition of the semantics of words in a second language. Using studies of the relation of vocabulary acquisition to intelligence and global amnesia, Ellis (1994a) argued that conscious learning is necessarily involved in the acquisition of the semantics of vocabulary. However, this widely-accepted viewpoint was challenged by a number of studies in which amnesia (with an impaired declarative memory system) still allowed intact learning of word meaning. For example, Vargha-Khadem et al. (1997) described three children with global anterograde amnesia who had suffered hippocampal injury early in life. Despite having severe difficulty in remembering episodes of everyday life, they showed normal vocabulary and reading development and considerable academic progress in school lessons. Verfaellie, Koseff, and Alexander (2000) reported that PS, a severely amnesic patient, performed well above chance in a recognition test of word meanings, indicating learning of a novel vocabulary after suffering amnesia. Even with impaired declarative memory, these participants acquired the meaning of novel words, which suggested that the process of abstracting the meaning of words may occur without explicitly recalling episodes of word used in daily experience. That is, learning vocabulary may in part occur implicitly.

Williams (2004, 2005) provided further evidence for both implicit and explicit learning of form–meaning connections. In his 2005 experiments, for instance, the learning materials were sentences containing ‘determiner + noun’ phrases, in which four novel determiners (ne, gi, ro, ul) were used. The appropriate determiner depended on two semantic values, the animacy and distance of the noun. Participants were only informed that the four novel words functioned like the English definite

\* Corresponding author. Address: School of Psychology, University of Sussex, Falmer, Brighton BN1 9QH, UK. Fax: +44 1273 678058.  
E-mail address: [dienes@sussex.ac.uk](mailto:dienes@sussex.ac.uk) (Z. Dienes).

article. They were asked to encode the distance between the speaker and the object. In the training phase, participants were instructed to listen, repeat and form images of the sentences containing these novel articles and nouns. In the test phase, participants selected the most appropriate noun phrase for each sentence from two alternative completions (e.g. *gi cushions/ro cushions*) on the basis of what they had learned during the training phase. Results showed that when asked what criteria they had used to make their choices, only seven of the 24 participants freely reported the relevance of animacy. These participants were thus classified as “aware” by Williams; the remaining 17 participant as “unaware”. Both these groups performed significantly above chance in the subsequent test. Williams’ study suggested that not only explicit but also implicit learning occurs in meaning acquisition when the target semantic feature is implicit in the lexical representation (e.g. the animacy of the noun), and this semantic feature enters into a grammatical agreement with the form (i.e. the form of the novel determiners).

Considering the acquisition of word meaning more generally, Evans (2006, 2009) proposed that word meanings, influenced by situated usage-events, are dependent on the utterance context in which they are embedded. So acquiring the semantic knowledge of a word is neither a one-to-one form-meaning mapping process (Labov, 1973), nor a once-and-for-all learning event, even if some meaning can be temporarily extracted from a single exposure to a word (Horst & Samuelson, 2008). Instead, learners need to abstract meaning of a word from varied instances of its use. Crucial to the meaning of a word is its semantic prosody, which plays a leading role in the integration of a lexical item with its context (Sinclair, 1996). Semantic prosody is a kind of connotational coloring resulting from a given word taking on the affective meaning common to all its typical collocates (surrounding words). It is an obligatory component of the extended meaning of the lexical item (Sinclair, 2004). Prosodies are often positive or negative; that is, the target word is frequently collocated with positive or negative surrounding words, respectively. Prosody thus reflects the attitude of the speaker or writer towards some pragmatic situation (Louw, 2000). For example, the word “cause” may seem to have the simple meaning “to bring about”, but because the word is largely used in contexts in which a negative event has been brought about, the word has a negative semantic prosody. Semantic prosody appears on the face of it inaccessible to a speaker’s conscious introspection (see Xiao & McEnery (2006), for a review). Sinclair (1994) referred to semantic prosody as “subliminal”, believing that we only become aware of it when we see a large number of typical instances at once. Semantic prosody is implicit in natural language, in the sense that it is implied by actual word use, though seldom explicitly articulated. The primary aim of this study was to empirically explore whether semantic prosody is acquired consciously or unconsciously.

Several studies have investigated how incidental versus intentional learning influences the involvement of conscious knowledge in second language vocabulary acquisition (e.g. Hulstijn, 2001, 2003; Laufer & Hulstijn, 2001; Rieder, 2003). Our second aim was to explore whether the contribution of conscious or unconscious knowledge depends on different learning conditions. In our experiment, participants learned semantic prosody under two different conditions: incidental vs. intentional learning (i.e. reading sentences for comprehension vs. finding rules in sentences). In order to rule out pre-experimental knowledge, six target words were replaced by pseudo-word substitutes presented as real words. In the training phase, participants in the read condition were only asked to read and understand sentences containing the target pseudo-words. Participants in the rule search condition were required to find the rule governing use of the target pseudo-words in the same sentences. After training, there was a test phase involving acceptability judgments on new phrases.

