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Effects of visual aids on intermediate Chinese reading comprehension

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Abstract

This study adopted the between-subjects and within-subjects group designs to examine the impact of visual aids on 26 intermediate Chinese as a Foreign Language (CFL) learners' reading comprehension in an American college. Students were assigned into two groups to complete multiple-choice and translation tasks to test effects of visual aids. The results show that visual aids have an overall positive effect on intermediate CFL reading. The results from the within-subjects design were partially statistically significant. This study postulates that this complication was due to factors such as learners' backgrounds, the types of tasks, and the nature of the visual aids. Using Dual-Coding Theory, this study offers implications for CFL pedagogy.

Keywords: visual aids, Chinese, reading

Due to its orthographic reading system, Mandarin Chinese is a challenging foreign language (FL) for western learners with alphabetical language backgrounds to read (Everson, 2009; Everson & Ke, 1995; Hadley, 2001; Xing, 2006). In the last thirty years, visual aids have been used extensively in communication (Gambrell, 1982; Gambrell & Bales, 1986; Pressley, 1976; Sadoski, 1983). The more recent reading research in education calls for understanding visually-aided reading in the purpose of communication (Gee, 2003). Not only do kids read visually-aided storybooks at an early age (Black, 2009; Gambrell, 1982; Gambrell & Bales, 1986; Pressley, 1976; Sadoski, Goetz, & Avila, 1995), but adults and college students also use a substantial amount of visual aids in both formal (Hou, 2006) and informal reading moments (Gee, 2003; Lammers, Curwood, & Magnifico, 2012). Reading now refers to texts, pictures, comics, emoji, and even symbols in multimodal settings (Lammers et al., 2012; Kress, 2009; Hafner, Chik, & Jones, 2015).

Although a growing number of Chinese as Foreign Language (CFL) researchers have investigated reading in CFL (Everson & Ke, 1995; Ke, 1998a, 1998b; Shen, 2013), such as relationships between Chinese orthographic features and CFL character reading (Everson & Ke, 1995), few scholars have paid attention to the use of visual aids in reading Chinese stories. While more and more current CFL teachers are incorporating visual aids in their multimedia classrooms (Paesani, 2016; Xie & Yao, 2009; Yu, 2012), no study has directly tackled the effects of visual aids on intermediate CFL reading comprehension. It is important for CFL educators to gain an understanding on this issue.

FL researchers often use recall as a tool to assess the effects of visual aids on reading comprehension (Hou, 2006; Liu, 2004). This study examines effects of storyboard visual aids measured by both multiple-choice and translation tasks because these two assessment methods overcome cognitive overload, which is a common concern in reading comprehension (Hou, 2006; Sadoski, 1983; Sadoski, Goetz, & Avila, 1995).

To better understand the effects of visual aids, this study answers the following two research questions:

1. Do groups reading the articles with visual aids outperform the groups without visual aids in multiple-choice and translation tasks in the between-subjects design? Why or why not?
2. In these two tasks, do students score higher when they read the articles with visual aids than without visual aids in multiple-choice and translation tasks in the within-subjects design? Why or why not?

Literature Review

Existing foreign language (FL) and general English reading research has investigated the effects of visual aids in terms of when, where, and how to use visual aids in reading comprehension. The found variables that influenced reading comprehension include: the learners' backgrounds (Hegarty & Just, 1993; Mayer & Anderson, 1991), the types of reading texts (Hou, 2006), and the types of visual aids (Hegarty & Just, 1993; Omaggio, 1979).

Some studies showed that visual aids improved reading comprehension (Hou, 2006; Omaggio, 1979), while other reading research showed contradictory results about visual aids' effects on reading (Glenberg & Langston, 1992; Waddill & McDaniel, 1992). For example, Glenberg and Langston (1992) claimed that students with less prior knowledge (low-skilled learners) get more benefits from visual aids than those with more prior knowledge (skilled learners). However, Waddill and McDaniel (1992) indicated that pictures benefit skilled learners but not the low-skilled learners.

It is important to test the effects of visual aids on reading comprehension measured by multiple choice and translation tasks. This warrants my study, which examines the visual effects on intermediate-level CFL reading with these two tasks. Because the intermediate level is a significant level in FL reading education (Herron, Corrie, Dubreil, & Cole, 2002), understanding the complexity of CFL reading with visual aids at this level will offer implications for classroom reading instructions.

