Article

LANGUAGE
TEACHING
RESEARCH

Language Teaching Research
16(4) 449–466

DOI: 10.1177/1362168812436910
ltr.sagepub.com
SAGE

The concreteness effect and the bilingual lexicon: The impact of visual stimuli attachment on meaning recall of abstract L2 words

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Abstract

According to the Dual-Coding Theory (Paivio & Desrochers, 1980), words that are associated with rich visual imagery are more easily learned than abstract words due to what is termed the concreteness effect (Altarriba & Bauer, 2004; de Groot, 1992, de Groot et al., 1994; ter Doest & Semin, 2005). The present study examined the effects of attaching visual imagery to abstract words through use of a meaning recall test. Eighty-seven American university students of first-year Spanish participated in the study. Participants were placed in either picture or non-picture groups and were given a treatment of 12 abstract and 12 concrete words. The treatment included three input phases lasting approximately 17 minutes. The posttest and delayed posttest involved a meaning recall test to measure receptive knowledge in which participants were supplied the L2 lexical item and asked to write the L1 translation. The results indicated that participants in the abstract picture group outperformed those in the abstract non-picture group on both posttest and delayed posttest; however, no such effect was found for concrete words. Findings suggest that meaning recall of abstract words can be facilitated by usage of metaphorical, emotive, or symbolic imagery.

Keywords

dual-coding theory, abstract, imagery system, concreteness effect

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I Introduction

Research in bilingualism has shown that concrete words are more easily learned than abstract words (Altarriba & Bauer, 2004; de Groot, 1992; de Groot et al., 1994; Duthie et al., 2008; Schwanenflugel et al., 1992). The reason for this has been attributed to the visual imagery of concrete words. The 'dual-coding theory' (Paivio & Desrochers, 1980) posits a concreteness effect, namely that the rich imagery of concrete words stored in the brain aid in retrieval of lexical information. No research until this point, however, has investigated whether or not storage of visually impoverished abstract lexical items can be facilitated by using metaphorical, emotive, or symbolic representations of those abstract words. If abstract words can acquire a richer visual representation, then according to dual-coding theory, learners would have faster and stronger lexical access to those words. The present study examines the effects of visual stimuli on the learner's receptive knowledge of abstract words.

II Theoretical background

There has been much debate in the past few decades over the structural arrangement of languages in the mental lexicon of bilinguals. Part of this debate centered on whether or not L1 and L2 lexical items have a singular or dual storage system. The 'interdependence perspective' assumes an independent storage of both L1 and L2 lexical items, while the 'independence perspective' assumes a separate storage system for L1 and L2 words (for further discussion, see Hummel, 1986; Paradis, 1978).

Under the independence perspective, dual-coding theory (DCT) provides a model to explain the way in which bilinguals store L1 and L2 words in a separate but interconnected way. According to DCT, there are two verbal systems (V1 and V2) that correspond to the two languages of a bilingual (L1 and L2). Although the two verbal systems are independent and can function separately, they are linked by V1–V2 connections through word-to-word translations. Furthermore, Paivio (1971) hypothesized that knowledge can be stored in verbal and visual structures. The dual-coding theory model integrates and expands this hypothesis by including an imagery system, which is engaged in processing visual and perceptual, or nonverbal, information (Paivio, 1991; Paivio & Desrochers, 1980).

Although this imagery system is able to work independently, it is also capable of connecting the two verbal systems (V1 and V2) by linking each of them to the imagery system. As a result of this interconnectivity, the verbal and imagery systems mutually interact. Since the imagery system is connected to the V1 and V2, DCT assumes that the visual referents located in the image system facilitates recall and recognition of words in the V1 and V2. As a result, this dual-coding (verbal and visual) effect leads to enhanced learning since the imagery system provides an additive contribution to the lexical access of those words.