In order to facilitate assessment of the conscious status of knowledge, Dienes and Scott (2005) distinguished between “structural knowledge” and “judgment knowledge” (see also Dienes, 2008a; Fu, Dienes, & Fu, 2010; Scott & Dienes, 2008; Scott & Dienes, 2010). When a person reliably makes a judgment, the judgment itself constitutes a particular knowledge content, that is, judgment knowledge. The knowledge of the structure of a domain that enabled the judgment is structural knowledge. Either of them can be conscious or unconscious. Two ways to assess the conscious status of judgment knowledge are the zero-correlation and guessing criteria. If judgment accuracy is above baseline but confidence does not relate to accuracy (zero-correlation criterion) or the participant believes they are guessing (guessing criterion), then judgment knowledge is shown to be unconscious (given some assumptions: Dienes & Perner, 2004). Both criteria are based on forced confidence ratings for each item in the test. Because ratings are taken immediately as a judgment is made, they are more sensitive than post-task free report (as demonstrated by Ziori and Dienes (2006)).

To assess the conscious status of structural knowledge, after each judgment Dienes and Scott (2005) asked subjects to choose from four options to indicate the basis of their judgment: pure guessing, intuition, a rule or rules they could state, or a memory. “Guessing” indicated that they felt their judgment had no basis, just like flipping a coin; “intuition” that they had some confidence in their judgment but absolutely no idea why it was right; “memory” that the judgment was based on a recollection from the training phase; and “rules” that they judged according to a rule or rules obtained in the training stage that they could state if asked. Compared to free report, participants need not report the exact rule, so the procedure is easy to administer and evaluate. Among the four attributions, ‘guess’ and ‘intuition’ are prima facie cases of unconscious structural knowledge and ‘rules’ and ‘memory’ of conscious structural knowledge. If the participant has above-baseline classification performance when attributing the basis of their judgment to guessing or intuition (rules or memory), they have acquired unconscious (conscious) structural knowledge. Dienes (2008a) reviewed evidence that this way of distinguishing conscious and unconscious structural knowledge picks out knowledge types that qualitatively differ in ways theoretically expected (see also Rebuschat, 2008, for an application of these methods to second language learning).

## 2. Method

### 2.1. Participants

Fifty-eight Chinese students (48 women and 10 men) took part. Participant's ages ranged from 20 to 26 years with a mean of 23 ( $SD = 1.6$ ). Each participant received a 10-yuan (about \$1.10) phone card in return for their participation.

Chinese was the native language of all participants, English the second language. Participants were all TEM 8 English certificate holders. TEM 8 is the highest grade among English ability tests specific to China. It is a criterion-referenced test only for English (or related) major undergraduate students, requiring an estimated vocabulary of 11,000 words, and testing language ability in listening, reading, writing, and translating.

The English teachers of the participants reported that semantic prosody was not explicitly taught in class.

### 2.2. Materials

The training phase comprised six target words (with their substitutes) and 48 sentences (see [Appendix A](#)). Each target word was presented in eight sentences so as to exhibit the contextual semantics and collocation of that particular word. The materials were extracted from the following corpora: Brown Corpus (Brown University Standard Corpus) of American English, Freiburg-LOB Corpus (i.e. FLOB, see [Hundt, Sand, & Siemund 1998](#)); British National Corpus (BNC) of British English; Chinese Learner English Corpus (CLEC) of parallel Mandarin Chinese and English from Chinese Learners; and the Beijing Foreign Studies University (BFSU, 2005, one million words) corpus. Except for BNC (World Edition), which has 100 million samples, each of the other corpora contains approximately one million samples of words. Reference was also made to OALD (2002, 2006) and COBUILD (2008).

From the above-mentioned corpora, we selected four verbs, one noun and one adverb that, based on the experimenters' teaching experience and intuition, Chinese learners are prone to collocate unconventionally: promote, cause, enhance, commit, career and totally (e.g. "cause improvement"). Among the selected six words, promote, enhance and career have a positive semantic prosody, and the other three a negative prosody. For example, on the basis of Brown corpus, we found that 91% of the concordances (of 254) of *promote* are positive; and in the FLOB and Brown corpora, 223 (in 287) occurrences of *cause* occur in a negative context. The prosody of all the selected words was determined by a rater of the valence of the collocations of the target words in these corpora.

