**Do second language learners always know what they know about L2
collocations? Exploring the acquisition of conscious and unconscious structural
knowledge of L2 collocations**

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Abstract

This study investigated the acquisition of conscious and unconscious structural knowledge of L2 collocations. The participants were two groups of 68 Chinese undergraduate students from the university community. The first group judged the typicality of 24 English collocations and their atypical counterparts and reported the basis of each judgment to indicate their conscious status. The second group were trained on 24 new collocations and then took a similar test. Results showed that learners acquired both conscious and unconscious structural knowledge of L2 collocations. The conscious status varied according to collocation types. Incidental exposure facilitated the development of conscious structural knowledge of incongruent collocations and unconscious structural knowledge of congruent ones. The advantage of congruent over incongruent collocations was greater for unconscious than conscious structural knowledge. The results are consistent with the theory that unconscious structural knowledge is based on acquiring statistical regularities while conscious structural knowledge codes more one-off exceptions.

Key words: conscious and unconscious structural knowledge; second language (L2) collocations; natural language learning

Introduction

In both psychological and linguistic research, the contrast between conscious and unconscious knowledge (also called implicit and explicit knowledge, hereafter used interchangeably) has figured centrally in the debate of how we acquire knowledge (e.g. Cleeremans, 2014; DeKeyser, 2007; Dienes, 2012; Dulany, 1991; N. Ellis, 1994, 2007; R. Ellis *et al.*, 2009; Godfroid, Loewen, Jung, et al., 2015; Janacsek & Nemeth, 2015; Krashen, 1981; Paciorek & Williams, 2015; A. Reber, 1967; Rebuschat, 2015; Shanks, 2005; VanPatten, 1994). Towards addressing the conscious versus unconscious distinction, artificial grammar learning (AGL, A. Reber, 1967) was originally introduced as a task for investigating implicit learning. Compared with AGL, natural language learning presents a different picture. For example, grammatical rules of a natural language can be (approximately) explicitly described (by linguists) while other important aspects like collocations, semantics and pragmatics are difficult to describe or quantify. Relevant research in second language learning primarily focuses on conscious and unconscious knowledge of grammatical rules (e.g. de Graaff, 1997; Paradis, 2009; R. Ellis, 2004, 2005, 2006; R. Ellis et al., 2009; Rebuschat et al., 2013). We will argue that the structures found in natural language provide especially probing material for exploring the relevance of the conscious vs unconscious distinction. In particular, we argue that phraseology has been insufficiently investigated, despite its importance for natural language, and thus it is a key domain in which the conscious versus unconscious distinction can be shown to be critical.

Orthogonal to the conscious versus unconscious distinction is the distinction between judgment knowledge (the knowledge that one knows the structure) versus structural knowledge (the knowledge of structure that enabled that judgment) (Dienes & Scott, 2005; Dienes, 2012). Since successful second language (L2) communication depends more on learners' structural knowledge than on judgment knowledge, research on conscious versus unconscious status of L2 knowledge should pay attention to structural knowledge. Not making the judgment-structural knowledge distinction may lead to claims of conscious knowledge when implicit learning remains relevant because judgment knowledge may be conscious when structural knowledge is unconscious (cf. Sonbul & Schimitt 2013; Toomer & Elgort, 2019).

As they are for L1, multi-word items (MWIs) are also important for second language (L2) learning and communication since they serve as conventional units of meaning and are often accepted as typical of native speakers' communication. Nonetheless, although collocation is widely recognized in L2 acquisition and psychological research, very few studies, to our knowledge, explicitly focus on what, psychologically, contributes to structural knowledge of L2 collocations (where the influence of L1 collocations is minimized) and what role semantic transparency plays in the acquisition of conscious and unconscious structural knowledge of L2 collocations. These questions are closely associated with L2 processing of collocations and thus important for understanding the role of conscious and unconscious processes in language acquisition. The present study involves two experiments, one of which tests L2 learners' conscious and unconscious structural knowledge of collocations, the other exploring the acquisition of these structural knowledge.

Multi-word items in natural languages and L1-L2 congruency

A key factor in naturalness of language use is the pervasive occurrence of multi-word items (MWIs) such as collocations (Hoey, 2005: 3; Kennedy, 2003), which is crucial for the fluency, accuracy and idiomaticity of natural communication (Boers & Lindstromberg, 2009; Ellis, Simpson-Vlach & Maynard, 2008; Grabe & Stroller, 2002; Hunston & Francis, 2000; Sinclair, 1991, 1996). Part of the language proficiency is the users' sensitivity to such recurrent lexical sequences (Sinclair, 2004: 24). L2 learners' knowledge of MWIs has been increasingly studied, primarily by off-line measures such as the observation of the use of collocations in L2 writing and speaking (e.g. Bahns & Eldaw, 1993; Barfield & Gyllstad, 2009; Boers & Lindstromberg, 2009; Granger & Meunier, 2008; Lewis, 2000; Wood, 2010; Paquot, 2014; Lu 2018). Rott (2009) examines how awareness-raising tasks can be used to facilitate the acquisition of formulae in L2. The studies reveal the fact that L2 learners' use of MWIs often deviates considerably from that of native speakers. However, these off-line measures are rather weak in terms of revealing how learners process L2 collocations, especially in terms of their conscious status.

The past decade has witnessed a growing interest in L2 learners' on-line processing of MWIs, where Reaction Time (RT) of form recognition is employed for measurement. For example, by using a lexical decision task based on the word-for-word translations of Chinese idioms (e.g. *draw a snake and add feet*) and their matched controls (e.g. *draw a snake and add hair*), Carrol & Conklin (2014) found that Chinese EFL learners responded to word-for-word translations significantly faster than their matched controls. The finding is echoed in Ueno (2009) and Wolter and Gyllstad (2011). Further, Gyllstad & Wolter (2016) and Wolter & Yamashita (2017) concluded that, for both L1 and advanced L2 speakers, the degree of semantic transparency plays an important role in the processing of L2 collocations. All these differences in RT highlight the facilitative

effect of L1-L2 congruency in form recognition of L2 MWIs, which is viewed as associated with implicit knowledge. The so-called congruency effect is further highlighted by literal vs. figurative meaning contrast (e.g. Siyanova-Chanturia, Conklin & Schmitt 2011a; Carrol & Conklin 2015), which indicates that either congruent collocations (literal meaning) facilitate form recognition or incongruent ones (figurative meaning) slow down the recognition. As there is a large body of collocations between semantically transparent and opaque MWIs, between literal and figurative meanings of MWIs is a large continuum known as collocational meaning. The RT differences between literal vs. figurative meaning processing suggest that collocational meaning has an important role to play in L2 collocational knowledge.