Within each V1 and V2 system are stored both abstract and concrete words. A robust number of studies, however, have shown that concrete words are learned better than abstract words (Altarriba & Bauer, 2004; de Groot, 1992, de Groot et al., 1994; Duthie et al., 2008; Schwanenflugel et al., 1992). Paivio's bilingual dual-coding theory helps to

explain this concreteness effect. According to the concreteness effect, the words that represent the tangible objects are recalled and recognized better than abstract words that represent intangible ideas or concepts. The reason is that concrete words, due to their rich visual imagery, can be encoded via both the verbal and imagery systems, while abstract words can only be encoded via a verbal system. Dual-coding theory can also account for the picture superiority effect, which demonstrates that pictures are more easily remembered than words because pictures benefit from mnemonic superiority in the imagery system and are able to elicit their label from V1 or V2. Findings from studies in bilinguals have found support for the picture superiority effect (Paivio & Lambert, 1981; Vaid, 1988). This suggests that pictures and images as input could help to establish a referent image in the imagery system.

III Vocabulary instruction

A recent estimate of the number of word families that learners need to know in order to read authentic texts or understand spoken discourse range from 8,000–9,000, and 6,000–7,000, respectively (Nation, 2006). For learners this can be a daunting task, most of whom fall short of achieving this (Schmitt, 2008). Perhaps in part for this reason, many studies have examined the efficiency of learning and retaining new words under varying conditions. One component of acquiring new words is depth of processing. If words are manipulated cognitively in a number of ways, this greater engagement will lead to better retention (Craik & Lockhart, 1972).

Using direct L1 translations is one such form of engagement that has shown to promote improved retention (Jones, 2004; Prince, 1996; Ramachandran & Rahim, 2004). One study (Laufer & Shmueli, 1997) looked at effects of L1 translations and contextual involvement of vocabulary. The participants receiving the lesser contextualized input outperformed the more highly contextualized groups. What's more, the meaning of target words under each condition was given either through direct L1 translations or by an explanation in English. Participants who received direct L1 translations outperformed their counterparts who were received English explanations.

There have been a number of other studies that have examined the effects of pictorial and visual stimuli with regards to self-selected learner strategy (Barcroft & Sunderman, 2009), annotations within a text (Chun & Plass, 1996; Jones, 2004), isolated lexical items (Shen, 2010), imagery keyword mediators (Ellis & Beaton, 1993), objects and nonobjects (Barcroft, 2008), etymological meaning (Boers et al., 2007), and reading fluency (Liu, 2004).

Barcroft (2009) looked at the kinds of learner strategies that participants relied on for remembering new lexical items. During the treatment, participants were presented with new words with pictures and told to remember them as best as they could. After the posttest, participants were asked to describe the strategies that they employed to remember the new words. The results of the strategy coding revealed 12 distinct categories of strategies. The most frequent of the 12 was L2 word–picture association. This study supports the notion that many learners will readily utilize visual stimuli even without explicitly being told to do so when attempting to remember new lexical items.

Pictorial support in research has also taken the form of annotations within a text. One series of studies (Chun & Plass, 1996) examined the effects of text, picture, and video annotations on both vocabulary acquisition and incidental learning during reading. The results indicate that text plus picture annotations allowed for better learning of vocabulary items than did text only. Furthermore, text plus picture annotations provided greater than expected gains in incidental learning as well. Jones (2004), however, compared translation versus picture annotations, and found that as far as production is concerned, the effect of translation annotations was superior to that of picture annotations. The results of these studies suggest that pictorial support might be more effective for the initial stages of receptive mastery, and less so for productive mastery.

A recent study by Shen (2010) examined the effects of pictorial support on vocabulary learning in Chinese by comparing verbal encoding with verbal encoding plus imagery encoding. Results indicated that the verbal encoding plus imagery encoding group learned the meaning of abstract words better than the verbal encoding only group. However, there was no significant difference between the two groups for concrete words. Shen attributes this finding to the already preexisting images in the imagery system of concrete lexical items. Since DCT assumes the storage of concrete lexical items both verbally and visually, the additive contribution of using pictures of concrete words in the input appears to be less than it would be for abstract words.

