



## **Do multimedia-oriented visual glosses really facilitate EFL vocabulary learning? : A comparison of planar images with three-dimensional images**

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### **Bio Data**

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### **Abstract**

It has been argued that glossy images in multimedia language textbooks or dictionaries bring about a certain amount of effectiveness in foreign language learning. These results might indicate the superiority of multimedia-based materials over paper-based ones. On the other hand, it might be also true that the superiority of the multimedia-oriented configuration of glosses has not been examined, which might imply that the potential of multimedia materials as tools for language learning has not been maximized.

Therefore, this paper aims to examine the superiority of multimedia-oriented gloss in comparison with traditional glosses. This paper addresses three-dimensional images as a multimedia gloss to demonstrate the spatial relationship of prepositions such as “above,” “across,” “below,” “in,” “on,” and “over,” which are regarded as difficult to learn because of the appropriate choice of the words’ several senses based on various contexts. This research begins with the development of two multimedia dictionaries of spatial prepositions: one with planar images, and the other with three-dimensional images of spatial relationships for each language item. This is followed by an experiment to verify the effectiveness of multimedia gloss by randomly dividing it into two groups—a control group and an experimental group, and then conducting a vocabulary test in each group to choose appropriate spatial prepositions with reference to these dictionaries. The results will be analyzed using a t-test. The results of this study should help in suggesting methods to optimize the application of multimedia materials in EFL settings.

**Key Words:** multimedia gloss, preposition, image schema, vocabulary learning, dictionary

## **Introduction**

In the learning of EFL, the use of dictionaries as glosses is indispensable for learners because a lack of vocabulary has been consistently reported to be a major problem with respect to their language proficiency (Ellis, 1995; Hatch & Brown, 1995). This might have led to the present situation wherein a large number of dictionaries—monolingual or bilingual and paper-based or multimedia-based—have been published. Paper-based dictionaries, however, have been criticized for not facilitating the learners' target language vocabulary because they have only one code, i.e., the verbal code (Chun & Plass, 1996). As a result, the effectiveness of multimedia-based dictionaries as electronic glosses has been emphasized.

The effectiveness of multimedia-based dictionaries primarily stems from their multimodality, referring to the combination of text, images, sound, etc. (Pachler, 2001). Many studies have stressed the importance of multimodal glosses to facilitate EFL vocabulary learning (Kost, Foss, & Lenzini 1999; Brett, 1998; Lomicka, 1998; Chanier & Selva, 1998; Watanabe, 1997; Ellis, 1995; Mayer & Anderson, 1991; Rieber, 1990). In particular, recent researches have examined the verification of visual glosses such as pictures, videos, and animation (e.g., Al-Seghayer, 2001; Chun & Plass, 1996; Yeh & Wang, 2003; Yoshii & Flaiz, 2002). Chun & Plass (1996), for example, showed that a combination of text and picture glosses is more effective than text-only or text and video glosses. Yoshii & Flaiz (2002) also illustrated that a combination of text and picture glosses is more effective than text-only or picture-only glosses. Moreover, Yeh & Wang (2003) concluded that a combination of text and picture glosses is more effective than text-only glosses or a combination of text, picture, and sound glosses. Given that all of the above studies conclude that visual glosses in combination with texts can be an effective technique, it can be concluded that multimodality in glosses, that is, a combination of different modes of input, facilitates the process of language learning (Brett, 1998).

Despite the advantage of multimodal glosses in language learning, it seems that many multimedia-oriented glosses, especially visual glosses, have not necessarily made effective use of this advantage. The results of these studies raise two new questions. The first concern is related to the type of vocabulary item that would be best suited for multimodal glosses. Most studies above (e.g., Laufer & Hill, 2000) examine the advantage of multimodal glosses only in terms of long-term retention or incidental vocabulary learning. This may reveal that the successful learning of L2 vocabulary is measured only by the reinforcement of long-term

retention of information. However, it is also true that there exist vocabulary items that seem simple in form but whose meanings are difficult to understand. Our second concern is related to the type of visual images that are being used as glosses. For effective usage of multimedia-oriented glosses, it is necessary to pay more attention to the configurations of visual glosses.