Defining L2 collocations and collocational knowledge

Among the various terms for describing the phenomenon of MWIs (see Boers & Lindstromberg, 2009), “collocation” as a linguistic concept is more systematically developed and thus more widely employed. For example, Firth (1957: 192) states that meaning by collocation is an abstraction at the syntagmatic level. Later on, collocation has been defined from textual, statistical and psychological perspectives (See Partington 1998; Hoey 2005: 3). Currently, it is primarily defined by two broad approaches, namely the statistical approach and the phraseological approach (Wolter & Gyllstad 2011). The former takes such criteria as syntax, semantics and/or pragmatics into account (See Howarth, 1998: 24; Nattinger & DeCarrico, 1992). And the latter defines collocations as co-occurrences of words which occur more frequently than expected by chance (e.g. Sinclair 1991: 170). The statistics involved in the definition include the co-occurring frequency, mutual information (MI), loglikelihood and T/Z-score.

The learning of L2 collocations is particularly susceptible to L1 influence (Carrol & Conklin, 2014; Carrol, Conklin, & Gyllstad, 2016; Wolter & Gyllstad, 2011). And the processing of L2 collocations also concerns the correspondence relationship between L2 collocations and their L1 counterparts at lexical level or only at phrasal level, namely the congruent vs incongruent distinction (cf. Nesselhauf, 2005; Yamashita & Jiang, 2010). Thus, apart from the traditional statistical and phraseological criteria employed in the monolingual context, the definition of collocational knowledge in L2 context should also take L1 influence into account. In the present study, we propose to define an L2 collocation as a lexical sequence with collocational strength of $MI \geq 3$ (See Xiao & McEnery, 2006), expressing specific meaning(s) and function(s) in natural communication. And L2 collocational knowledge is defined as learners' knowledge of L2-specific collocations.

Measuring conscious and unconscious structural knowledge of L2 collocations

Collocational knowledge has been measured by form recall (e.g. Webb & Kagimoto 2011: 268), form recognition (Gyllstad 2007: 108), meaning recall (Webb, Newton, & Chang 2013: 104), meaning recognition (McGavigan 2009) and cloze test (Schmitt et al. 2004: 73). Since such formats are closely associated with or frequently employed in teaching practice, we call them pedagogically-oriented measurement. When subjects achieve high accuracy in such cases, it largely reflects that they know consciously which sequences are typical collocations (Sonbul & Schmitt, 2013; Toomer & Elgort, 2019, where form recognition and form recall were employed to measure explicit collocational knowledge).

Besides, psycholinguistic techniques like reaction time (RT) are increasingly used in measuring learners' knowledge of MWIs either by priming or by eye-tracking. When

the subjects are sensitive to target MWIs, the RT will be faster and the facilitation is attributed to their knowledge of relevant sequences. RT effects are generally supposed to be associated with unconscious or implicit knowledge (See Carrol & Conklin 2014, 2015; Gyllstad & Wolter 2016; Siyanova-Chanturia, et al. 2011a, b; Ueno 2009; Wolter & Gyllstad 2011; Sonbul & Schimit 2013; Wolter & Yamashita 2017; Tommer & Elgort 2019).

Nonetheless, the RT formats (especially by lexical decision task, LDT) as an approach to measuring unconscious or implicit L2 collocational knowledge can be problematic. First, EFL learners' knowledge of L2 MWIs can be greatly affected by their L1 but the influence is hard to calculate or filter, as shown by the congruency effect in Carrol & Conklin (2013, 2014), Ueno (2009) and Lu & Wei (2018). Second, RT (particularly by LDT) is more sensitive to the processing of word forms than to that of collocational meaning, which makes it not adequate for determining the conscious status of L2 collocational knowledge. Further, RT and other indirect measures do not directly address the conscious vs unconscious distinction, as conscious knowledge can be associated with RT benefits both in principle and empirically (Vadillo, Linssen, Orgaz, Parsons, & Shanks, 2020). Thus, what is needed are measures directly motivated by theories of consciousness (Dienes & Seth, 2010).

The two main classes of theories of consciousness that have particularly influenced behavioural research are global workspace theories and higher order theories (Dehaene, Lau, & Kouider, 2017; Michel et al., 2018). According to higher order theories (e.g. Brown, Lau, & LeDoux, 2019; Rosenthal, 2005), a mental state is conscious if we are aware of being in that state; awareness of being in a state consists of having a higher order state asserting one is in the lower order state (different theories may postulate slightly variant higher order content, e.g. Fleming, 2020). According to global

workspace theories, a state is conscious if its content is globally broadcast to whichever processors might find that content relevant (Baars & Alonzi, 2018; Dehaene, 2014). Thus, both higher order and global broadcast theories postulate that conscious contents will go with the ability to report such states subjectively. Recent developments extending the predictive processing framework to consciousness also postulate that the experience of a conscious state consists in modeling the existence of that state (Clark, 2019), thereby leading to the same theoretical connection between a state experienced as conscious and the ability to report it.

In claiming conscious knowledge, one must be clear just what content is claimed to be conscious. Even when subjects claim that they do not know they still can achieve significantly high accuracy rate by guessing, suggesting unconscious knowledge (Dienes & Scott 2005). In this case, they naturally do not know what they know so both the judgment and the structural knowledge are unconscious (compare the “I don’t know” option in some studies, e.g. Sonbul & Schmitt 2013; Tommer & Elgort 2019). In cases where subjects know that they know, namely judgment knowledge is conscious, it is still possible that they do not know what they know (to use the phrases of Reber, 1989). A typical example is one’s L1 knowledge. A credible method for assessing the conscious or unconscious status of knowledge should involve measuring the existence of higher order thoughts relevant to the content being assessed (i.e. judgment vs structural knowledge).

Subjects can be required to judge whether they know specific structures and then report their basis of the judgment by choosing from a set of attribution categories such as Random (Guess), Intuition, Familiarity, Memory and Rule (for previous use of these source attributions see e.g. Jurchiş, Costea, Dienes et al. in press; Kemeny, & Luckacs, 2013; Li, Guo, Zhu et al. 2013; Ling, Guo, Zheng, et al. 2015; Maie & Dekeyser, 2019;

Mealor & Dienes, 2013; Neil, & Higham, 2012; Norman & Price, 2012; Norman, Scott, Price et al., 2016; Rebuschat, Hamrick, Riestenberg et al. 2015; Rogers, Revesz, & Rebuschat, 2016; Waroquier, Abadie, & Dienes, in press; Ziori & Dienes, 2015). By Random, we mean that the subject believes that the judgment had no basis whatsoever; Intuition, the judgment had some basis but the subject had no idea what it was; Familiarity, the decision was based on a feeling of familiarity, or its absence, but the subject had no idea on what the familiarity itself was based; Memory, the basis of judgment was a recollection of an item or items or part(s) of the item(s) from training or learning, or its absence; and Rule, the basis of judgment was a rule or rules that the subject could state if asked.