Other studies involve similar visual methods of input in order to access gains in performance on recall protocols. One such study (Liu, 2004) involving comic strips found that lower level students reading comic strips accompanied by images outperformed their counterparts in the no picture group in a recall protocol, indicating that the pictures served as a reference point for the lexical items in the picture group. No effect, on the other hand, was found between the picture and no picture group for the higher level students, which appears to point to a greater reliance on the imagery system for those learners who are exposed to more challenging input.

Boers et al. (2007) also used imagery in attaching meaning to certain idioms based on their etymological meaning. Participants were taught idioms through an online tool, which presented the participants with multiple choice questions regarding various idioms. One particular type of question was one in which the participant had to guess the etymological origin (religion and superstition, war and aggression, etc.) of the idiom. As feedback, the correct answer with etymological information would be displayed, the assumption being that the mental scene evoked by this information would add a concreteness effect to the idiom. The results in this study supported the dual-coding theory in that the concreteness resulting from a mental scene of an idiom's origin could explain why those idioms were learned more effectively.

The implication of the above study seems to be that a concreteness effect can be attached to words that have little or no apparent concreteness in the context of contemporary usage. Sadoski (2005) has suggested that all abstract words are in fact concrete, in the sense that they are etymologically based in some historically literal sense and have since become 'dead metaphors' (p. 229). He uses several examples to illustrate this point, such as the word *true* originating from *tree*, since something true was thought to be firmly rooted, just as a tree is. It could be inferred from this observation that, under the

DCT model, images presented to learners based on literal etymology could help to create a link between the verbal and visual systems.

Although many of these studies report positive effects for the use of pictures, some pictorial support could lead to decreased learning, at least with respects to word form. Boers et al. (2009) again examined the effects of pictorial support on learning on form of idioms. The results indicated no statistically significant difference between the two groups, although there was a decrease in absolute terms in the performance of the participant group that was exposed to pictures intended to elucidate the meaning of idioms. Taken together, the current body of research on pictorial support seem to point to favorable gains for recall of meaning, but not necessarily so for other aspects of knowing a word, such as word form.

Many of these previous studies have been concerned with the concreteness effect of concrete words. No known study, however, has specifically investigated whether or not meaning recall of abstract words can be enhanced by attaching a meaningful and rich visual image to them through use of metaphorical, emotive, or symbolic imagery. With this in mind, the research question for the present study is the following: among early bilinguals, is there a significant effect for concrete visual stimuli on the meaning recall of abstract L2 lexical items?

IV Participants

Participants initially consisted of 160 students enrolled in eight sections of a first semester Spanish course at a university in the southwestern USA. This Spanish course was part of a language curriculum requirement for all undergraduate students; as such, the participants were non-majors. A biographical questionnaire was administered to determine eligibility for participation in the study. Participants who had more than three years of high school Spanish, study of another Romance language, previous study abroad experience in a Spanish speaking country, spoke Spanish at home as a heritage speaker, or had difficulty reading were excluded from the study. The data from the final pool of 87 participants were included in the results and the discussion, with an *n* size of 51 in the picture group and 36 in the non-picture group.

V Method

The materials used in this study consisted of an initial biographical questionnaire, pretest, treatment PowerPoint slides, immediate posttest, delayed posttest, and posttest questionnaire. Both the biographical questionnaire and pretest were administered by the classroom instructors. The biographical questionnaire provided information about the participants such as major, previous language study, languages spoken at home, outside contact with Spanish, and whether or not participants had difficulty reading to guide the criteria for selection of participants to be included in the study.

The pretest contained a total of 66 nouns, 33 concrete and 33 abstract. The criteria for selecting words for the pretest were that each L2 item had to be at least two syllables in length, not have a corresponding cognate or near cognate in the L1 (English), and have a

suitable image that could represent the word in the treatment slides. The latter criterion applied primarily to abstract words, since it is inherently more difficult to find an appropriate metaphorical or emotive representation of an abstract concept than it is for a concrete, tangible word. Based on these four stipulations, items for the pretest were selected.