With these concerns in mind, this paper discusses the advantage of multimedia-oriented glosses with a focus on one language item in particular—English spatial prepositions as polysemous words. We focus on the use of spatial prepositions as polysemous words because the semantic network in spatial prepositions might be the cause of confusion in learners. This confusion occurs despite the frequent use of such vocabulary” provided the intended meaning is conveyed, resulting in difficulty in learning the words (Brala, 2002; Lindstromberg, 2001a; Hatch & Brown, 1995). Our work is based on the image schema theory in cognitive semantics, a field of cognitive linguistics.

## **Background**

### ***English spatial prepositions and the Image Schema Theory in Cognitive Linguistics***

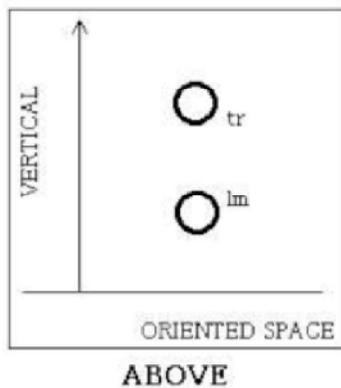
Our first rationale for focusing on spatial prepositions is the fact that, while learning prepositions is regarded as an important and difficult task (largely because they appear so frequently), L2 learners, despite being advanced learners, do not always understand their meanings (Brala, 2002; Lindstromberg, 2001a). Furthermore, they tend to memorize prepositions as idioms, and rote memorization cannot ensure the accurate usage of each word in the given context (Lindstromberg, 2001b). Thus, a greater focus on meaning, context, and usage is required, which seems to be lacking in previous studies.

We now move on to the definition of an image schema, a key concept of cognitive semantics, the most interesting claim of which is the embodiment of meaning (Zlatev, 1999). Lakoff explains the claim as follows.

Thought is embodied, that is, the structures used to put together our conceptual systems grow out of bodily experience and make sense in terms of it; moreover, the core of our conceptual systems is directly grounded in perception, body movement, and experience of a physical and social character. (Lakoff, 1987, xiv, as cited in

Zlatev, 1999)

On the basis of this claim, cognitive semantics primarily deals with the issues of polysemy of the vocabulary such as spatial prepositions (Lakoff, 1987) by way of an image schema. Johnson (1987, p. 2) defines an image schema as abstract patterns in experience and understanding that are not propositional. Figure 1 shows an example of an image schema of the preposition above and illustrates how an object is located on the upper side of another object.



*Figure 1* An example of an image schema (Langacker, 1987)

The image schema may cover all extended examples, even though each meaning appears to be different. The figure may indicate, with regard to EFL vocabulary learning, how the image schema can play an active role in extended examples. In other words, along the same lines as Lindstrobmerg's study (2001a), which emphasizes the importance of pictorial information of basic prepositional senses, other papers show that the representation of image schemata of spatial prepositions as visual glosses on an EFL dictionary can facilitate the learners' comprehension and thus help learners accurately choose prepositions and understand their meanings (Sato, 2003; Sato & Suzuki, in press).

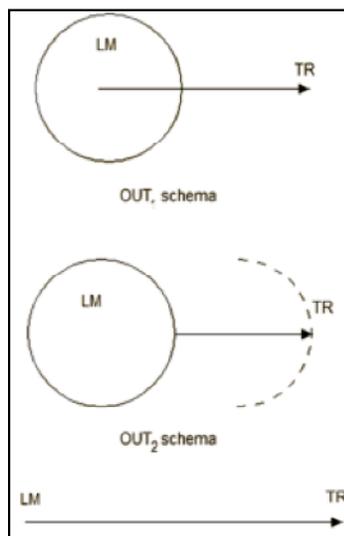
### ***Advantages of Electronic Glosses***

As mentioned above, the high appraisal of electronic glosses results from their multimodality. By juxtaposing different and supporting modes of input, Brett (1998) argues that the multimedia environment may facilitate a greater comprehension of the input than that facilitated by input delivered only via one of these modes, which brings about the reinforcement of long-term

retention of information.