Performance above baseline suggests that the subjects have some knowledge of relevant structures and the following logical relationships can be concluded. When the judgment is accompanied by a Random attribution, the subjects do not know that they have any relevant knowledge and therefore both judgment and structural knowledge are unconscious. Similarly, a judgment accompanied by Intuition or Familiarity attributions suggests that the subjects know that they have knowledge (conscious judgment knowledge) but they are not conscious of what they know (unconscious structural knowledge). Finally, when the judgment is accompanied by Memory or Rule attributions, both judgment and structural knowledge are conscious. Compared with the objective measures for gauging collocational knowledge as reviewed above, subjective judgment can be based on learners' understanding of semantic or/and pragmatic aspects of a natural language. That is, it takes into account the qualitative and functional aspects of linguistic knowledge (cf. Maie & Dekeyser 2019: 19).

Different mechanisms for consciously and unconsciously learning structure

If implicit versus explicit learning relates wholes to parts by different mechanisms (e.g. connectionist vs hypothesis testing/episodic memory; Cleeremans & Dienes, 2008), congruent versus incongruent collocations may differentially engage conscious vs unconscious structural knowledge. For example, L1 associations may help the learning of corresponding L2 ones even implicitly (cf Dienes, Altmann, & Gao, 1999; Thierry, & Wu, 2007); that is, transparency or congruency might aid unconscious as well as conscious structural knowledge. Conversely, odd L2 associations may be striking and by their very oddness aid recognition explicitly (Greve, Cooper, Tibon, & Henson, 2019; Sakamoto & Love, 2004; cf. Elgort, 2011). While transparency should aid both conscious and unconscious structural knowledge according to models of each (e.g. connectionist vs hypothesis testing), oddness or rule violations have been argued to help explicit memory, but do not play a helpful role in any of the models of implicit learning reviewed in Cleeremans and Dienes. Models of implicit learning as currently postulated acquire and use long term regularities (e.g. Zhang et al., 2020). That is, the advantage of transparency over incongruent collocations should be less for conscious than unconscious structural knowledge.

THE STUDY

The present study consisted of two experiments. They were intended to throw light on the conscious status of the structural knowledge of L2 collocations by addressing the following research questions.

- 1) To what extent do L2 learners have conscious and unconscious structural knowledge of L2 collocations?
- 2) How does incidental learning through exposure contribute to the acquisition of conscious and unconscious structural knowledge of L2 collocations?

3) What factors contribute to learners' conscious and unconscious structural knowledge of L2 collocations? Specifically, assuming oddness favours especially conscious rather than unconscious structural knowledge, is the congruent versus incongruent distinction especially associated with unconscious rather than conscious structural knowledge?

Experiment 1

Method

Participants

Sixty-eight Chinese undergraduate students (37 female and 31 male) from the university community participated in Experiment 1. Each participant received CNY ¥10 (about US\$1.5) in return for their participation in the experiments. They ranged from 18 to 20 years in age with a mean of 18.6 ($SD = 0.69$). Their native language was Chinese. They had all learned English for at least 9 years and passed a national College English Test Band-4 (CET-4) with comparatively high scores (mean score of 515.89 out of 710, $SD=39.80$). CET-4 is a norm-referenced English proficiency test for English learners in Chinese universities, requiring an estimated vocabulary of 4,500-5,500 words and testing language ability in listening, reading, writing, and translating. The mean 515.89 is at the 58th percentile of Chinese College English Learners' Proficiency Norm. Thus, the subjects were representative of the English learning population of Chinese college students.

Materials

In Experiment 1, 24 English collocations and 24 atypical sequences were employed for testing (see Appendix A). The collocations were the lexical sequences

judged as conventionally used in native English by well-educated native speakers and had relatively strong collocational strength (e.g. of $MI \geq 3$ by British National Corpus (BNC)). Among them, there were 12 VP+NP and 12 Adj+NP collocations, which were two leading patterns in English (See Hunston & Francis, 2000). And each subgroup consisted of 6 congruent collocations and 6 incongruent ones (see Table 1). The direct translation of each congruent collocation would yield an equivalent sequence typical of Chinese while an incongruent collocation would produce an acceptable or inequivalent Chinese sequence.

These collocations were chosen partly because a confusing atypical counterpart could be created for each of them (e.g. *take medicine* vs. *eat medicine**, *master skill* vs. *grasp skill**). Such atypical sequences were seldom or never used in native English and were regarded as unusual or atypical by 2 well-educated native speakers. Nonetheless, the difference from their typical counterparts is not clearly discernable to Chinese EFL learners as each pair shared the same Chinese translations, which helped to cancel out the influence of Chinese equivalents in typicality judgment. All words involved in the sequences were high frequency ones and fell within the scope of the participants' proficiency.

TABLE 1. Congruent and incongruent collocations used in Experiment 1

Congruent Collocation				Incongruent Collocation			
Adj+NP	MI	VP+NP	MI	Adj+NP	MI	VP+NP	MI
a private car	4.24	grasp meaning	7.75	heavy smoker	9.41	fly a plane	6.11
fast speed	6.02	have the courage	3.43	warm welcome	11.28	make a mistake	7.18
heated discussion	7.67	make breakfast	3.76	black tea	3.12	take effect	3.00
personal safety	5.23	master skills	7.25	heavy rain	8.77	take medicine	3.25
high price	5.70	acquire knowledge	7.37	small population	3.38	*take years	1.47
powerful car	3.03	prepare for life	3.85	strong tea	4.46	be in good mood	3.55

Note: *Take years* as a sequence occurs frequently (about 800 times in BNC) and is well accepted as a collocation. But as *take* (particularly for the delexicalized use) and *year* occur highly frequently, the MI score is rather low.

Testing phase

In testing, the 48 lexical sequences were presented randomly one by one on a computer, programmed in E-prime 2.0. Participants were required to complete the following two tasks in turn for each sequence:

(1) Classification. The task was to decide whether a test item was a collocation or an atypical sequence in English.

(2) Structural knowledge attributions. After classifying each sequence, participants were required to identify the basis of their judgment by choosing among “Guessing”, “Feeling (Intuition/Familiarity)”, “Memory/Rule” (See Dienes & Scott, 2005).