Participants were given the pretest after completing the biographical questionnaire and instructed to circle the words that they knew. The purpose of the pretest was to narrow down the scope of vocabulary used on the treatment slides by eliminating any words already known to the participants. There were a few cases in that an item which ended up being on the treatment slides was known to a participant. In these cases that participant's results were excluded from the study. Participants who were absent the day of the pretest but present for the following treatment and testing were also excluded from the study. The participants were told by their classroom instructors only that these materials were for a vocabulary activity and later in the week there would be a guest speaker (the researchers involved) who would be invited to the class to carry out the activity (the treatment).

After analysing the results from the pretest, a final pool of 12 concrete and 12 abstract words were chosen (see Appendix 1) for the treatment, and each of the eight sections of Spanish were assigned to either a picture or non-picture treatment group. Since each section had roughly the same number of participants (approximately 20 per section), four classes were assigned to the picture group, and the remaining four were assigned to the non-picture group. The researchers coordinated with the classroom instructors so that the treatment would happen on the same day for all eight sections.

At the start of class the researcher told the participants that they were going to learn some new vocabulary items and to try to remember these items as best as they could. PowerPoint was used as the medium of instruction for input of the items in the treatments and the two groups of concrete and abstract words were integrated into three different input phases, consisting of a total of 77 slides for both the picture and non-picture groups. Seventy-two of the 77 slides were input of the 24 words over three distinct phases. The remaining 5 slides comprised a title slide and four slides for instruction (3 slides for instructions for each phase, and the last slide for instructions on the immediate posttest). The three input phases for the picture and non-picture groups were identical except that the non-picture group lacked the images present in the picture group. The input order between the concrete and abstract words were alternated to control for the recency effect, but within each group, the order was randomized for each phase before alternating between the two. The total time required to finish all three phases was approximately 16–17 minutes.

The first phase of input (for images used, see Appendices 2 and 3) provided non-picture participants with a blank slide for about one second followed by the L2 word and a timed fading in of the word's L1 English translation for each target item. In the picture group, a picture first appeared for about one second followed by the L2 word with its corresponding L1 translation appearing in the same manner and position as the non-picture group. After the L1 translation appeared, the participants listened to a pre-recorded native speaker pronunciation of the word and were required to repeat it. After the participants repeated the word, the researcher clicked to the next slide and repeated this process until the first phase was complete.

In the second phase of input, participants were presented with a binary option – a or b – in which either two images for the picture group, or two L1 words in the non-picture group faded in consecutively, followed by the appearance of the target L2 word. No audio was included in this section, but the researcher prompted participants to respond by saying *a o b?* ('a or b'). After the participants responded, the researcher then clicked to display the correct answer, which was the letter of the correct answer with the L1 translation in parentheses. When the fade-in was complete, the researcher repeated the correct letter answer and then clicked to the next slide and repeated this until the end of phase two.

The third and final phase of input was also binary option, but organized differently. In this phase, the participants first saw either an image in the picture group or an English L1 word in the non-picture group followed by a binary option of two L2 Spanish words. A native-speaker voice then repeated the binary option of the L2 words. This prompted participants to respond by repeating the correct L2 word that corresponded to the picture or L1 English word. After the participants responded, the researcher revealed the correct answer by clicking and followed this with a second audio file, which also repeated the correct L2 word. This continued until the remaining input slides were completed.

At the end of the treatment, a final slide appeared, which informed the participants that they were to take a short quiz based on the vocabulary they had just learned. At this point, the researcher left the classroom and the classroom instructors passed out the immediate posttests. In order for participation to be mandatory for all students, the study had to be treated as normal classroom curriculum. For this reason, the regular classroom instructors were the ones who distributed and collected all of the materials provided to them by the researchers to the participants. Instructors were asked to administer the immediate posttest as soon as the treatment ended, and to tell the participants that they had a maximum of eight minutes to complete the activity.

The immediate posttest was a meaning recall task (see Appendix 4) of the 12 concrete and 12 abstract words. Meaning recall was measured by prompting the participants with the L2 words and having them write the corresponding L1 English single-word translation. The instructions on the test simply directed them to write the English translation for as many of the words below as they could. An example was given of a non-treatment word so that the participants would be clear on what was expected of them (example: *gato* / *cat*). If the participants demonstrated that they could recognize the meaning of the L2 word by writing the corresponding L1 translation, then that answer would be counted as correct.