Another advantage of electronic glosses is that onscreen presentation can make lexical items and their linguistic features salient (Pachler, 2001). Brett (1998) explains this saliency: “The multimedia environment has features which enable on-screen language to be made salient and noticed using hypertext to provide additional information about language through explanations, definitions or examples (p.180).”

This saliency leads to noticing in learners, which plays a pivotal role in language learning because no vocabulary or knowledge can be acquired without noticing, even when the learner is extensively exposed to such knowledge. Further, dictionaries might function only as a reference tool. The importance of noticing is supported by several cognitive perspectives. Brett (1998) points out that, in language learning, noticing plays a pivotal role in converting input to intake. In other words, without the learners’ noticing of lexical items, any lexical item can be screened out; moreover, the long-term retention of these lexical items can be enhanced only by noticing. Furthermore, the perspectives of cognitive linguistics support the saliency of noticing, that is, the foregrounding of a certain part of the image schema (Langacker, 1987). Johnson (1987) illustrates the examples of foregrounding by using of the image schemata of the preposition out (figure 2).



*Figure 2* Examples of foregrounding (Johnson, 1987, p. 32)

As seen in figure 2, the image schema can be transformed according to what part can be focused

on or foregrounded. These images convey to EFL learners that the senses of polysemous words such as prepositions originate from the schematic images of spatial relation transformed by the foregrounding. Noticing this origination can be the key to the successful learning of prepositions, which are regarded as difficult to learn. In this sense, multimedia glosses, especially visual ones, have the potential to facilitate EFL vocabulary learning. This is due to the standpoint that a moving or 3D (three-dimensional) image, which can be produced in a multimedia environment, makes the image schemata approximate our bodily experiences and therefore facilitate noticing in EFL learners.

### ***The Problem of Visual Gloss in a Multimedia Dictionary***

Although many researchers point out the dimensions of multimodality in visual glosses encompassing multimedia dictionaries, it appears that their research has been insufficient. This is because most of the studies on glosses for EFL vocabulary learning mentioned in the introductory part of this paper focus on the retention of vocabulary. Thus, these studies pay less attention to our concerns regarding the importance of meaning comprehension and the configuration of visual glosses in making effective use of the advantage provided by electronic glosses.

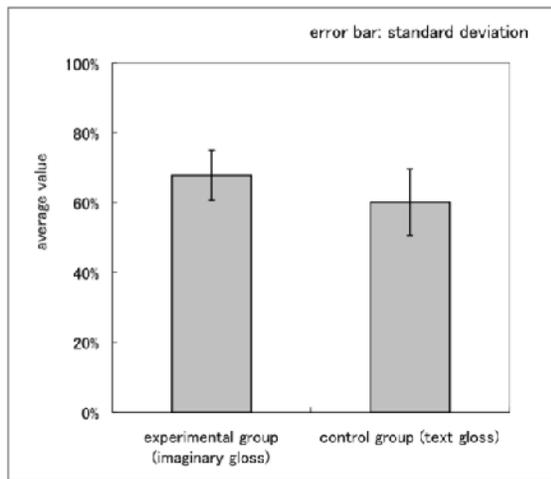
Taking these concerns into consideration, we conduct an experimental research in the following section.