Before testing, the participants were trained to identify English collocations from atypical sequences by extra examples. An English collocation here refers to a typical sequence, which sounds natural, conveys idiomatic meaning(s), and is frequently used in native English. An atypical sequence, though literally interpretable, does not sound natural or idiomatic and is never or seldom used in native English. Then, they were instructed in a pilot experiment that “Guessing” was chosen when they felt their judgment had no basis whatsoever; “Intuition/Familiarity” referred to the situation when they had some confidence in their judgment but had no idea why it was right, they just had a feeling of intuition or familiarity; “Memory” meant that they recollected that target sequence was or was not learnt, taught or memorized as typical or atypical previously; and “Rule” referred to the situation when they made a judgment according to a rule or rules obtained in English learning. The rule or rules here primarily referred to such preferred patterns that words tend to collocate words sharing certain semantic features and lexical co-occurrences tend to express certain idiomatic attitudinal meanings in natural communication. As “Intuition” and “Familiarity” may be hard to

distinguish and both indicate the conscious judgment knowledge and unconscious structural knowledge, we combined them into one broader category and denoted them as “Feeling”. Similarly, both “Memory” and “Rule” are combined into one category (denoted as “Memory/Rule”). The relevant criteria were easily mastered by all participants by going through the practice items.

Results

Five of the 68 participants did not use Feeling or Memory/Rule in Experiment 1, so their data were excluded from further analysis. We calculated d' based on hits (typical trials judged as typical), false alarms (atypical trials judged as typical), misses (typical trials judged as atypical) and correct rejections (atypical trials regarded as atypical). As perfect accuracy implies an infinite d' , in order to avoid infinite values, we added 0.5 to *all* data cells (namely hit, false alarm, miss, and correct rejection) regardless of whether zeroes were present (see also Guo et al., 2011; Upton, 1978). The strategy implements a unit information prior (Kass & Wasserman, 1995), corresponding to the belief that with approximately 95% probability the hit and false alarm rates lie between 0.05 and 0.95; that with 95% probability d' lies between ± 3 (Barrett, Dienes & Seth, 2014).

Bayes factors (B) were used to assess strength of evidence for the alternative hypothesis, H_1 , over the null, H_0 (Wagenmakers et al., 2017; for the use of Bayes factors in implicit cognition research, see Dienes, 2015; Sand & Nilsson, 2016). A B of above 3 indicates moderate evidence for H_1 over H_0 and below 1/3 moderate evidence for the H_0 over H_1 . All Bayes factors, B , reported here represent the evidence for H_1 relative to H_0 ; to find the evidence for H_0 relative to H_1 , take $1/B$. B s between 3 and 1/3 indicate data insensitivity (see Dienes, 2014; cf Jeffreys, 1939). Here, $B_{H(0,x)}$ refers to a Bayes factor in which the predictions of H_1 were modeled as a half-normal

distribution with an SD of x (see Dienes, 2014); the half-normal can be used when a theory makes a directional prediction where x scales the size of effect that could be expected. For testing differences between d' , we set x to be the average d' across all conditions (cf. Ziori & Dienes, 2015). To indicate the robustness of Bayesian conclusions, for each B, a Robustness Region is reported, giving the range of scale factors (SDS of the half-normal) that qualitatively support the same conclusion (i.e. evidence as supporting H0, or as supporting H1, or there not being much evidence at all), notated as: $RRB > 3[x1, x2]$ where $x1$ is the smallest SD that gives the same conclusion and $x2$ is the largest; or $RRB < 1/3[x1, x2]$; or $RR1/3 < B < 3[x1, x2]$ (Dienes, in press).

The proportions of different attributions and d' for congruent and incongruent collocations are presented in Table 2 and Table 3 respectively.

**TABLE 2. Proportions of Guessing, Feeling and Memory/Rule attributions:
Means with standard deviations (M (SD))**

	Congruent			Incongruent		
	Guessing	Feeling	Memory/Rule	Guessing	feeling	Memory/Rule
Mean	0.14	0.36	0.50	0.12	0.31	0.57
(SD)	(0.16)	(0.16)	(0.23)	(0.14)	(0.15)	(0.18)

TABLE 3. d' for Guessing, Feeling and Memory/Rule attributions (Mean (SD)).

**“95% CI” is a 95% credibility interval based on a uniform prior, i.e.
equivalently, a 95% confidence interval.**

Congruent			Incongruent		
Guessing	Feeling	Memory /Rule	Guessing	Feeling	Memory /Rule

Mean	0.01	0.62	0.98	-0.02	0.15	0.90
(SD)	(0.76)	(0.80)	(0.68)	(0.81)	(0.89)	(0.67)
95% CI	-.24, .25	.42, .83	.81, 1.15	-.27, .24	-.07, .38	.73, 1.07

As shown in Table 3, compared with Feeling and Memory/Rule, Guessing accounts for a small proportion of responses. Following Meador and Dienes (2013), we distinguished conscious from unconscious structural knowledge (with judgment knowledge conscious in both cases) by contrasting Feelings vs Memory/Rule attributions. A repeated-measures ANOVA was employed and the data were verified to meet the assumptions for an ANOVA, with normality of variance tested by the Shapiro–Wilk test, ranging from .254 to .922 (all p -values $> .05$). A 2 (structural knowledge: conscious vs unconscious) X 2 (collocation type: congruent vs incongruent) ANOVA on d' indicated evidence for a main effect of structural knowledge, $F(1, 61) = 32.10$, $p < .001$, $\eta_p^2 = .345$, $B_{H(0, 0.70)} = 1.90 \times 10^6$, $RR_{B>3} [0.02, 194.33]$, that is, accuracy was higher when structural knowledge was conscious rather than unconscious (mean difference = 0.94 vs 0.39 = 0.55 d' units); evidence for a main effect of collocation type, $F(1, 61) = 10.18$, $p = .002$, $\eta_p^2 = .143$, $B_{H(0, 0.70)} = 36.27$, $RR_{B>3} [0.03, 9.16]$, that is, accuracy was higher for congruent rather than incongruent collocations (mean difference = 0.80 vs 0.53 = 0.27 d' units); and evidence for an interaction, $F(1, 61) = 4.31$, $p = .042$, $\eta_p^2 = .066$, $B_{H(0, 0.70)} = 3.61$, $RR_{B>3} [0.14, 1.01]$, that is the difference in unconscious structural knowledge between congruent and incongruent was greater than the difference in conscious structural knowledge (0.47 vs 0.06 = 0.41 d' units).