The delayed posttest was administered exactly two weeks after the treatment and immediate posttests were given. The format of the delayed posttest was identical to that of the immediate posttest. Its purpose was to measure how well the concrete and abstract vocabulary items would be retained over time between the picture and non-picture group. In addition to the delayed posttest, participants were required to answer a posttest questionnaire that confirmed that the participants had not sought any additional information regarding the treatment items during the two week period between the immediate and delayed posttests. If a participant circled yes, he or she was required to explain. This ensured that results from the delayed posttest would not be skewed by participants who received additional input between the immediate and delayed posttest period.

After all the test materials were collected, the eight sections of materials were collapsed into a singular picture or non-picture group and organized into participant profiles that were assigned a number to facilitate identification of specific results. Immediate and delayed posttests were scored and profiles were reviewed to determine eligibility based on the outlined criteria discussed.

VI Results

The principal focus of this study is on learner meaning recall of abstract words when enhanced by images. A considerable number of participant responses included incorrect translations, but synonyms of the target item, which indicated those participants recalled meaning, but not the form. For this reason, the following tables and figures display data from test results under two different scoring criteria. One scoring criteria reflects data from form plus meaning recall; the other reflects data which also counted synonyms of target items as correct. As shown in Tables 1 and 2, the difference between the resulting scores for the picture group and non-picture group for the abstract immediate posttest is significant (p value < 0.01). The average number of correct responses for picture group is 7.47 and 7.75 out of 12 while the average score for non-picture group is 5.14 and 5.22 out of 12 for excluding and including synonyms, respectively. For the abstract delayed posttest, the difference between the picture and non-picture group is also significant (p value = 0.04 for form plus meaning and p value = 0.03 with synonym responses). The average score for picture group is 1.22 and 1.41 out of 12 while the average score for non-picture group is 0.81 and 0.92 out of 12.

For concrete words, the results between the immediate and delayed posttests do not show a statistically significant effect between the picture and non-picture groups, with a p value for the immediate posttest of 0.12 and 0.08 and for the delayed posttest of 0.09 and 0.13 for each of the scoring criteria. Mean scores for immediate posttests were 8.47

Table 1 Means and standard deviations for conditions in posttest and delayed posttest (excluding synonyms) (percentages in parentheses)

Condition	Vocabulary meaning recall (12 possible)	
	M	SD
Posttest: picture:		
Concrete	8.47 (71)	2.44
Abstract	7.47 (62)	2.64
Posttest: non-picture:		
Concrete	7.89 (66)	2.02
Abstract	5.14 (43)	2.55
Delayed posttest: picture:		
Concrete	2.18 (18)	1.40
Abstract	1.22 (10)	1.26
Delayed posttest: non-picture:		
Concrete	1.78 (15)	1.29
Abstract	0.81 (7)	0.94

Table 2 Means and standard deviations for conditions in posttest and delayed posttest (including synonyms) (percentages in parentheses)

Condition	Vocabulary meaning recall (12 possible)	
	M	SD
Posttest: picture		
Concrete	8.63 (72)	2.47
Abstract	7.75 (65)	2.70
Posttest: non-picture		
Concrete	7.94 (66)	1.97
Abstract	5.22 (44)	2.60
Delayed posttest: picture		
Concrete	2.43 (20)	1.55
Abstract	1.41 (12)	1.43
Delayed posttest: non-picture		
Concrete	2.01 (17)	1.45
Abstract	0.92 (8)	0.97