## **Research**

### ***Research Questions***

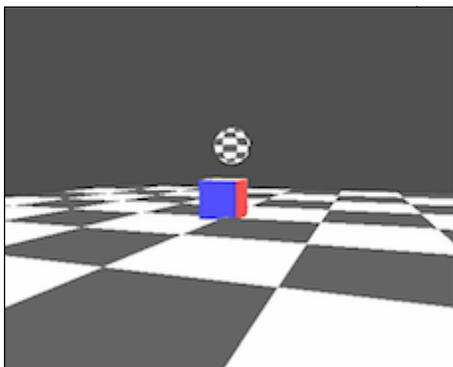
On the basis of the concerns discussed above, two research questions can be raised. The first is whether visual glosses are more effective in the comprehension of spatial prepositions rather than long-term retention of vocabulary. This concern, however, was examined in Study 1 by Sato and Suzuki (2010 forthcoming), an experimental study exploring whether the image schemata of spatial prepositions as visual glosses can facilitate learners' comprehension of prepositional information better than verbal gloss, which verbally explains the spatial relationship of the vocabulary. The participants were divided into two groups and answered 40 questions about physical senses of special prepositions. The result analyzed by the t-test (see Figure 3) revealed significant differences between the two groups ( $t(43) = 3.10, p = 0.003$ ). This result shows that image schema can be a more effective gloss in helping learners comprehend the meanings of

polysemous words.



*Figure 3* The result of the experiment for Study 1

Our second research question, which we not only examined in Study 2 (Sato & Suzuki, in press), but also refocus on in the present study, addresses the types of image schema that are more effective as multimedia glosses. The procedure we used is based on a paper by Al-Seghayer (2001), in which he shows that animation is a more effective technique than the use of planar images. Furthermore, cognitive linguistics, which is the theoretical background of our study, emphasizes our physical experience in language comprehension. Therefore, our study examines whether image schema, which is close to our perception of spatial relation with 3D (Figure 4) and animation techniques, can be more effective visual glosses than pictorial image schema (Figure 5), which is traditionally viewed as gloss.



*Figure 4* 3D image schema as electronic gloss

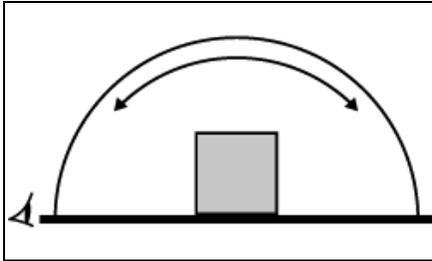


Figure 5 Planar image schema as visual gloss from Tanaka, Takeda & Kawade (Eds.) (2003)

To verify multimedia-oriented visual gloss in Sato & Suzuki (in press), three different types of multimedia glosses were created in a web-based English-Japanese dictionary for spatial prepositions. The first includes a static, two-dimensional gloss (Figure 5). The second includes a two-dimensional animation gloss, and the third a three-dimensional animation gloss (Figure 4). The result of the research in Sato and Suzuki (2010 forthcoming) where participants were asked to choose appropriate prepositions (on the same test as Study 1) with reference to these visual glosses, shows no significant difference between the scores of the three groups ( $F=0.2277$ ,  $df=2/54$ ,  $p>.05$ ; see Figure 6). As a result of this research, we were unable to determine whether or not a certain type of visual gloss is more effective than the others.

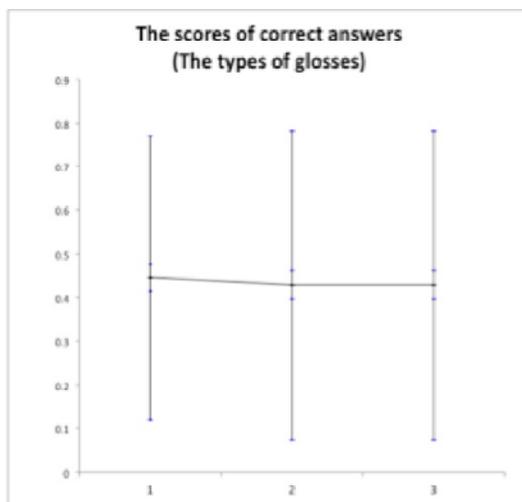


Figure 6 The result of the experiment for Study 2 (✳factor 1: planar visual gloss, factor 2: planar gloss with motion, factor 3: 3D gloss with motion)

Based on the results of our previous research, we conducted experimental research in this study.