Theoretical Framework

Theoretically, the early cognitive studies (Gambrell & Bales, 1986; Pressley, 1976; Sadoski, 1983; Sadoski, Goetz, & Avila, 1995) offered an important understanding of the current reading research in visual effects on FL learning, particularly in Dual Coding Theory (DCT).

DCT claims that information registered both visually and verbally is processed twice in a human brain (Clark & Paivio, 1991; Mayer & Anderson, 1991, 1992; Paivio, 1971, 1986). This helps FL reading because students comprehend text information in multiple ways, both visually and verbally. In FL learning, DCT supports the idea that when learning content is imaginable, better FL reading comprehension can be expected, as information is dual coded. In other words, two mental representations (verbal and visual) are more powerful than one (textual and verbal) alone, as shown in Figure 1.

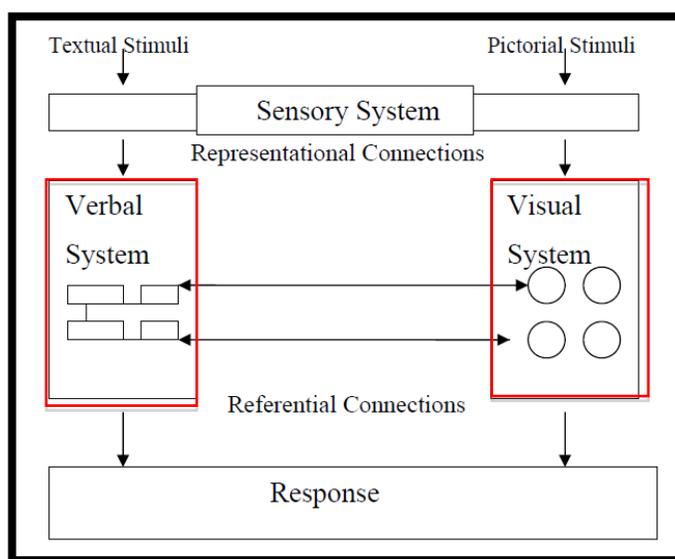


Figure 1. Adaption from Paivio's (1976) model of Relationship between Verbal and Mental Representation

From a DCT stance, FL researchers showed positive effects of visual aids, for example, reading with visual aids could create more mental inferences than reading a FL text alone (Hou, 2006; Liu, 2004). Using DCT, Hou (2006) studied visual effects on 80 English as a Second Language (ESL) readers, who participated in reading tasks in four groups: 1) an elaborate story with storyboards, 2) an elaborate story without storyboards, 3) a non-elaborate story with storyboards, and 4) a non-elaborate story without storyboards. Hou discovered that in the non-elaborate story group the ESL students' performances with storyboards were significantly higher than the scores of participants in the group without storyboards, which echoes that the low-skill learners benefited more from the visual aids than skilled readers (Glenberg & Langston, 1992). Hou's (2006) study is an example that illustrates how DCT can be a theoretical lens to examine various relationships between the effects of visual aids and FL reading in general. Borrowing Hou's idea, DCT allowed me to explore the visual effects of two Chinese storyboards on Chinese story reading specifically.

Method

This section first introduces the participants. Next, it describes the reading materials, the validity of the materials, and the designs of the reading tasks.

Participants

The study involved 26 CFL learners (17 males and 9 females) enrolled in two sections of intermediate Chinese courses in the spring semester of 2009 in a Midwest American public university. Twenty-four of them were U.S. citizens including the 10 heritage learners. The two non-US students were an Italian and a Canadian. All 26 students considered themselves native English speakers except the Italian student. Twenty-five of them were undergraduate students with various majors. One student was a graduate student. The average age of the 26 students was 19 years old, ranging from 18 to 23 years old.

There were two groups in this study: Group 1 has 14 students from section 1 and Group 2 has 12 students from section 2. Table 1 shows the comparisons between Group 1 and 2 in terms of gender and heritage backgrounds¹ because having a Chinese heritage background may play a role in their reading comprehension tasks (Xing, 2006).

Table 1. *Comparison between group 1 and 2*

Backgrounds	Number of Students	
	Group 1	Group 2
Females	7	2
Males	7	10
Heritage students	4	6
Non-heritage students	10	6

At the time of investigation, all students had studied Chinese for one and a half years in college. Their Chinese reading levels reached the American Council on the Teaching of Foreign Languages (ACTFL, 2019) intermediate level (being able to recognize 1000-1500 frequently used Chinese characters).