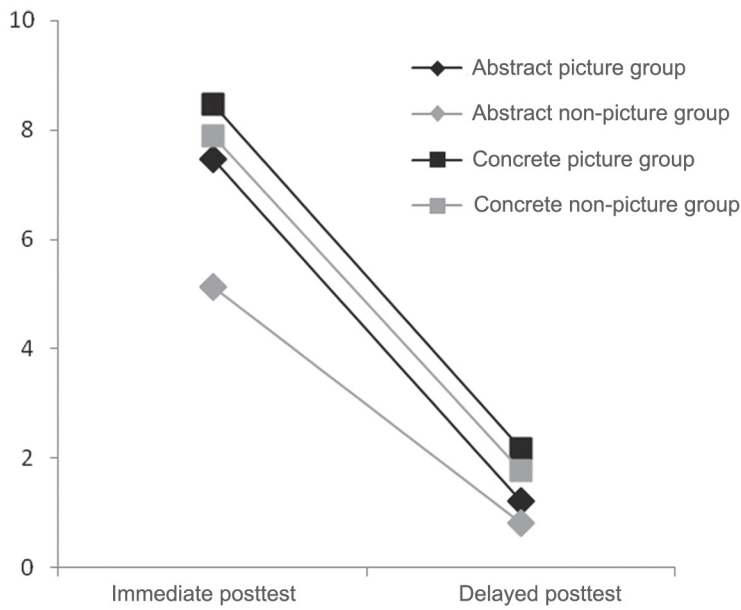

Figure 1 Comparison between abstract and concrete picture and non-picture groups (excluding synonyms)

and 8.63 for the picture group and 7.89 and 7.94 for the non-picture group, while delayed posttests were 2.18 and 2.43 for picture group and 1.78 and 2.01 for the non-picture group. The effects of visual imagery on learner meaning recall is highlighted graphically in Figure 1 and 2.

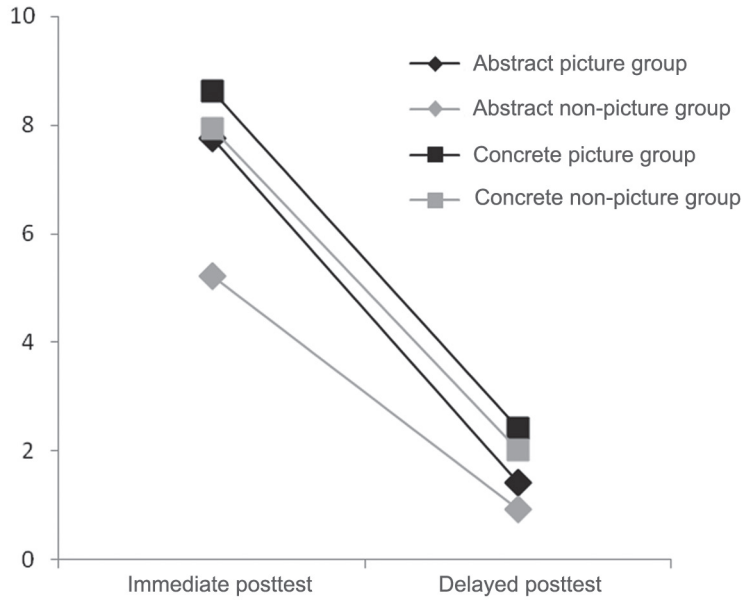

Figure 2 Comparison between abstract and concrete picture and non-picture groups (including synonyms)

VII Discussion

These results support the hypothesis that use of symbolic, metaphorical, or emotive imagery assists meaning retention of abstract vocabulary items. The resulting scores for the abstract picture group were significantly higher than those of the abstract non-picture group on both the immediate and delayed posttest, although posttest results revealed considerable decay across all groups. The implication is that the images in the abstract picture group contributed to the increased gains over the abstract non-picture group.

In terms of absolute gains, posttest results for the abstract picture group, although statistically higher in relation to results from the abstract non-picture group, certainly showed a great deal of attrition when compared to the immediate posttest results. From a pedagogical perspective, this might appear discouraging, considering that three input phases were carried out. However, the rate of attrition becomes less surprising in this particular study given amount of exposure and number of lexical items. Due to issues of practicality, only one treatment was administered.