In fact, there was evidence for a difference in unconscious structural knowledge between congruent vs incongruent collocation types (mean difference = 0.62 vs 0.15 = 0.47 d' units), $t(123) = 3.12$, $p = .002$, $r = .27$, $B_{H(0, 0.70)} = 44.12$, $RR_{B>3} [0.0575, 13.02]$;

but for conscious structural knowledge, there was evidence for no difference between the two collocation types (mean difference = 0.98 vs 0.90 = 0.08 d' units), $t(123) = .64$, $p = .521$, $r = .06$ $B_{H(0, 0.70)} = 0.27$, $RR_{B < 1/3} [0.56, \infty]$.

Discussion for experiment 1

Experiment 1 shows that learners have both conscious and unconscious structural knowledge of English collocations, with conscious structural knowledge being the dominant part. Knowledge can be implicit in that one is not aware that one judges correctly (unconscious judgment knowledge) or one is not aware of the structural knowledge that enabled the judgment (unconscious structural knowledge) (Dienes & Scott, 2005). For when participants thought they were completely guessing in the judgment of L2 collocations, the estimated sensitivity (d') was not likely larger than about 0.20, and likely rather smaller. That is, unconscious judgment knowledge was at best small in magnitude. In contrast, the estimated sensitivity of knowledge associated with Feeling and Memory/Rule was about 0.4 and 0.9 respectively, indicating substantial conscious judgment knowledge. In the case of judgment by Feeling, they can identify typical sequences from atypical ones with a rather high accuracy but do not know why, indicating unconscious structural knowledge of L2 collocations. Meanwhile, in the judgment by Memory/Rule, they know why the target sequences are typical or atypical, indicating conscious structural knowledge. Further, the contrast between conscious and unconscious structural knowledge (0.94 vs 0.39 = 0.55 d' units) suggests that learners' structural knowledge of L2 collocations is largely conscious.

Further, data also suggests that congruent and incongruent collocations contribute differently to learners' conscious and unconscious structural knowledge of L2

collocations, with congruent collocations playing a leading role in the contribution. The interaction between collocation types (congruent vs incongruent) and structural knowledge (conscious vs unconscious) shows that the difference between learners' conscious and unconscious knowledge of L2 collocations varies considerably according to collocation types. To be specific, learners have little unconscious knowledge of incongruent collocations when compared with congruent ones (0.15 vs $0.62=0.47$ d' units) but have similar amount of conscious knowledge of both types of collocations (0.90 vs $0.98=0.08$ d' units). The contrast between congruent and incongruent collocations in d' suggests that the two types of collocations contribute differently to learners' structural knowledge of L2 collocations, with congruent ones playing a leading part (0.80 vs $0.53 = 0.27$ d' units). That is, congruent collocations are largely responsible for learners' knowledge of L2 collocations, particularly in terms of unconscious knowledge. Thus, the greater difference between unconscious rather than conscious knowledge for incongruent rather than congruent collocations supports models of implicit learning that accumulate statistical regularities (Cleeremans & Dienes, 2008) leaving a role for conscious knowledge in coding more one-off exceptions. Consistent with this claim, the statistical regularities may arise both from L1 and L2; but conscious work has to be done to sort out what is an exception. An alternative interpretation could be that the congruent collocations benefit from unconscious co-activation of L1 equivalent, increasing the feeling of familiarity. Incongruent collocations require explicit memory of usage in English (See Thierry & Wu 2007).

Experiment 2

In Experiment 2, we trained subjects on new collocations in order to determine whether the difference between congruent and incongruent collocations found in

Experiment 1 still held in the process of learning.

Method

Participants

A second group of sixty-eight Chinese undergraduate students (39 female and 29 male) from the university community took part in Experiment 2. They are largely equivalent to those in Experiment 1, ranging in age from 18 to 20 years with a mean of 18.50 (SD = 0.70). Their CET-4 score mean was 516.47 out of total 710 (SD=37.81), also near the 58th percentile of Chinese College English Learners' Proficiency Norm.

Materials

Experiment 2 also comprised 24 collocations (12 congruent and 12 incongruent ones) (see Table 4) and 24 atypical sequences, which were structured in the same way as in Experiment 1 (see Appendix B). According to a pilot study, the collocations are largely new to learners at the participants' proficiency level. They could understand the incongruent collocations literally but had considerable difficulty in understanding their conventional meanings. Further, 96 sentences were chosen from BNC for training in Experiment Class, each containing a target collocation and each target collocation occurring four times in four separate sentences. The sentences used for Control Class were the same as or equivalent to those used in Experiment Class except that the target collocation in each sentence was replaced by a non-target sequence (expressing the same or similar meaning).

TABLE 4. Congruent and incongruent collocations used in Experiment 2.

Congruent Collocation				Incongruent Collocation			
Adj+NP	MI	VP+NP	MI	Adj+NP	MI	VP+NP	MI
recent case	4.11	increase ability	4.10	narrow escape	8.06	hit the headline	9.13
smart suit	9.29	admit defeat	6.79	live wire	8.45	perform a service	4.81

intelligent beings	8.82	bake cake	10.00	a close shave	8.15	read meter	5.71
leather shoes	8.29	gain weight	6.59	a tight spot	6.89	break the news	6.48
modern society	6.68	boil water	10.10	heavy price	3.92	catch attention	6.09
private collector	8.31	establish bases	5.87	corner stone	3.51	take the lead	5.50

Training phase

The 68 participants were randomly assigned to the Experiment Class and the Control Class, 34 for each class. In both classes, participants were required to work in pairs to read aloud and then interpret 96 sentences one by one. Each sentence appeared on the screen for 60 seconds, followed by a 10-second blank screen for a break. The 96 sentences were evenly distributed according to the 24 collocations or the relevant substitute sequences. Some complex sentences were partly simplified. In order to minimize the effect of fatigue and also to improve the natural language learning context through repeated encounter, the reading and interpreting task was equally divided into 4 sessions (once a week).

Testing phase

Testing was administered 3 weeks after training was completed, which helped to minimize recency effects and also to explore learners' implicit learning over relatively useful time spans. In testing, 48 lexical sequences were presented randomly on computer screen one by one, including 24 collocations and 24 atypical sequences as distracters. Participants were required to complete the same testing tasks (namely Classification and Structural knowledge attribution) as those in Experiment 1.

Results of Experiment 2

In Experiment 2, 2 participants did not use the judgment by Feeling or

Memory/Rule and the data were excluded from further analysis.

A mixed-design ANOVA was then employed to answer the research questions. The data were verified to meet the assumptions for an ANOVA, with normality of variance tested by the Shapiro–Wilk test, ranging from **.055 to .998**, and equality of variance tested by Levene’s test, ranging from .120 to .980 (all p-values>.05).