Reading Materials

This researcher created Article 1 from the existing storyboards from a website, *Enfang* (2009). Article 2 was adapted from the already existing text that was written for the storyboards on the website, *Diyifanwen* (2009) (See Appendices A and B). In brief, the researcher first wrote Article 1--the stories based on the first storyboards from a website called *Enfang*, and then she modified Article 2--the existing story from a website called *Diyifanwen* (See note 5).

Article 1 is a story about a school kid who picks up a wallet from the street and waits to return it to the original owner. Article 2 is a story about a father and a son trying to jump over the safety barriers that separate pedestrians from the traffic in the street. An officer catches them and reprimands the father, instead of the son. Both articles are typical stories for teaching moral standards in elementary school in China. Article 1 teaches school kids honesty and Article 2 suggests the importance of setting a good example. Both of the articles express basic concepts that can transcend cultural barriers.

Validity

There are three ways that the researcher ensured the validity of this study. They are namely; (a) the similarity of reading texts in the between-subjects and within-subjects designs, (b) the appropriateness of the reading texts for the participants, and (c) the control of participants' reading levels.

In order to make sure that there are similar reading texts in the between-subjects and within-subjects designs, the researcher produced stories that are linguistically similar. The researcher created the two reading texts (i.e., Articles 1 and 2. See Appendices A and B) to be comparable in terms of length, vocabulary, and syntax. They had similar total number of characters, character difficulty levels, and total character occurrences, regardless of the fact that Article 1 has 10 sentences and Article 2 has 7 sentences. Moreover, the researcher used Chinese reading analysis software named *Chinese TA* to confirm the similarity between the two reading texts. Table 2 compares the two texts.

Table 2. *Comparisons between the two texts*

Group	Article 1	Article 2
Number of characters	258	253
Character difficulty levels *	111/甲	94/甲
	11/乙	9/乙
	2/丙	2/丙
		2/丁
Total Character Occurrences	232	214

Note. *Based on the official standard and testing guideline in HSK

Second, in order to ensure that the reading texts for the participants are appropriate, the researcher checked that the vocabulary level, content, and proficiency level of the articles are the appropriate level for the participants. The researcher was an experienced Chinese teacher, who has extensive educational training and background in Chinese instruction, and thus, she judged the appropriateness of the level when designing.

Third, in order to make sure participants' reading levels are appropriate for the texts, the researcher used the strategy of employing cross-researcher perspectives. She invited another experienced Chinese language instructor to check the level-appropriateness for the participants. This way, the reading materials are ensured to be valid. Cross-researchers checking also helped with validity of the reading materials. In addition, the researcher controlled the proficiency of the participants being the intermediate level. In summary, the reading materials are at the appropriate level for the participants.

Two Reading Comprehension Tasks

This study examines effects of storyboard visual aids measured by both multiple-choice and translation tasks² because multiple-choice and translation tasks could better overcome cognitive overload, which is a critical issue in assessing reading comprehension (Baddeley, 2003; Liu, 2004; Sadoski, 1983; Sadoski, Goetz, & Avila, 1995). This researcher asked the students to first

read the text and then complete both multiple-choice and translation tasks, in a fifty-minute class period (approximately twelve minutes per task, alternating between two readings and two tasks). All the students completed the two tasks within the budgeted period. If students read with visual aids, the visuals were presented at the same time as the reading processes.

Twenty-six students were assigned into two groups. The first group (N=14) read Article 1 without storyboard visual aids and Article 2 with visual aids (See Appendices), while the second group (N=12) read Article 1 with visual aids and Article 2 without. The reason for the unequal number of students in the first and the second groups was because there were two students who did not complete the tasks and whose data were dropped for analysis from the original Group 2, which had had 14 students.

Multiple-choice tasks (MTs). There were MTs for each article including two main idea questions, four factual questions, two inferential questions, and two predictive questions. These types of questions were randomly interwoven (See Appendices A and B). The question types were mirrored in the two articles in order to confirm that the MTs are equal in format in both articles.

Each multiple-choice task consists of a question or incomplete statement, followed by four options. The options consist of the correct answer and distracters (incorrect but tempting options). The distracters are comparable with the correct option in terms of length, complexity, and grammatical form. Thus, there was no cue bias or reading comprehension difference in favor of the distracters. After the options were designed, the location of the answer was varied as randomly as possible. In the designing these questions, the researcher collaborated with her MA advisor, a professor in a research public university, who possesses expertise in the content area of CFL reading research. She reviewed the items for possible ambiguities, redundancies, and other structural difficulties, which were important issues in designing reading tasks (Baddeley, 2003; Liu, 2004; Sadoski, 1983; Sadoski, Goetz, & Avila, 1995).