From the above-mentioned corpora, we chose contextual sentences for the six target words, which were subsequently slightly modified to ensure similarity of difficulty and length. Next we replaced the above-mentioned target words with six pseudo-words to avoid the possible influence of relevant previous knowledge. The six pseudo-words complied with word-form and pronunciation rules of English: slane (cause), lampit (promote), britten (enhance), homear (commit), pooth (career), tinberly (totally). Participants were not informed of the artificial nature of the target words. Finally, to promote "noticing" ([Schmidt, 1990, 2001](#); [Schmidt & Frota, 1986](#)) of relevant features in conscious awareness, we highlighted the target words and collocated words by underlining them.

The materials for the test phase comprised 48 new phrases (6 words X 8 phrases each; see [Appendix B](#)). Four phrases for each target word complied with the collocation rules of semantic prosody ('vernacular') while the other four phrases violated those rules ('non-vernacular'), except for eight phrases with "homear" of which five were vernacular. For slane, homear and tinberly, collocations with negative words were vernacular; while for lampit, britten and pooth, collocations with positive words were vernacular.

### 2.3. Design

The only between-subject independent variable was learning condition, with three levels: read, rule search, and a control condition to serve as baseline. Fifty-eight participants were randomly assigned to the three groups ( $n = 20$  for read group,  $n = 22$  for rule search group and  $n = 16$  for control group). Participants in the control group missed the training phase and directly entered the test phase.

### 2.4. Procedure

All materials were displayed on a computer, programmed in Visual Basic 6.0.

#### 2.4.1. Training phase

Each block consisted of one randomly selected sentence for each target word, for eight blocks in total so that each of the 48 sentences was presented once. Participants were allowed to take a 30-s rest every two blocks. In each block, the sentences were presented in the same random order for each participant, and each sentence was presented individually for 35 s. Participants in the read group were required to understand each sentence by repeating it out loud continuously while thinking about its possible meaning. Participants in the rule search group were required to work out the rules of usage of the underlined phrases. They were informed that each phrase was rule-based and asked to make up 1–3 sentences with the target

words on the answer sheet. Notice both groups were asked to focus on meaning, though degree of elaboration plausibly differed between the groups. The control group entered the test phase directly without any training.

#### 2.4.2. Test phase

After the training phase, participants rested for one minute before the test phase. All groups shared the same test phase.

In test phase, 48 phrases were presented randomly one by one, 5 s for each. Participants completed the following three tasks in turn for each phase:

- (1) *Classification*. Participants judged whether or not the phrase accorded with normal habits of English use (i.e. was 'vernacular'), with a deadline of five seconds. All decisions were made within the deadline.
- (2) *Confidence*. Participants rated their confidence in their classification on a scale (50–100), where 50 indicated no confidence, and 100 indicated complete certainty, with any number in between permitted.
- (3) *Structural knowledge attributions*. Participants chose among categories of "guessing", "intuition", "memory" and "rule". Participants were instructed to use: guessing when they felt their judgment had no basis whatsoever, they may as well flipped a coin; intuition when they had some confidence in their judgment but they had no idea why it was right; memory when the judgment was based on a recollection of training material; and, rules when they chose according to a rule or rules obtained in the training stage that they could state if asked.

### 3. Results

We calculated  $d'$  and  $\beta$  based on hits (vernacular trials judged as vernacular, where 'vernacular' means in accordance with the normal habits of usage) and false alarms (non-vernacular trials judged as vernacular). To deal with the instability in  $d'$  with very high or low hits and false alarms, we corrected all hit and false alarm rates by adding 0.5 to each frequency and dividing by  $N + 1$ , where  $N$  is the number of vernacular or non-vernacular trials respectively (Upton, 1978; Snodgrass & Corwin, 1998). This correction amounts to a prior expectation of a zero  $d'$  and bias worth two observations in total. There was one phrase for "slane" excluded because of a procedural error.

#### 3.1. Overall performance and conscious status of judgment knowledge

Table 1 displays the means (with standard deviations) of overall  $d'$  in three groups. The overall sensitivity of classifications in the read condition was significantly greater than control,  $t(32.35) = 4.99$ , with degrees of freedom corrected for unequal variance, indicating that reading sentences did result in learning semantic prosody. Further, mean  $d'$  for the rule search condition was significantly greater than that of the read condition,  $t(40) = 2.96$ ,  $ps < .05$  with sequential Bonferroni correction.