TABLE 5. Proportion of Guessing, Feeling and Memory/Rule attributions: Means with standard deviations (M (SD))

	Congruent			Incongruent		
	Guessing	Feeling	Memory/Rule	Guessing	Feeling	Memory/Rule
Control	0.17	0.42	0.44	0.23	0.41	0.42
Class	(0.14)	(0.22)	(0.22)	(0.13)	(0.24)	(0.21)
Experiment	0.14	0.32	0.57	0.21	0.37	0.45
Class	(0.10)	(0.13)	(0.17)	(0.10)	(0.14)	(0.14)

TABLE 6. Accuracy in d’ for Guessing, Feeling and Memory/Rule attributions

		Congruent			Incongruent		
		Guessing	Feeling	Memory /Rule	Guessing	Feeling	Memory /Rule
Control	Mean	0.27	0.48	1.05	-0.12	0.15	0.79
	(SD)	(0.76)	(0.73)	(0.87)	(0.8)	(0.58)	(0.39)
	95%	-0.02	0.22	0.75	-0.45	-0.05	0.66
	CI	0.56	0.73	1.35	0.21	0.35	0.93
Experiment	Mean	0.10	0.93	1.06	-0.08	0.35	1.16
	(SD)	(0.92)	(0.65)	(0.55)	(0.8)	(0.66)	(0.57)
	95%	-0.28	0.7	0.86	-0.39	0.11	0.96
	CI	0.48	1.16	1.26	0.24	0.59	1.37

Tables 5 and 6 show that, compared with Feeling and Memory/Rule attributions,

the Guessing attribution was far less often used and the d' primes by Guessing are low. The distribution again suggests that, in the case of examining L2 collocational knowledge, it is useful to look at the conscious vs. unconscious contrast of structural knowledge given conscious judgment knowledge. Thus, we again distinguished conscious from unconscious structural knowledge by contrasting Feeling vs Memory/Rule attributions in the analysis of Experiment 2.

A 2 (structural knowledge: conscious vs unconscious) X 2 (collocation type: congruent vs incongruent) X 2 (training: control vs trained classes) mixed ANOVA on d' was performed. The results indicated evidence for a main effect of training on accuracy, $F(1, 64)=10.48, p=.002, \eta_p^2=0.14, B_{H(0, 0.75)}=37.84, RR_{B>3} [0.029, 10.1]$ (mean difference =0.62 vs 0.88=0.26 d' units); evidence for a main effect of structural knowledge, $F(1, 64)=39.56, p=.000, \eta_p^2=0.38, B_{H(0, 0.8)}=6.86 \times 10^7, RR_{B>3} [0.015, 196.1]$ with conscious knowledge higher than unconscious structural knowledge (mean difference = 1.02 vs 0.48 = 0.54 d' units); and evidence for a main effect of collocation type, $F(1, 64)=11.78, p=.001, \eta_p^2=0.16, B_{H(0, 0.75)}=70.70, RR_{B>3} [0.027, 18.9]$. Also, there was evidence for the interaction between collocation type and structural knowledge, $F(1, 64)=6.95, \eta_p^2=0.10, p=.011, B_{H(0, 0.75)}=10.72, RR_{B>3} [0.069, 3.1]$ (mean difference= 0.38 d' units) but there was no evidence one way or the other for an interaction either between collocation type and training, $F(1, 64)=.69, p=.411, \eta_p^2=.01, B_{H(0, 0.75)}=0.60, RR_{1/3<B<3} [0, 1.6]$ (mean difference=0.18 d' units) or between structural knowledge and training, $F(1, 64)=.14, p=.705, \eta_p^2=0.00, B_{H(0, 0.75)}=0.60, RR_{1/3<B<3} [0, 1.68]$ (mean difference = 0.14 d' units). There was evidence for the three-way interaction, $F(1, 64)=4.48, p=.038, \eta_p^2=0.07, B_{H(0, 0.75)}=4.93, RR_{B>3} [0.2, 1.63]$ (mean difference =0.61 d' units).

To interpret the three-way interaction, it was first decomposed into the collocation

type (incongruent vs congruent) by structural knowledge (conscious vs unconscious) partial two-way interactions for the control and trained groups separately. For the control group, there was evidence for no difference between incongruent and congruent in conscious structural knowledge and the corresponding difference in unconscious structural knowledge [$F(1, 64) = 0.24, p = .711, \eta_p^2 = 0.00, B_{H(0, 0.75)} = 0.29$], $RR_{B < 1/3} [0.69, \infty]$ (mean difference = 0.07 d' units). In fact, the control group appeared to use conscious rules or memory predominantly, resulting in good performance for conscious collocational knowledge, but poor performance otherwise.

For the trained group, in contrast, there was evidence for the partial interaction, [$F(1, 64) = 10.96, p = .002, \eta_p^2 = 0.15, B_{H(0, 0.75)} = 86.39, RR_{B > 3} [0.073, 32.7]$], that is, the difference in conscious structural knowledge between incongruent and congruent was greater than the difference in unconscious structural knowledge (mean difference = 0.68 d' units). This interaction is the crucial one that we found in Experiment 1. And note that means go in exactly the predicted direction. For conscious structural knowledge, there was almost good enough evidence for no difference between incongruent and congruent collocations, [$F(1, 64) = .66, p = 0.419, \eta_p^2 = 0.01, 1.16$ vs. $1.06 = 0.1 d'$ units, $B_{H(0, 0.75)} = 0.35, RR_{1/3 < B < 3} [0, 0.9]$], but for unconscious knowledge there was evidence for a difference between congruent and incongruent collocations [$F(1, 64) = 11.80, p = .001, \eta_p^2 = 0.16, B_{H(0, 0.39)} = 120.58, RR_{B > 3} [0.057, 41]$] (0.93 vs. $0.35 = 0.58 d'$). So the three-way interaction shows that training moved subjects in the direction of structural knowledge by collocation type interaction we observed in Experiment 1.

Second, a 2 (control vs trained) X 2 (conscious vs unconscious) partial two-way interactions were performed for incongruent and congruent collocations separately. There was not evidence for the partial interaction for either congruent collocations [$F(1, 64) = 3.16, p = .080, \eta_p^2 = 0.05, B_{H(0, 0.75)} = 2.49, RR_{1/3 < B < 3} [0, 0.31; 0.48, 7]$] nor for

incongruent collocations, $[F(1, 64)=0.71, p=.402, \eta_p^2=0.01, B_{H(0, 0.75)}=0.57, RR_{1/3<B<3}[0, 1.5]]$.