Translation Tasks (TTs). The TT for Article 1 was to translate the ten sentences of Article 1 (TT1); The TT for Article 2 was translating the seven sentences of Article 2 (TT2). The evaluation for both translation tasks is based on grammatical components, which is a common method to measure the production of linguistic knowledge gained from reading comprehension.

Moreover, in order to determine the validity of the grading for the TTs, two raters (this researcher and her colleague) first individually and blindly determined the grammatical components of the texts and assigned scores to essential information that students were expected to produce during their translation. Then they graded the students' performance of the tasks. The Pearson correlation between the two raters on the judgment for grammatical components of the reading texts is $R = 0.95$ ($n=21$), and the correlation for their grades for the TTs is $R = 0.99$ ($n=21$). The high correlation means that the raters agreed on both the key grammatical components of the texts and the scores the students gained.

Results

Between-Subject Design

RQ1: Do groups reading the articles with visual aids outperform the groups without visual aids in multiple-choice and translation tasks in the between-subjects design?

Between-subjects design refers to comparisons between Group 1 and Group 2. Before introducing the results from the independent *t* tests, we can see positive effects from visual aids in the descriptive statistics.

In both MTs and TTs, the average scores for the groups with visual aids were higher than those of the groups who read the same articles without visual aids. For example, Group 2, who read Article 1 with visual aids, answered 4.8 questions (out of 10 questions) correctly on average ($M=48$, $SD=23$) in MTs. Whereas Group 1, who read the same article (Article 1) without visual aids, answered on average only 3.6 questions correctly in their MTs ($M=36$, $SD=18$). Table 3 shows the results of the MTs.

Table 3. Accuracy rates in the multiple-choice tasks (in percentages)

Group	Article	Number of students	With visual aids	<i>M</i>	<i>SD</i>
1	1	14	N	36	18
1	2	14	Y	50	24
2	1	12	Y	48	23
2	2	12	N	43	21

Note. N means without visual aids, Y means with visual aids

For Article 1, with visual aids, Group 2 answered 1.2 more questions correctly on average than Group 1 without visual aids in the MT1. For Article 2, similar pattern exists for the MT2. Likewise, in the TTs, in both groups, students with visual aids performed better than without. Table 4 shows the results of the TTs.

Table 4. Accuracy rates in the translation tasks (in Percentages)

Group	Article	Number Of students	With visual aids	<i>M</i>	<i>SD</i>
1	1	14	N	71	22
1	2	14	Y	72	26
2	1	12	Y	75	25
2	2	12	N	65	27

Based on the descriptive statistics, four independent *t* tests calculated the inferential statistics. Table 5 shows the results for the independent *t* tests for all MTs and TTs.

Table 5. *Independent t test (Between-subjects design) p-value results*

Test type	Article	T test	p-value	Group 1		Group 2	
				With visual aids	Mean	With visual aids	Mean
MT1	1	-1.38	0.18	N	36	Y	48
MT2	2	0.85	0.41	Y	50	N	43
TT1	1	-0.37	0.71	N	71	Y	75
TT2	2	0.68	0.51	Y	72	N	65

Note. Levene's Test was not significant for all the four tests, thus the equal variance between the two groups was assumed.

The results in between-subjects design were all not statically significant. For MT1, when Group 1 read Article 1 without visual aids (M=36, SD=18), the performance was not significantly lower than Group 2 who read the same article with visual aids (M=48, SD=23), $t(24) = -1.38$, $p = 0.18$, effect size=0.27. In MT2, a similar pattern exists. When Group 1 read Article 2 with visual aids (M=50, SD=24), their performance was also not significantly higher than the performance of Group 2 who read the same article (M=43, SD=21), $t(24) = 0.85$, $p = 0.41$, effect size=0.17. As for TT1, likewise, when Group 1 read Article 1 without visual aids (M=71, SD=22), their performance was not significantly lower than Group 2 who read the same article with visual aids (M=75, SD=25), $t(24) = -.37$, $p = 0.71$, effect size=0.07. A similar pattern exists in TT2.