According to the zero-correlation criterion (Chan, 1992; Dienes, 2008a), we compared the mean confidence of correct and incorrect trials. There was a significant difference between the mean confidence when correct versus incorrect in the rule-search condition,  $t(21) = 3.70$ ,  $p < .01$ , and a one-tailed significant difference in the read condition,  $t(19) = 2.08$ ,  $p < .05$ . Thus, participants were at least to some degree aware of whether their judgments were correct or not, indicating the existence of conscious judgment knowledge. The difference in average confidence when correct versus incorrect differed significantly between the read and rule-search conditions,  $t(32.34) = 2.24$ ,  $p < .05$ , with degrees of freedom corrected for unequal variance, indicating, as expected, more conscious judgment knowledge when people searched for rules rather than learned incidentally. People used the 50% confidence option only 6% of the time in the read group (5% in the rule search group), precluding an analysis of the guessing criterion. It seems judgment knowledge was largely conscious.

#### 3.2. Structural knowledge

We combined guess and intuition as indicators of unconscious structural knowledge (implicit attributions), and memory and rules as indicators of conscious structural knowledge (explicit attributions) (Dienes & Scott, 2005). There was no detectable difference in proportion of implicit attributions between read ( $M = .33$ ,  $SD = .21$ ) and rule search ( $M = .26$ ,  $SD = .21$ ) conditions,  $t(40) = 1.21$ , 95% confidence interval:  $[-.06, .20]$ , consistent with no difference between groups but also with up to 20% more implicit attributions in the read rather than rule search condition (for comparison, Dienes & Scott, 2005, found 10%

**Table 1**

Means with standard deviations of overall  $d'$  and mean confidence of correct and incorrect trails for different conditions ( $M$  ( $SD$ )).

	Overall $d'$	Mean confidence	
		Correct	Incorrect
Read	0.83 (0.71)	75.51 (11.69)	73.96 (11.49)
Rule search	1.50 (0.74)	83.58 (8.70)	75.31 (9.67)
Control	-0.14 (0.45)	67.05 (8.34)	66.83 (9.43)

**Table 2**Means with standard deviations of proportion of different attributions ( $M$  ( $SD$ )).

	Implicit attributions		Explicit attributions	
	Guessing	Intuition	Memory	Rule
Read	0.07 (0.09)	0.26 (0.15)	0.43 (0.23)	0.23 (0.25)
Rule search	0.06 (0.09)	0.20 (0.15)	0.41 (0.27)	0.33 (0.30)
Control	0.18 (0.19)	0.44 (0.20)	0.18 (0.18)	0.20 (0.24)

**Table 3**Means with standard deviations of  $d'$  for different conditions under implicit and explicit attributions ( $M$  ( $SD$ )).

	Implicit attribution	Explicit attribution
Read	0.39 (0.79)	1.02 (0.91)
Rule search	0.53 (0.72)	1.81 (0.93)
Control	-0.22 (0.68)	0.12 (0.92)

more implicit attributions for read rather than rules search with an artificial grammar paradigm; see Dienes (2008b), for the use of confidence intervals in statistical inference). Table 2 shows the overall proportions of the different attributions.

Two of 22 participants in rule search condition did not use guess or intuition, so their data on implicit attributions were excluded from further analysis. Table 3 displays the mean  $d'$  (with standard deviations) for the different conditions. A  $t$ -test on mean  $d'$  for when participants gave implicit attributions revealed no significant difference between read and rule-search conditions,  $t(38) = 0.61$ . A confidence interval on this difference indicated it was consistent with the read condition having more implicit knowledge than the rule search condition by no more than .34  $d'$  units. That is, if rule search impairs implicit learning, it is by no more than this amount. Further, implicit knowledge in the read condition differed significantly from that in control  $t(34) = 2.41$ ; likewise, the level of implicit knowledge in the rule search condition differed from that in the control,  $t(34) = 3.18$ ,  $ps < .05$  with sequential Bonferroni correction, indicating unconscious structural knowledge of semantic prosody in both conditions. For explicit attributions, the mean  $d'$  in the read condition was significantly greater than control,  $t(34) = 3.29$ , and the difference between rule search and read conditions was also significant,  $t(40) = 2.76$ ,  $ps < .05$  with sequential Bonferroni correction, indicating that participants in the rule search condition learned more conscious structural knowledge of semantic prosody than those in the read condition.

#### 4. Discussion

We explored the development of conscious and unconscious knowledge of second language semantics under incidental and intentional learning conditions (cf Rebuschat (2008), for a similar exploration of second language syntax). The motivation for the current experiment was the idea that when words are learned implicitly, plausibly more than just dictionary definitions or close synonyms in other languages are learned as translations. Instead, contextual shadings in meaning (semantic prosody) are acquired. In this experiment, people acquired structural knowledge in the form of knowing the positive or negative prosody of certain target words. Such knowledge was expressed in the ability to judge whether the prosody of certain test phrases was in accord with the learned regularities. This judgment was largely conscious; however, the structural knowledge was in part conscious and in part unconscious.