### ***Method***

The null hypothesis for this study is, as in Study 2, that no significant difference exists between the two different kinds of multimedia visual glosses that help learners comprehend the meaning of spatial prepositions. Therefore, we used two different types of multimedia glosses in a multimedia English–Japanese dictionary for seven spatial prepositions, such as above, across, below, in, into, on and over. The first dictionary included a static 2D gloss (figure 5) while the other dictionary included a 3D (figure 4) animation gloss.

### ***Experimental Procedure***

24 EFL learners from the first author's university participated in this research. They were randomly divided into two groups: control and experimental groups and then given a test to write twenty appropriate spatial prepositions according to the context. After the test, they were instructed to use the dictionaries and then asked to use them within a predetermined time. In order to check whether they can use the dictionaries with reference to the glosses, we conducted another vocabulary test wherein they were required to choose an appropriate spatial preposition according to the context. This multiple-choice test consisted of 45 questions about the seven spatial prepositions; 14 questions, which describe physical meanings of the prepositions were derived from the test in Study 2, in which lower percentage of correct answers were shown; the other 30 questions describe metaphorical meanings such as "Health is above wealth " which might be more difficult to answer than physical meanings. Following the completion of the test, the scores were analyzed using t-test and two-way ANOVA to validate our null hypothesis.

### ***Results***

First of all, a t-test was conducted to find the significant differences between control groups (referring to planar image glosses) and experimental group (referring to stereoscopic image glosses). As the result of the t-test, firstly we found that there is no difference in the linguistic knowledge of special prepositions between control and experimental groups ( $p=0.9115$ ). However, we also found that there is no statistical significance between those who refer to planar and 3D dictionaries. The p-value in Figure 7 shows that the associate p-value is not within a

significant level ( $p=0.5575$ ).

	Control Group (n=12)		Experimental Group (n=12)		P (two-sided)
	M	SD	M	SD	
Pre Test	0.592	0.093	0.596	0.089	0.9115
Post Test	0.504	0.067	0.519	0.057	0.5575

Figure 7 The results of the t-test

Then, two-way ANOVA was implemented to examine between-subject (2D and 3D visual glosses) factors can influence within-subject factors (physical and metaphorical senses of spatial prepositions). As a result of our analysis shown in Figure 8, 9 and 10, it was found that interaction was not statistically significant ( $F(1, 22)=2.74, P>.05$ ). This means that there is no significant difference between the use of planar schematic image and that of multimedia-oriented tridimensional image in EFL preposition learning.

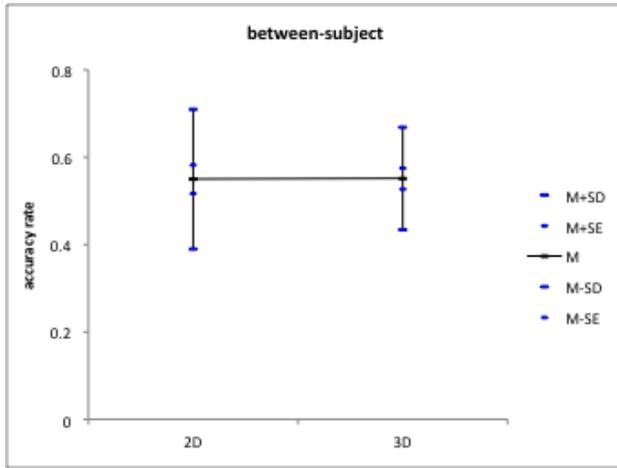


Figure 8 The result of two-way ANOVA analysis (between-subject)