In sum, the consistent better performance of groups with visual aids has demonstrated that visual aids did help reading comprehension regardless of the types of tasks, in descriptive statistics. However, in both MTs and TTs, the impact of visual aids on the reading performance of Group 1 and Group 2 were not statistically significant.

Within-Subjects Design

RQ2: In these two tasks, do students score higher when they read the articles with visual aids than without visual aids in multiple-choice and translation tasks in the within-subjects design?

Within-subjects design refers to comparisons between performance within the same group. The average scores for students within the same group who read one article with visual aids were higher than their scores for the other article without visual aids in both MTs and TTs. Four paired t tests were used to calculate the statistical significances. The results of the two pairs of comparisons were statistically significant. However, the other two pairs of t tests were not statistically significant. Table 6 shows the results of these four pairs.

Table 6. *Results of the four paired t-tests (Within-subjects design)*

Test type	Group	<i>t</i> test	<i>p</i>	Article 1		Article 2	
				With visual aids	Mean	With visual aids	Mean
MT1	1	-2.23	.04*	N	36	Y	50
MT2	2	1.39	.19	Y	48	N	43
TT1	1	-.406	.69	N	71	Y	72
TT2	2	2.18	.05*	Y	75	N	65

Note. * $p \leq .05$

The two pairs of scores (in the paired *t* tests), that are statistically significant, were in two different tasks: MT1 and TT2. In another word, the statistical significance was only found in MTs, in favor of Group 1 with visual aids. When Group 2 read with visual aids, their performance was not statistically significantly better than their performance of reading without visual aids.

Specifically, when the same group—Group 1 read Article 2 with visual aids ($M=50$, $SD=24$), their performance was significantly better than their performance on Article 1 without visual aids ($M=36$, $SD=18$) where the *p*-value was 0.04 ($t(13)=-2.23$, effect size=0.52), which indicated the statistical significance. However, with the same task type MT, when the other group (Group 2) read Article 1 with visual aids ($M=48$, $SD=23$), their performance was not significantly higher than their performance on Article 2 without visual aids ($M=43$, $SD=21$); $t(13)=1.39$, $p=0.19$, effect size=0.36.

The statistical significance was found in a reverse way in the task type of TTs, in favor of Group 2 with visual aids. In TTs, when Group 1 read Article 2 with visual aids ($M=72$, $SD=26$), they did not perform significantly better than when they read Article 1 without visual aids ($M=71$, $SD=22$), $p=0.69$, effect size=0.02. However, when Group 2 read Article 1 with visual aids ($M=75$, $SD=25$), their performance was significantly better than when reading Article 2 without visual aids ($M=65$, $SD=27$); the *p*-value was 0.05, effect size=0.18.

In the next section, I will briefly state the significance of this study. Secondly, I will provide some information about the complexity of the participants' backgrounds and their relations to their reading performance recorded in this study. Third, using that discussion, I will discuss some of the possible reasons to explain the partially significant results of this current study, in regard to visual effects on intermediate CFL reading. In the end, I will point out the limitation before the conclusion of this study.

Discussion

This study examines one model of instructional strategies of reading, which uses visual aids along with the reading texts to facilitate reading comprehension at the intermediate level. The results show that visual aids are effective in helping Chinese reading comprehension in terms of two types of tasks: MTs and TTs. This echoes Hou's (2006) findings that visual aids are powerful tools at the intermediate level for English as a Foreign Language (EFL) reading. In this study, visual effects also helped intermediate level CFL readers. This was due to the fact that, at

this level, the students' proficiency in reading was neither too high nor too low so that the visual effects could play a significant role.

This study fills a gap in the FL reading research because previous FL reading research has demonstrated that visual effects helped reading recall (e.g., Hou, 2006), mainly in the EFL context. Extending this line of research about visual effects on reading in a FL, this study proved that (a) storyboards can help CFL reading and (b) visual effects can help reading in MTs and TTs, in addition to recall. These two findings added to this line of reading research in visual effects by assessing FL readings further in a less commonly taught language--Chinese (other than EFL, or Spanish as FL) and in the formats of multiple choice and translation tasks.

Admittedly, even though there are overarching positive visual effects found in this study, there are also complexities found in the partial statistically significant positive effects from visual aids. In the following text, to unveil the complexities, let us first consider the reasons behind the positive effects.