The implicit learning of semantic prosody in this study appears to contradict the notion that acquisition of L2 word meaning involves only conscious explicit learning (e.g. Ellis, 1994a, 1994b). However, there may be a key difference between learning central rather than detailed contextual meaning. In the first encounter with a word, the acquisition of semantic knowledge involves mapping the word-form in the second language (a new label) onto pre-existing conceptual meanings or onto its translation equivalents (Ellis, 1997). After initially hypothesizing the form-meaning connection, the learner continues to cross validate previous hypotheses in new contexts. The whole process calls for conscious exploitation of one's metacognitive/cognitive strategies. That is, conscious cognitive effort plausibly plays a vital role in the acquisition of the central meaning of words in a second language. However, conscious strategies might be less likely to detect the systematic but less salient probabilistic relationship between the form of the target node word and its implicit attitudinal meaning. Take *cause* in the experiment for example. In the FLOB and Brown corpora, there are 287 instances of *cause* used as a verb, and 223 occurrences of these associates with negative words, suggesting *cause* has a negative semantic prosody (Hunston, 2007). Conversely, *enhance* is frequently (80% of the time) followed by positive words according to the Brown corpus. These connections are strong, but once a person has established a core meaning for a word consciously (e.g. *cause*), they may cease to test more fine-grained hypotheses about the word's use. If implicit learning is based on connectionist networks, fine-grained contextual bases of usage is exactly what would be learned (Cleeremans & Dienes, 2008; McClelland & Rumelhart; 1986).

In our experiment, both unconscious and conscious knowledge were acquired under the incidental learning condition, supporting the viewpoint in the second language learning literature that both implicit and explicit learning mechanisms are involved in incidental vocabulary acquisition (see e.g. Laufer & Hulstijn, 2001). Our results also indicated more explicit knowledge in the rule search rather than read condition, indicating that learning intentionally rather incidentally promotes the conscious acquisition of semantic prosody. This finding both helps validate the method of measuring conscious and unconscious knowledge (see also Rebuschat and Williams (2009), for another application of the method to second language learning) and shows the importance of learners thinking actively about the nature of their second language. Conversely, the roughly equivalent implicit knowledge in the two conditions suggests that implicit learning may operate regardless of whether the person just reads or searches for rules. So, based on this result, pedagogically it seems that intentional rather than incidental learning of semantic prosody would be more effective because it promotes more explicit knowledge yet similar levels of implicit knowledge.

## Appendix A

Materials in the training phase, including six target words (with their substitutes) and 48 sentences (8 sentences per word).

britten (enhance)	<ol style="list-style-type: none"> <li>1. Health services [britten wellbeing] by providing care, reducing distress and pain, and issuing a diagnosis which may provide comfort</li> <li>2. In this way they are seeking to increase their competitiveness and [britten the attractiveness] of their services to purchasers</li> <li>3. It is important to know how to deal with some picky, difficult customers, since A well handled complaint can [britten our company's reputation]</li> <li>4. Such a mechanism, if extensively adopted, could [britten our national ability] to compete with other world-class research communities</li> <li>5. Accordingly, the expanding markets for consumer goods and housing should [britten the general economic prospects] of the Sixties</li> <li>6. The protector, smiling and genial, rode behind his nephews: such excursions did much to [britten his image] as a benevolent and conscientious guardian</li> <li>7. The style of life chosen by the beat generation, the rhythm and ritual they have adopted as uniquely their own, is designed to [britten the value] of the sexual experience</li> <li>8. The style of life chosen by the beat generation, the rhythm and ritual they have adopted as uniquely their own, is designed to [britten the value] of the sexual experience</li> <li>9. The water company is under an obligation to [britten drinking water standards] and is liable to be prosecuted if the improvements haven't been undertaken by 1995</li> </ol>
slane (cause)	<ol style="list-style-type: none"> <li>1. Agents that are known to [slane frequent infections] among laboratory workers such as those [slaning Q fever] and tularemia belong in this category</li> <li>2 For three years our boss kept his elastic patience, and because he knew retaliation could [slane only violent warfare] and disaster to business</li> <li>3. His religious beliefs provide him with plausible explanations for many conditions which [slane him great concern], enabling him to endure fear and suffering</li> <li>4. Indeed, the Belgians discouraged higher education, fearing that the creation of a native intellectual elite might [slane unrest]</li> <li>5. Long-lived carbon-14 from the fusion process would [slane four million childhood deaths and stillbirths] over the next 20 generations</li> <li>6. Military power does not [slane war]; actually, war is the result of mistrust and lack of understanding between people</li> <li>7. Such insects [slane extensive damage] to the flowers, leaves and roots of aquatic plants, not only by feeding on them, but by gathering debris to create protective shelters</li> <li>8. There is no objection to an occasional exhibition, depending on whether your exhibition is likely to [slane traffic congestion] and aggravation to the neighbors!</li> </ol>
tinberly (totally)	<ol style="list-style-type: none"> <li>1. Aircraft are vital to winning a war today because they can perform those missions which a missile is [tinberly incapable] of performing</li> <li>2. Her little speech at yesterday's dinner party was [tinberly out of character] with the sort of person I thought she was</li> <li>3. If a man [tinberly ignorant] of America were to judge our land and his civilization based on Hollywood alone, what conclusions do you think he might come to?</li> </ol>