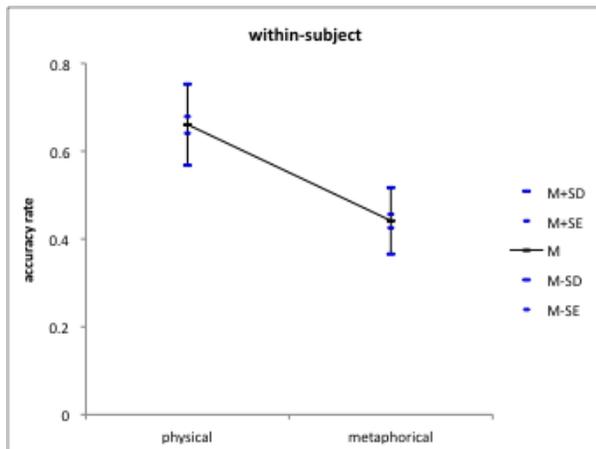


Figure 9 The result of two-way ANOVA analysis (within-subject)

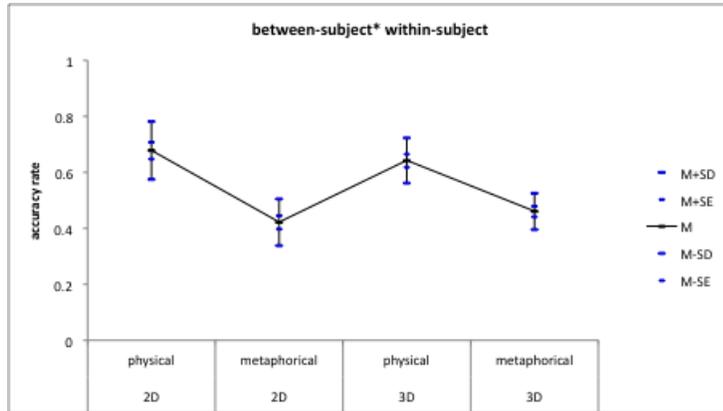


Figure 10 The result of two-way ANOVA analysis (between-subject\*within-subject)

### Discussion

Why isn't the reference to multimedia-oriented glosses in EFL vocabulary learning more effective than planar image glosses? In Cognitive Linguistics, schematic images have flexibility and changeability (Langacker, 1987), which means the foregrounding, rotation and focusing of a certain part of the images. Considering the results of this current study, 3D images might disturb learners' transformation of the images and therefore lead to the failure to understand the meaning according to the context.

### Conclusions

The present study has sought to verify the differences between three types of multimedia visual glosses. Another of our studies (Sato & Suzuki, 2010 forthcoming) shows that image schema, or schematic representations of spatial relationships, are more effective in learning the meaning of spatial prepositions and in choosing appropriate prepositions according to context. On the basis of the results, this study has explored whether multimedia-oriented visual gloss with 3D and animation techniques in image schema can affect the understanding of vocabulary. A series of our studies, however, consistently reveals that there is no difference between multimedia-oriented visual gloss and planar visual gloss which can be shown in print-based dictionary or textbook. In this respect, we cannot derive any claim on this issue from this result, but we still

believe that our study will contribute to the effective use of advanced media in a CALL environment due to the fact that many studies uncritically insist on the advantages of multimedia-oriented aids. Our study, however, is not generally the case in a CALL environment. This might imply that more deliberate use of multimedia-oriented aids should be needed. Taking this into consideration, dictionaries with such multimedia-oriented glosses could extend programs from being mere reference tools which provide an appropriate meaning or definition for learners, to becoming learning tools.