The Positive Effects

The visual aids in this study were found to be helpful due to the sequential order of the storyboards, which predicts the storylines of the reading texts. This helps the students associate the storyboards with the corresponding texts easily. As a result, it helps the students complete the MTs and TTs better based on the sequential order of the story with visual aids. This echoes with Glenberg and Langston (1992), who provided similar perspectives. In their study, they claimed that readers benefited from reading graphics underlining the sequential links between the steps of the procedures described in the corresponding texts. In brief, the vivid plots depicted in the visual aids mediated better performance in reading.

Second, the transcultural nature of storyboards reinforced the message conveyed in the texts. This is because the moral standards ("honesty" in Article 1, and "setting a good example" in Article 2) are basic values that can transcend cultural barriers. This is predicted by recommendations from the Standards for Foreign Language Learning (1996), which proposed three categories for cultural reading: cultural practices, products, and perspectives. Cultural practices refer to the patterns of interactions in a story; cultural products are defined as results of a story; and cultural perspectives refer to cultural values that are presented in a story. If a given story with these three categories is culturally loaded, then the story will be harder for FL learners to comprehend. However, in this study, regarding these three categories, the storyboards used for the articles are not culturally loaded.

Thus, the positive effects of the visual aids were expected because the visual aids facilitated the reading performance in their cross-cultural nature. The visual aids in Article 1, for example, present a basic transcultural assumption, that if you found an unattended wallet you should return it to the owner. This is because using the concepts of cultural reading, (a) everyone in the world can understand the patterns of interactions about honesty (cultural practices), (b) be aware that it is honest to return money to the owner if found (cultural products), and (c) everyone can know the value of being honest (cultural perspectives). Therefore, from a sociological view (Macionis,

2016), the story could be easily understood for any cultural group, and thus the visual aids enhanced the CFL reading comprehension of the participants in this study.

Briefly, the patterns of results associated with the significant paired t tests (within-subjects design) between visual aided and non-visual aided articles in both tasks partly support the prediction in DCT. Visual aids have facilitative effects on reading if they are transcultural and sequential. Given the limits on working memory (Baddeley, 2003) and the design of this study (reading and visuals are presented at the same time), I postulate that referential connections between representations of words and pictures could be constructed when the words and pictures are presented contiguously in time and space, especially at the intermediate level of CFL reading. The significant results of visual aids confirmed this postulation.

In this study, not all the positive effects were strong enough to be statistically significant, given the small sample size. However, there are some possible explanations for the partially statistically significant effects of visual aids. Next, I explain this complexity by unveiling the backgrounds of learners (e.g., gender) in the study. To understand the complexities of the study's results, I also use what the reading research knows about how other factors might impact reading performance, such as academic strategies, learning styles, task types, and interplay of learners and these factors. By doing this, I hope to explain the partially statically significant effects of visual aids on intermediate CFL reading.

The Complexities

There are insignificant, yet positive effects, in the results from between-subjects design. In addition, the results from the within-subjects design are complicated with two statistically significant pairs. Considering the positive visual effects, I postulate that whether or not visual aids play a strong positive role could potentially be dependent on gender differences, academic strategies, learning styles, the types of tasks, and interactions among these factors.

To illustrate these complications, I will discuss the complexities in between-subjects and within-subjects designs respectively.

Complications in between-subjects design. Since this study compares the performance of students in Group 1 and 2 using the same article in this between-subjects design, one cannot only attribute the differences of performance to the text itself. In order to fully understand the results, it is then necessary to explain the nuanced demographic variables in Group 1 and 2.

First, gender differences were found between Group 1 and 2. In Group 1, there were 7 female and 7 male students. In contrast, in Group 2, there were only 2 female students, but 10 male students. The reason why Group 2 did not perform significantly better than Group 1 in the between-subjects design could be potentially explained by this difference.

In other words, the reason why on Article 1 visual aids, even positive, did not have a significant impact on the performance (MT & TT) of Group 2 could be due to the dominant number of male students in Group 2 (than Group 1). We know from literature that gender plays a role in visual learning (e.g., Glenberg & Langston, 1992; Waddill & McDaniel, 1992). This study extends this

idea and finds that female students are more likely to be visual learners. Specifically, with more male students, the effects of visual aids on reading tasks were somewhat neutralized, making the effects not statistically significant, yet still positive.

In addition, FL studies have shown that gender also plays a role in terms of how each gender uses learning strategies (Oxford, 2002). For example, women used memory, cognitive, metacognitive, affective, and social strategies more frequently than men (Lan & Oxford, 2003; Oxford & Ehrman, 1995). Among these five factors, two of them--cognitive and metacognitive strategies--are most relevant to my study, as female students might better utilize the visual aids than male students, in the cognitive and metacognitive reading process.