pooth (career)	<p>4. If you look at the number of games we've had so far this season, it would be [tinberly impractical] for both teams to have played on the same pitch</p> <p>5. It's disappointing to realize that Paul and I are in the kind of business where we are [tinberly detached] from our kids and hardly see them grow up</p> <p>6. The editorial, by omitting the words anti-trust enforcement, [tinberly distorted] Mr. Kennedy's views</p> <p>7. There was something suspicious about the signature and that [tinberly invalidated] the whole will and that didn't please some people</p> <p>8. We're fighting a battle against an enemy who has a [tinberly alien] philosophy to ours. It would be a pretty tough fight</p> <p>1. An [improved clinical pooth] structure would enable nurses to continue the practice of nursing without loss of status to their educational and managerial colleagues</p> <p>2. Jane is the envy of most people. She's a caring wife and mother, with [a successful pooth] as a silversmith and a comfortable home in California</p> <p>3. Love is not initiated by or nurtured upon nice table manners, an even temperament, a [respectable pooth], an observance of the law</p> <p>4. Mary is a distinguished dancer; the seeds of [a dramatic pooth] were first sown while she was at the University of Indiana studying music</p> <p>5. Mr. Dryfoos' [outstanding pooth] as a journalist guarantees that the high standards which have made the Times one of the world's great newspapers will be maintained</p> <p>6. The final achievement of Mr. Brown's [long and interesting mechanical pooth] runs a close second in importance to his development of the universal milling machine</p> <p>7. He manages to combine [stage and film pooth] and switch successfully from high comedy to heart-wrenching drama.</p> <p>8. It is sad to see a young politician's [promising pooth] go down the drain in a personal corruption scandal</p>
lampit (promote)	<p>1. Government must establish greater controls upon corporations so that their activities [lampit what is deemed essential to the national interest]</p> <p>2. Mr. Muawad was quoted in the Syrian daily, al-Thawara, as saying he would work pretty hard to [lampit ties with Syria]</p> <p>3. Radio and television should [lampit the development] of Namibia's cultural heritage through comprehensive coverage of native people's artistic creativity</p> <p>4. Since the Chancellor is not playing with taxes there isn't much for consumers. He has confirmed that he wants to [lampit economic growth]</p> <p>5. Such economic policies are designed to [lampit the efficient allocation] of resources through the encouragement of healthy competition</p> <p>6. The United Nations Charter sets forth standards which, if adhered to, will [lampit peace and justice] throughout the world</p> <p>7. This team is structured to respond swiftly to changing market circumstances, to [lampit employee creativity] and to monitor the effectiveness of our product and marketing strategies</p> <p>8. Yasser Arafat arrived in Jordan yesterday to meet King Hussein as part of the American-backed effort to [lampit Israeli- Palestinian peace talks]</p>
homear (commit)	<p>1. His lunatic uncle was arrested for [homearing assault] on a young boy in a bus. It's a disgrace for the whole family</p> <p>2. I'd rather [homear suicide] instead of living like animals. . . There were hundreds of people in this centre but only two toilets and no running water</p> <p>3. If such a paragon of perfection as Palmer could [homear such a scoring sacrilege], there was no hope left for all</p> <p>4. Marriage is good because it produces better-brought-up children who are less likely to [homear crimes] and thus saves the taxpayer policing bills</p> <p>5. Our cooperation is based on mutual trust. That is, if you [homear any breach] of the contract, our business relationship will be terminated</p> <p>6. The government should watch those members of the medical profession who [homear scientific misconduct] by distorting published evidence in reviews</p> <p>7. There have been some convictions for two men conspiring to [homear armed robbery] or anything of that sort, have there?</p> <p>8. We all suspect that Middle East is a trap and that Israel would [homear a historic error if it took part]</p>