Furthermore, the combined time for the three input phases in the treatment accounted for 16–17 minutes worth of input on a single occasion covering 24 different lexical items. The number of lexical items, 24, was intentionally high, in order to avoid a scenario in which mastery of all lexical items occurred for both groups due to the facility of the treatment. For this reason, a large number of words were selected for the study that perhaps impacted the rate of attrition. Under normal teaching conditions, teaching fewer words per session and later revisiting those words for long-term memory consolidation would be a more pedagogically sound approach. Future studies in which frequency and

Table 3 Independent *t*-tests for meaning recall of abstract and concrete words (excluding synonyms)

Condition	Posttest		Delayed posttest	
	t	*p*	*t*	*p*
Abstract items (picture and non-picture)	4.14	.000**	1.74	.044*
Concrete items (picture and non-picture)	1.21	.117	1.35	.092

Notes: * p < .05, ** p < .01

Table 4 Independent *t*-tests for meaning recall of abstract and concrete words (including synonyms)

Condition	Posttest		Delayed Posttest	
	t	*p*	*t*	*p*
Abstract items (picture and non-picture)	4.45	.000**	1.95	.029*
Concrete items (picture and non-picture)	1.45	.078	1.17	.126

Notes: * p < .05, ** p < .01

amount of input are also controlled for would be useful in determining the strength of effect of pictorial support on durable learning.

With regards to the inclusion of synonym responses as correct items, it was found that the *p* value for the results was strengthened when compared to form plus meaning results for both immediate and delayed posttests for abstract words, but mixed for concrete words. Although both picture and non-picture group results contained synonym reponses, they were more prevalent in the picture group. These differences can be observed in the differences between the mean scores on Tables 3 and 4. Some examples of synonyms include responses such as 'anger' or 'frustration' instead of 'wrath', or 'bird' and 'swan' instead of 'crane'. It is possible that this may be a result, at least in part, of the participants relying on the imagery system to summon up visuals of the word aided by the visual stimuli during the treatment, but still being unable to recollect the precise translation provided in the slides. This evidence of synonyms serves as further support for DCT, since the greater incidence of synonyms implies that the imagery system works in conjunction with the verbal system to retrieve the lexical items and their meanings.

In addition to synonym responses, there were a few cases in which picture group participants incorrectly recalled meaning, but instead supplied a word relating to some aspect of the picture. One instance of this was the answer 'donkey' instead of the correct response 'stubbornness' on the delayed posttest for the picture group (the picture was of a man pulling a donkey that refused to move, which can be seen in Appendix 3). This type of response, although incorrect, does suggest that at least in this case, the image was involved in the interactions with and processing of the L2 target form during the

treatment. Moreover, as this was a response from the delayed posttest, the image from the treatment slide was still in some aspect associated with the L2 target form two weeks later.

For the concrete vocabulary words, results from immediate and delayed posttests show no statistically significant difference between the picture and non-picture groups. This could be due to an already existing mental representation of concrete nouns for those items in the participants' mental lexicon (Shen, 2010). If this is the case, then it seems intuitive that the images of concrete words are of less benefit than images associated with abstract words. Conversely, since the DCT predicts that abstract nouns are not represented in the image system of the mental lexicon, it would follow that if input included rich imagery of abstract words previously absent in the imagery system, then the effect from the picture group treatment for abstract words would have a greater impact on recall and recognition than would the picture group treatment for concrete words. The results from this study support this hypothesis.

The present study possesses certain limitations. First, the selection of words for the treatment were limited, especially for abstract words, in that Spanish and English share a relatively large number of cognates due to English being so heavily influenced over the centuries by Latin and French. Because of this, a number of potentially effective target items was rejected since the learning of a cognate is considerably easier due to the graphemic similarity. Moreover, convenience samples of intact classes were used, which could impact the validity of the study. For stronger results, it would be ideal to select from a more robust pool of words, randomize participant group selection, and to have participants rate levels of concreteness of L1 words during the pretest in order to analyse the inter-concreteness data in more depth.

VIII Conclusions

The results of this study suggest that abstract words can, through input, integrate metaphorical, symbolic, or emotive imagery into the image system under dual-coding theory, which can improve meaning recall of those abstract words due to the additive contributions of the image system.

The present study carries pedagogical implications as well. The findings indicate that images that can be associated with abstract words aid in strengthening lexical access to those items. For this reason, these results suggest that images be used whenever possible during input as a way of dual coding, verbally and visually, the new vocabulary so that students can learn more effectively and efficiently. With respect to durable learning, the rather discouraging absolute gains for abstract words on the delayed posttest were perhaps due in part to the large number of lexical items in the treatment, and brevity of the input phases.