Consequently, when Group 2 had visual aids, they might not utilize the visual aids as a cognitive and metacognitive strategy as well as the other group that has more female students. In other words, the gender differences between Group 1 and 2 might have become a mediating variable for the positive effects of visual aids on the performance of Group 2 reading Article 1 with visual aids. That might be why the descriptive scores of reading performance of Group 2 with visual aids was better but not significantly better than Group 1. In other words, visual aids might still have positive effects for Group 2 (which has more males) while reading Article 1. However, the fact that there were more male students in Group 2 had diminished the positive effects of visual aids.

In the same between-subjects design, why were the performance of Group 1 with visual aids still not significantly better than Group 2 on Article 2? There are complicated reasons for it. As I mentioned, gender distributions were different in the two groups. In addition, the two groups also differed in their Chinese heritage³ backgrounds. Group 1 had more non-heritage students (n=10) than Group 2 (n=6). Non-heritage and heritage students, who differ in family, sociocultural, and historical backgrounds, differ in adopting reading strategies (Xiao, 2009). In other words, the heritage backgrounds could have positive effects on the reading performance for Group 2, which had more heritage students. This was because heritage students may be more familiar with these cultural stories from their Chinese parents and grandparents. Even though the stories both conveyed transcultural values, once they had some life experiences of hearing the stories, they performed better.

Even though Group 1 had visual aids, the fact that Group 2 had more heritage learners had countered the positive effects of visual aids on Group 1. That was why there were no significant differences observed from between-subjects design when Group 1 had visual aids. Future studies may consider the mediating factors in terms of heritage background.

In sum, the complications of gender differences and heritage backgrounds of learners may explain why the comparisons between the performance of Group 1 and 2 with visual aids were not statistically significant.

Complications in within-subjects design. The comparisons in the within-subjects design are between the reading performance of Article 1 and Article 2 from the same group of readers (within either Group 1 or 2). In this section, I explain why the visual effects, which were statistically significant, appeared in two different tasks (MT1 and TT2) within these two groups.

Recall the statistical significance was only found in MTs, in favor of Group 1 with visual aids reading Article 2, compared to the same group reading Article 1. In contrast, the statistical significance was only found in TTs, in favor of Group 2 with visual aided Article 1.

There are a few aspects to unveil such complexity: (a) the differences between the strategies used by two groups of readers when working on different tasks (i.e., MTs and TTs), (b) the variance of students' gender and heritage backgrounds when they adopt academic strategies, (c) the divergent demands for reading, including the interactions between the background of the students and the content of their reading tasks (MTs versus TTs), and (d) The dissimilar content between Article 1 ("Honesty") and Article 2 ("Set a good example").

It is important to note here that these four factors might interact with each other. For instance, learners' background interacted with their uses of academic strategies. The reading performance of dissimilar content of the two articles may be impacted by a heritage background. At a result, together these factors enhanced or neutralized the visual effects; thus, I cannot discuss each factor in isolation. In the discussion below, I explore each factor by bringing in other factors in an integrated model.

The differences between the strategies. Academic strategies, for the purpose of this paper, refer to different reading methods, in which students with different backgrounds may selectively use. Academic strategies can impact reading performance (Säljö, 1997). This may explain why the results in within-subjects design were both significant and insignificant. Students may selectively use the available visual aids in different types of tasks. That is to say, academic strategies varied when disparate students had various purposeful intentions in reading tasks in this study. These strategies reflect an individual reader's own choice based on their divergent socio-cultural backgrounds, genders, and ways of thinking. To give a very simple illustration, female students might depend more on visual aids while reading because gender impact the degree of how academic strategies are facilitated by visual aids (Hou, 2006). Female students in the study may outperform their male counterparts due to higher instances of colorblindness in males.

The variance of students' gender and heritage backgrounds. First, Group 1 has more female non-heritage learners than Group 2. Group 1 may be greatly helped by the visual effects in their multiple-choice tasks because we can reasonably assume here that gender might play a role in the differences in the results in our within-subjects design. Hence, Group 1's performance of reading Article 2 with visual aids were significantly better than Article 1 without visual aids. However, in contrast, translation tasks require a fundamental linguistic background to produce language, their visual aids were not that effective in their performances. After all, the visual effects cannot magically help writing performances improve in a few minutes. In other words, when they are reading Article 2 while completing translation tasks, the significance of visual aids might be neutralized by the actual levels of learners' Chinese reading and writing. Academic strategies can only do so much.