Finally, a 2 (control vs trained) X 2 (incongruent vs congruent) partial interactions were performed for conscious vs unconscious knowledge separately. For the conscious knowledge there was almost good enough evidence for the partial interaction, $[F(1, 64)=3.88, p=.053, \eta_p^2=0.06, B_{H(0, 0.75)}=2.88, RR_{1/3<B<3}[0, 0.15; 0.71, 7.5]]$, that is, the difference in incongruent collocations between control vs trained groups was greater than the difference in congruent ones $(1.05-0.79)-(1.06-1.16) = 0.36 d'$ units). In particular, there was evidence for a difference in the conscious structural knowledge of incongruent collocations between the trained and control groups, $[F(1, 66)=9.48, p=.003, \eta_p^2=0.13, (1.16 \text{ vs } 0.79 = 0.37 d' \text{ units}, B_{H(0, 0.75)}=32.12, RR_{B>3}[0.046, 9.2]]$. That is, training allowed subjects to learn the collocations they could not work out from first principles, as would be expected. In contrast, there was no sensitive evidence for difference in the conscious structural knowledge of congruent collocations $[F(1, 64)=.00, p=.973, \eta_p^2=0.00, B_{H(0, 0.75)}=.81, RR_{1/3<B<3}[0, 2.9]]$. For unconscious knowledge, there was no evidence one way or the other for the interaction, $F(1, 64)=1.11, p=.296, \eta_p^2=0.02, B_{H(0, 0.75)}=0.84, RR_{1/3<B<3}[0, 2.1]]$, that is, the data were not sensitive enough to determine whether or not the difference in incongruent collocations between control and trained group was greater than the difference in congruent collocations $((0.93-0.35)-(0.48-0.15)=0.25 d' \text{ units})$. Nevertheless, there was evidence for difference in the unconscious structural knowledge of congruent collocations between the trained and control groups, $[F(1, 64)=7.04, p=.010, \eta_p^2=0.10, 0.93 \text{ vs. } 0.48=0.45 d' \text{ units}, B_{H(0, 0.75)}=12.50, RR_{B>3}[0.08, 3.8]]$ while no sensitive evidence for difference in that of incongruent collocations between the two groups, $F(1, 64)=1.83, p=.181, \eta_p^2=0.03, 0.35 \text{ vs. } 0.15=0.20 d' \text{ units}, B_{H(0, 0.75)}=0.85, RR_{1/3<B<3}[0, 2]$. It again shows that training

grants people unconscious knowledge by exposure to the regularity but not by the exposure to the oddness. This is exactly as would be expected for a group with no prior knowledge of the idioms; all they can do is simply to combine the words known separately to work out the meaning of the combination.

In sum, the three-way interaction arose because training moved subjects from relying mainly on deriving meaning by consciously combining the separate meaning of words (which works only for congruent collocations), to having similar conscious and unconscious knowledge of congruent collocations, and good conscious knowledge of incongruent collocations. That is, subjects were moved towards the shape of two-way interaction between structural knowledge and collocation type we found in Experiment 1.

Discussion for Experiment 2

Results of Experiment 2 indicate that exposure (to and interpretation of target collocations in natural learning context) contributes to the gaining of conscious and unconscious structural knowledge of L2 collocations. Most important, learning moved our subjects from their starting state towards the theoretically predicted pattern found in Experiment 1. That is, the relative advantage of congruent over incongruent collocations for unconscious relative to conscious structural knowledge increased with training. Our trained subjects acquired conscious knowledge of incongruent collocations, and unconscious knowledge of congruent collocations, as predicted from Experiment 1. This does not seem to agree with Sonbul and Schmitt's (2013) conclusion that all their experiment conditions (enriched, enhanced, and decontextualized learning) led to significant gains in explicit collocational knowledge but not in implicit collocational knowledge. The disagreement can be associated with the employment of form recognition as a format for tapping conscious collocational knowledge, which fails

to make a distinction between judgment and structural knowledge.

Further, the acquisition of conscious and unconscious structural knowledge of L2 collocations varies considerably according to collocation types. The interaction of collocation type, structural knowledge and experiment treatment suggests substantial difference between congruent and incongruent collocations in terms of the development of conscious and unconscious structural knowledge. In other words, congruent and incongruent collocations contribute differently to the development of conscious and unconscious structural knowledge, as theories of implicit and explicit learning predict (Cleeremans & Dienes, 2008); that is, unconscious structural knowledge learning is a gradual process of learning regularities, whereas conscious learning can readily acquire exceptions. On the one hand, there was evidence that learners gained conscious structural knowledge of incongruent collocations but not that of congruent ones. On the other hand, there was substantial evidence that learners acquired significant unconscious structural knowledge of congruent collocations but no sensitive evidence for incongruent ones.

General Discussion and Implications

Experiment 1 concluded that learners have both conscious and unconscious structural knowledge of L2 collocations, with the former being the dominant part, and that learners have different amounts of conscious and unconscious knowledge of congruent and incongruent collocations. Compared with incongruent ones, congruent collocations tend to play a leading role in the acquired structural knowledge, unconscious knowledge in particular. Experiment 2 showed that exposure facilitates the development of both conscious and unconscious structural knowledge of L2 collocations, which varies considerably between congruent and incongruent collocations, with the former being dominant in the acquisition of unconscious

structural knowledge. As congruent collocations account for a considerably larger proportion than incongruent ones in natural languages, they tend to have a dominant role to play in both conscious and unconscious structural knowledge of L2 collocations.

The above results suggest a close association between collocation types and the acquisition of conscious/unconscious structural knowledge. For L2 learners, congruent collocations are highly transparent semantically, especially with reference to their L1 equivalent sequences, and thus can be understood or interpreted by means of L1 collocational knowledge. The implicit nature of L1 collocational knowledge facilitates learners to use this type of L2 equivalent sequences as collocations even without being aware of the associations, which contributes considerably to implicit learning (cf Dienes, Altmann, & Gao, 1999). Thus the high congruency contributes considerably to the acquisition or development of unconscious structural knowledge of L2 collocations (cf Ziori, Pothos, & Dienes, 2014).