## Appendix B

Materials in the test phase, including six target words (with their substitutes) and 48 phrases (eight phrases per word).

briten (enhance)	briten employee disloyalty briten hatred and distrust briten life quality briten our prestige briten suspicion briten the functions of natural killer cells briten unemployment rate briten women's income	homear (commit)	homear a burglary homear a career blunder homear a favor homear a miracle homear a murder homear a sacrifice homear an investigation homear heroic deeds
lampit (promote)	lampit a constructive evolution of that process lampit a dirty piece of business lampit dependence on social welfare lampit good will abroad lampit hostility between two countries lampit monopoly abuse lampit the environmental restructuring of the region lampit the free enterprise culture within the EC	slane (cause)	slane abolition of slavery  slane complications slane confusion slane economic development slane offence to minorities slane suspicion slane technological innovation
tinberly (totally)	tinberly amazing tinberly correct tinberly immoral tinberly satisfied tinberly separate tinberly unjustified tinberly unprepared tinberly wonderful	pooth (career)	double pooth heavy pooth 1criminal pooth academic pooth managerial pooth pooth burden racing pooth brilliant pooth

## References

- Chan, C. (1992). Implicit cognitive processes: Theoretical issues and applications in computer systems design. Unpublished D.Phil thesis, University of Oxford.
- Cleeremans, A., & Dienes, Z. (2008). Computational models of implicit learning. In R. Sun (Ed.), *Cambridge handbook of computational psychology* (pp. 396–421). Cambridge: Cambridge University Press.
- DeKeyser, R. (2003). Implicit and explicit learning. In C. Doughty & M. Long (Eds.), *Handbook of second language acquisition* (pp. 313–348). Oxford: Blackwell.
- Dienes, Z. (2008a). Subjective measures of unconscious knowledge. *Progress in Brain Research*, 168, 49–64.
- Dienes, Z. (2008b). *Psychology as a science: An introduction to scientific and statistical inference*. Palgrave Macmillan.
- Dienes, Z., & Perner, J. (2004). Assumptions of a subjective measure of consciousness: Three mappings. In R. Gennaro (Ed.), *Higher order theories of consciousness* (pp. 173–199). Amsterdam: John Benjamins Publishers.
- Dienes, Z., & Scott, R. (2005). Measuring unconscious knowledge: Distinguishing structural knowledge and judgment knowledge. *Psychological Research*, 69, 338–351.
- Ellis, N. C. (1994a). Consciousness in second language learning: Psychological perspectives on the role of conscious processes in vocabulary acquisition. *ALL Review*, 11, 37–56.
- Ellis, N. C. (1994b). *Implicit and explicit learning of language*. San Diego: Academic Press.
- Ellis, N. C. (1997). Vocabulary acquisition: Word structure, collocation, word-class and meaning. In N. Schmitt & M. McCarthy (Eds.), *Vocabulary: Description, acquisition and pedagogy* (pp. 133–135). Cambridge: Cambridge University Press.
- Ellis, R., Loewen, S., Elder, C., Erlam, R., Philp, J., & Reinders, H. (2009). *Implicit and Explicit Knowledge in Second Language Learning, Testing and Teaching*. Bristol, England: Multilingual Matters.
- Evans, V. (2006). Lexical concepts, cognitive models, and meaning-construction. *Cognitive Linguistics*, 17, 491–534.
- Evans, V. (2009). *How words mean: Lexical concepts, cognitive models and meaning construction*. New York: Oxford University Press.
- Fu, Q., Dienes, Z., & Fu, X. (2010). The distinction between intuition and guessing in the SRT task generation: A reply to Norman and Price. *Consciousness & Cognition*, 19, 478–480.
- Horst, J. S., & Samuelson, L. K. (2008). Fast mapping but poor retention in 24-month-old infants. *Infancy*, 13, 128–157.
- Hulstijn, J. H. (2001). Intentional and incidental second language vocabulary learning: A reappraisal of elaboration, rehearsal and automaticity. In Peter. Robinson (Ed.), *Cognition and second language instruction* (pp. 258–287). Cambridge: Cambridge University Press.
- Hulstijn, J. H. (2003). Incidental and intentional learning. In C. Doughty & M. H. Long (Eds.), *The handbook of second language research* (pp. 349–381). London: Blackwell.
- Hulstijn, J. H. (2005). Theoretical and empirical issues in the study of implicit and explicit second-language learning. *Studies in Second Language Acquisition*, 27, 129–140.