## References

- Al-Seghayer, K. (2001). The effect of multimedia annotation modes on L2 vocabulary acquisition: a comparative study. *Language Learning and Technology*, 5(1), 202-232
- Brala, M, M. (2002). Prepositions in UK Monolingual Learners' Dictionaries: Expanding on Lindstromberg's Problems and Solutions. *Applied Linguistics*, 23(1), 134-140.
- Brett, P. (1998). Using Multimedia: A Descriptive Investigation of Incidental Language Learning. *Computer Assisted Language Learning*, 11(2), 179-200.
- Chanier, T., and Selva, T. (1998) The ALEXIA system: the use of visual representations to enhance vocabulary learning. *Computer Assisted Language Learning*. 11(5), 489-521.
- Chun, D. L., & Plass, J.L. (1996). Effects of multimedia annotations on vocabulary acquisition. *Modern Language Journal*, 80(2), 183-198.
- Hatch, E. & Brown, C. (1995). *Vocabulary, Semantics, and Language Education*. Cambridge: Cambridge University Press.
- Ellis, N.C. (1995) The Psychology of foreign language vocabulary acquisition: Implication for CALL. *Computer Assisted Language Learning*, 8(2-3), 103-128.
- Johnson, M. (1987). *Body in the Mind*. Chicago: Chicago University Press.
- Kost, C. R., Foss, P., & Lenzini, J. J. (1999). Textual and pictorial glosses: Effectiveness on incidental vocabulary growth when reading in a foreign language. *Foreign Language Annals*, 32 (1), 89-113.
- Lakoff, G. (1987). *Woman, fire and dangerous thing*. Chicago: Chicago University Press.

- Langacker, R. W. (1987). *Foundations of Cognitive Grammar, Volume I, Theoretical Prerequisites*. Stanford, California: Stanford University Press.
- Lindstromberg, S. (2001a). Preposition Entries in UK Monolingual Learner's Dictionaries: Problems and Possible Solutions. *Applied Linguistics*, 2 (1), 79-103.
- Lindstromberg, S. (2001b). Are English prepositions really incredibly idiomatic? *Humanising Language Teaching Magazine*, 3(3). Retrieved April 10, 2010 from <http://www.hltmag.co.uk/may01/lind.htm>
- Laufer, B., & Hill, M. (2000). What lexical information do L2 learners select in a CALLdictionary and how does it affect word retention? *Language Learning and Technology*, 3(2), 58-76.
- Lomicka, L. L. (1998). 'To Gloss or Not To Gloss': An Investigation of Reading Comprehension Online. *Language Learning & Technology*, 1, 41-50.
- Mayer, R. E. & Anderson, R. B. (1991). Animations need narrations: An experimental test of a dual-code hypothesis. *Journal of Educational Psychology*, 83,484-490.
- Pachler, N. (2001). Electronic reference tools for foreign language learners, Teachers and users: Offline vocabulary look-up programs. *Language Learning Journal*, 24, 24-29. Also in *TELL&CALL*, 4, 18-23.
- Rieber, L. P. (1990). Effects of animated visuals on incidental learning and motivation. *Proceedings of Selected Paper Presentations at the Convention of the Association for Educational Communications and Technology*. Dallas, Texas.
- Sato, T. (2003). The Effectiveness of the Combination of Verbal Explanation with Imagery as Electronic Glosses from the Perspective of Second Vocabulary Acquisition; In the case of Spatial Polysemous Words. *Media and Education*, 11, 9-25.
- Sato, T., & Suzuki, A. (in press). Verifying multimedia gloss: Image schemata and polysemous vocabulary in English. *Proceedings of EUROCALL 2009 Conference*.
- Tanaka, S., Takeda, S., & Kawade, S.(Eds.). (2003). *E-gate English-Japanese dictionary*, Tokyo: Benesse Corporation.
- Watanabe, Y. (1997). Input, intake, and retention: Effects of increased processing on incidental learning of foreign language vocabulary. *Studies in Second Language*

*Acquisition*, 19, 287-307.

Yoshii, M., & Fraitz, J. (2002). Second Language Incidental Vocabulary Retention: The Effect of Text and Picture Annotation Types. *CALICO Journal*, 20(1), 33-58.

Yeh, Y., & Wang, C. (2003). Effects of Multimedia Vocabulary Annotations and learning styles on vocabulary learning. *CALICO Journal*, 21(1), 131-144.

Zlatev, J. (1999). Situated embodied semantics and connectionist modeling. In Allwood, J. & Gardenfors, P. (Eds.), *Cognitive semantics: Meaning and cognition*, (pp. 173-194). Amsterdam: John Benjamin