Conversely, incongruent collocations are characterized by their semantic opaqueness in that they cannot be directly translated into learners' L1 equivalent sequences in a rather word-for-word way. Due to the semantic opaqueness, L2 learners will fail to process such sequences by means of literal interpretation. The failure will encourage learners to reprocess the sequences in other ways, for example, understanding them largely as whole units or single phrasal units. The failure to understand them literally and the reprocessing by accepting them as single units generally require greater attention, which makes them distinct in memory and leads to improved memory (cf. Hastie & Kumar, 1979). Thus the comparatively odd associations between incongruent collocations and their L1 equivalents may be striking and their very oddness aid recognition explicitly (Sakamoto & Love, 2004). They are more likely to be stored explicitly since schema incongruity may help episodic memory

under some conditions (Sakamoto & Love, 2004). However, it is unlikely to help a system designed to extract general regularities (cf Sherry & Schacter, 1987), such as the mechanisms postulated to underlie implicit learning (e.g. Williams, 2009).

Note that such interesting interactions between prior knowledge (e.g. L1) and new learning are less easily explored in AGL (though see Ziori et al, 2014). The interactions suggest that conscious and unconscious structural knowledge of L2 collocations are co-defined by both L1 and L2 knowledge (cf. Yamashita & Jiang 2010), which may vary considerably according to the degree of L1-L2 congruency. Among them, conscious structural knowledge of incongruent collocations is formed with the aid of their conflict with their L1 counterparts (cf Jacoby, 1991) while unconscious structural knowledge of congruent collocations is partially dependent upon their L1 counterparts. It follows that learners' knowledge of L1 collocations plays an important role in forming both conscious and unconscious structural knowledge of L2 collocations. Therefore, as well as focusing on the likelihood of explicit knowledge being transformed into implicit knowledge (namely interface issues), effort should be spent in exploring how to exploit L1 collocational knowledge in L2 learning and teaching.

The interactions of L1 and L2 collocations also suggest that the gaining of L2 collocational knowledge (particularly that of unconscious knowledge) is achieved through the processing of collocational meaning or semantic associations. In particular, the semantic association of congruent collocations may involve the meaning of L1 equivalents and their relationship with more extended context (e.g. in terms of pragmatic meaning or semantic prosody in Sinclair's (1996) term). It is the implicit nature of such associations that contributes considerably to the acquisition of unconscious collocational knowledge. By contrast, such a learning process is inhibited for incongruent collocations due to the semantic conflict against their literal translations.

This supports the argument that the measurement of L2 collocational knowledge (unconscious knowledge in particular) should take meaning into account (e.g. by the subjective judgment), rather than the mere association of word forms (e.g. by form recognition or lexical decision tasks).

Further, the meaningful nature of L2 collocational knowledge highlights the significance of distinguishing judgment knowledge from structural knowledge in the measurement. As shown in Tables 3 and 6, judgment by Guessing accounts for a small proportion of knowledge and has a low accuracy. In Reber's (1989) words, it seldom occurs that one does not know that one knows some L2 collocations. Instead, when one knows an L2 sequence as a collocation, one knows that he or she knows, though not necessarily knowing what he or she knows. This is closely associated with the meaningful nature of collocational knowledge and greater attention spent in meaning processing. To be exact, one knows that a target sequence is an L2 collocation only when one knows that it makes sense in communication. According to Schmidt (1990: 132), when such meaning processing is involved, particularly with reference to their L1 equivalents, more attention is spent than just satisfying the mere perception of target word forms or their physical co-occurrence. The relatively high level of attention contributes to conscious judgment knowledge while structural knowledge can still be unconscious. This contrasts AGL learning where meaning is seldom processed and judgment knowledge may be unconscious in more cases (cf. Dienes & Scott, 2005). It also suggests that the tapping formats like meaning recall or recognition tasks are more likely to elicit conscious judgment knowledge but not make distinction between conscious and unconscious structural knowledge (see McGavigan, 2009; Sonbul & Schmitt, 2013; Toomer & Elgort, 2019; Webb, Newton, & Chang 2013: 104).

Conclusion

To sum up, learners acquired both conscious and unconscious structural knowledge of L2 collocations, with the former being dominant. The conscious status varies considerably between congruent and incongruent collocations. Incidental exposure to collocations in sentences facilitated the development of conscious structural knowledge of incongruent collocations and that of unconscious structural knowledge of congruent ones. In the development process, the semantic opaqueness of incongruent collocations tends to contribute to the construction of conscious structural knowledge while the semantic transparency of congruent collocations contributing to unconscious collocational knowledge, which is closely associated with L1 collocational knowledge. The advantage of congruent over incongruent collocations is more for unconscious than conscious structural knowledge. The results are consistent with the theory that unconscious structural knowledge is based on acquiring statistical regularities while conscious structural knowledge codes in addition more one-off exceptions.

The above findings have the following pedagogical and practical implications. First, as the acquisition of L2 collocations is closely associated with L1 collocations, more effort should be spent in exploiting learners' L1 collocational knowledge in L2 learning and teaching practice, and in the study of interface issue of implicit and explicit knowledge. Second, since the acquisition of L2 collocational knowledge occurs through meaningful communication, it is advisable that the measurement of L2 collocational knowledge should take (collocational) meaning into account (e.g. by such means as subjective judgment). Third, as the judgment knowledge of L2 collocations is more likely to be conscious, it is of great significance to look at the conscious vs. unconscious contrast of structural knowledge, especially in the study of L2 collocation learning.

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Appendix A.

Collocations and Atypical Sequences for Experiment 1

Collocations	Atypical sequences	Collocations	Atypical sequences
a private car	a personal car	grasp meaning	master meaning
fast speed	quick speed	have the courage	have the bravery
heated discussion	hot discussion	make breakfast	produce breakfast
personal safety	private safety	master basic skills	grasp the skill
a high price	an expensive price	acquire knowledge	study knowledge
a powerful car	a strong car	prepare for life	prepare life

a heavy smoker	a big smoker	fly a plane	drive a plane
a warm welcome	a hot welcome	make a mistake	have a mistake
black tea	red tea	take effect	serve effect
heavy rain	big rain	take medicine	eat medicine
a small population	a lot of population	take years	cost years
strong tea	thick tea	be in a bad mood	have a bad mood

Appendix B.

Collocations and Atypical Sequences for Experiment 2

Collocations	Atypical Sequences	Collocations	Atypical Sequences
a recent case	a near case	increase ability	form ability
smart suit	clever suit	admit defeat	recognize defeat
leather shoes	skin shoes	bake cake	bake burger
modern society	recent society	gain weight	receive weight
intelligent beings	smart beings	boil water	cook water
private collector	personal collector	establish bases	found bases
narrow escape	close escape	hit the headline	attack the headline
live wire	living wire	perform a service	practice a service
a close shave	a near shave	read meter	copy meter
a tight spot	a tightened spot	break the news	destroy the news
heavy price	weighty price	catch attention	grasp attention
corner stone	base stone	take the lead	make the lead