The findings also suggest that images and pictures produce no additive contribution to meaning recall of concrete words. This was unexpected, because it was predicted that pictures representing the concrete words would strengthen retrieval of those concrete words with the aid of visual stimuli. It could be that due to the pre-existing visual referents in the mental lexical under the DCT minimizes the need for pictorial support for concrete words during input. However, more research is needed to determine if pictures in input play an important role in the learning of concrete words.

Future research in this vein might examine a number of issues not investigated in the current study. In this study, receptive knowledge of meaning was measured. However, recognition of form is the first among many aspects of depth of vocabulary knowledge (Schmitt, 2010). Studies designed to measure the effects of visual stimuli on abstract lexical items for productive mastery might shed some light on whether the additive contributions of the imagery system carry over from receptive knowledge to productive knowledge. Furthermore, replication in another language that has fewer cognates – preferably one that is from a different language phylum – would allow for a more robust selection of words and provide data from a different L2 to see if results could be reproduced. In addition, controlling for subcategories of abstract words, such as stative, procedural, and/or emotive, to analyse possible differences in recall and recognition might reveal whether or not certain types of abstract words are more conducive to visual encoding than others. Finally, in order to investigate how the number of words affect posttest attrition, a similar study utilizing fewer lexical items might yield more encouraging results with regard to absolute gains in receptive knowledge of the lexical items.

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Appendix 1 Lexical items used in present study

Concrete nouns	*Translation*
Alce	Moose
Cobija	Blanket
Enano	Dwarf
Estanque	Pond
Foca	Seal
Grulla	Crane
Guepardo	Cheetah
Hada	Fairy
Lana	Wool
Mozo	Bellhop
Sapo	Frog
Trasgo	Goblin

Abstract nouns	*Translation*
Bondad	Kindness
Chismorreo	Gossip
Congoja	Sadness
Derrota	Defeat
Desenvoltura	Confidence
Espanto	Fear
Haraganería	Laziness
Ira	Wrath
Pujanza	Strength
Regaño	Scolding
Testarudez	Stubbornness
Vergüenza	Shame

Appendix 2 Concrete pictures in treatment

Alce (Moose)

Foca (Seal)

Lana (Wool)

Cobija (Blanket)

Grulla (Crane)

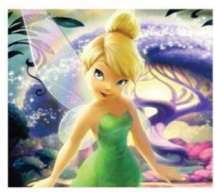
Mozo (Bellhop)

Enano (Dwarf)

Guepardo (Cheetah)

Sapo (Frog)

Estanque (Pond)



Hada (Fairy)

Trasgo (Goblin)

Appendix 3 Abstract pictures in treatment

Bondad (Kindness)

Desenvoltura (Confidence)

Pujanza (Strength)

Chismorreo (Gossip)

Espanto (Fear)

Regaño (Scolding)

Congoja (Sadness)

Haraganería (Laziness)

Testarudez (Stubborness)

Derrota (Defeat)

Ira (Wrath)

Vergüenza (Shame)

Appendix 4 Meaning recall task used for posttest and delayed posttest

First name _____

Vocabulary activity quiz

Instructions:
Write the English translation for as many of the words below as you can.
(example: *gato* cat)

Alce	(Moose)
Bondad	(Kindness)
Chismorreo	(Gossip)
Cobija	(Blanket)
Congoja	(Sadness)
Derrota	(Defeat)
Desenvoltura	(Confidence)
Enano	(Dwarf)
Espanto	(Fear)
Estanque	(Pond)
Foca	(Seal)
Grulla	(Crane)
Guepardo	(Cheetah)
Hada	(Fairy)
Haraganería	(Laziness)
Ira	(Wrath)
Lana	(Wool)
Mozo	(Bellhop)
Pujanza	(Strength)
Regaño	(Scolding)
Sapo	(Frog)
Testarudez	(Stubborness)
Trasgo	(Goblin)
Vergüenza	(Shame)