- Hundt, M., Sand, A., & Siemund, R. (1998). *Manual of information to accompany the Freiburg – LOB Corpus of British English ('FLOB')*. Englisches Seminar: Albert-Ludwigs-Universität Freiburg.
- Hunston, S. (2007). Semantic prosody revisited. *International Journal of Corpus Linguistics*, 12, 249–268.
- Krashen, S. D. (1981). *Second language acquisition and second learning*. Oxford: Pergamon.
- Krashen, S. D. (1985). *The input hypothesis: Issues and Implications*. London; New York: Longman.
- Labov, W. (1973). The boundaries of words and their meanings. In C. J. Bailey & R. Shuy (Eds.), *New ways of analyzing variation in English* (pp. 34–73). Washington, DC: Georgetown University Press.
- Lauffer, B., & Hulstijn, J. (2001). Incidental vocabulary acquisition in a second language: The construct of task-induced involvement. *Applied Linguistics*, 22, 1–26.
- Louw, B. (2000). Contextual prosodic theory: Bringing semantic prosodies to life. In C. Heffer, H. Sauntson, & G. Fox (Eds.), *Words in context: A tribute to John Sinclair on his retirement*. Birmingham: University of Birmingham.
- McClelland, J. L., & Rumelhart, D. E. The PDP research group. (1986). *Parallel distributed processing: Explorations in the microstructure of cognition*. Cambridge, MA: MIT Press.
- Rebuschat, P. (2008). Implicit learning of natural language syntax. Unpublished dissertation. University of Cambridge.
- Rebuschat, P., & Williams, J. (2009). Implicit learning of word order. In N. A. Taatgen & H. van Rijn (Eds.), *Proceedings of the 31th annual conference of the cognitive science society*. Austin, TX: Cognitive Science Society.
- Rieder, A. (2003). Implicit and explicit learning in incidental vocabulary acquisition. *IEWS*, 12, 24–39.
- Schmidt, R. (1990). The role of consciousness in second language learning. *Applied Linguistics*, 11, 129–158.
- Schmidt, R. (1995). *Attention and awareness in foreign language learning*. Hawaii: University of Hawaii Press.
- Schmidt, R. (2001). Attention. In P. Robinson (Ed.), *Cognition and second language instruction* (pp. 3–32). New York: Cambridge University Press.
- Schmidt, R., & Frota, S. (1986). Developing basic conversational ability in a second language: A case study of an adult learner of Portuguese. In R. R. Day (Ed.), *Talking to learn: Conversation in second language acquisition* (pp. 237–326). Rowley, MA: Newbury House.
- Scott, R. B., & Dienes, Z. (2008). The conscious, the unconscious, and familiarity. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, 34, 1264–1288.
- Scott, R. B., & Dienes, Z. (2010). Knowledge applied to new domains: The unconscious succeeds where the conscious fails. *Consciousness & Cognition*, 19, 391–398.
- Sinclair, J. (1994). Trust the text. In M. Coulthard (Ed.), *Advances in written text analysis* (pp. 12–25). London: Routledge.
- Sinclair, J. (1996). The search for units of meaning. *Textus*, 9, 75–106.
- Sinclair, J. (2004). *Trust the text: Language, corpus and discourse*. London: Routledge.
- Snodgrass, G. J., & Corwin, J. (1998). Pragmatics of measuring recognition memory: Applications to dementia and amnesia. *Journal of Experimental Psychology: General*, 117, 34–50.
- Upton, G. J. G. (1978). *The analysis of cross-tabulated data*. Chichester, England: Wiley.
- Vargha-Khadem, F., Gadian, D. G., Watkins, K. E., Connelly, A., Van Paesschen, W., & Mishkin, M. (1997). Differential effects of early hippocampal pathology on episodic and semantic memory. *Science*, 277, 376–380.
- Verfaellie, M., Koseff, P., & Alexander, M. P. (2000). Acquisition of novel semantic information in lesion location. *Neuropsychologia*, 38, 484–492.
- Williams, J. N. (2004). Implicit learning of form-meaning connections. In J. Williams, B. VanPatten, S. Rott, & M. Overstreet (Eds.), *Form meaning connections in second language acquisition* (pp. 203–218). Mahwah, NJ: Lawrence Erlbaum Associates.
- Williams, J. N. (2005). Learning without awareness. *SALL*, 27, 269–304.
- Williams, J. N. (2009). Implicit learning. In W. C. Ritchie & T. K. Bhatia (Eds.), *New handbook of second language acquisition* (pp. 319–353). Emerald Group Publishing Ltd.
- Xiao, R., & McEnery, T. (2006). Collocation, semantic prosody and near synonym: A cross-language perspective. *Applied Linguistics*, 27, 103–129.
- Ziori, E., & Dienes, Z. (2006). Subjective measures of unconscious knowledge of concepts. *Mind & Society*, 5, 105–122.