Second, there might be interactions between demands of reading performance and learners' backgrounds. Group 1 has more non-heritage students than Group 2. Non-heritage female may be good at using visual effects than male heritage learners. Heritage students who are more familiar with Chinese reading genres may be less likely to even bother using the visual aids⁴.

The divergent demands of tasks for reading. Types of tasks might also have complicated the visual aids' impacts on reading (Liu, 2004). In this study, we have two types of tasks in Chinese reading: multiple choice tasks (MTs) and translation tasks (TTs), interacting with the gender and sociocultural backgrounds. Multiple choice tasks require readers to not only locate specific information, but also to engage in deep-level comprehension activities such as evaluate and synthesize the information from the reading texts. In contrast, translation tasks require readers to have strong cultural and meaning understanding in the Chinese language *per se* in print so that they can translate the meaning into English. Translation tasks also generally require the readers to produce fundamental and accurate linguistic output of English after reading Chinese text.

In other words, the two tasks demand different aspects of language abilities from the readers, thus might have different effects on learners from different backgrounds (gender and heritage variables). For example, Group 1, which had more non-heritage students might better adopt visual aids as reading strategies in MTs (which do not require deep-level linguistic knowledge), thus they performed significantly better on MT of Article 2 with visual aids compared to MT of Article 1 without visual aids. In contrast, non-heritage students might not benefit as well from visual aids in translation task, as translation tasks in general demand substantial linguistic knowledge—which visual aids could not boost that much. Thus, Group 1 did not perform significantly better on translation tasks on Article 2 with visual aids compared to translation task of Article 1 without visual aids.

To specify in this postulation, considering the significant results of visual aids by Group 2 in Article 1 and by Group 1 in Article 2, I postulate that the high number of non-heritage-female students in Group 1 impacted their performance in multiple choice tasks. And the high number of heritage-male students in Group 2 might be counterbalancing effects of the visual aids, especially for MTs, which could be better facilitated by visual aids than TTs.

The dissimilar content of Article 1 and 2. Since the Chinese language level of Article 1 and 2 were controlled to be linguistically similar, the content of Article 1 and 2 could be a factor. Even though Article 1 and 2 are very similar in linguistic aspects (length, character difficulty, and reading level), they have different storyline and different cultural theme (honesty in Article 1 and setting a good example in Article 2). Heritage-male students, who tend to have linguistic and cultural backgrounds of Chinese (Xing, 2006), might be better at understanding the Chinese concept of honest, which is an important lesson when they grew up. Hence, they had less difficulties in using visual aids as strategies. In other words, with more heritage-male students who familiar with the moral stands of “honesty” in Chinese culture, Group 2 used better visual aids in their translation tasks. In contrast, Article 2 with complex sequencing of pictures (fewer pictures) might less aided by its storyboards among the more male and heritage formed Group 2.

It is reasonable to assume that MTs are tasks that require more academic strategies (e.g., identify information and locate details), thus Group 2 with more males (who are less likely to use academic strategies) might not as well aided by the storyboards. In addition to that, this finding is consistent with a finding in the reading research by Säljö (1997). Säljö (1997) contended that reading in academic context increases the difficulty of using strategies involved in the process of reading texts. In responding to Säljö (1997), this study argued that male students also have more difficulty of using strategies in academic context than female students. Also, it is reasonable to

think, when providing students with visual storyboards, visual aids are not the more the merrier because both Article 1 (6 pictures) and Article 2 (3 pictures) yielded positive outcomes. From the results of this study, we can say that non-heritage female students might be more visual learners while solving multiple-choices tasks because Group 1 was better aided in Article 2 by the storyboards to locate, summarize, evaluate, and synthesize the information in their MT1.

The section above accounted for possible explanation and illustration of the previous considerations in the within-subjects designs. We can apply this to the MTs and TTs, in which Group 1 and Group 2 with visual aids performed significantly better, respectively. To conclude, we can see that the significant visual effects were both found in Article 1 and Article 2.

Summary of the complexities. In other words, whether visual effects were strong enough to be statistically significant might be explained by academic strategies adopted by learners based on their different backgrounds. It is also notable that there might be interactions among the adoptions of academic strategies (e.g. visual versus non-visual) and the demands from different types of tasks.

In the between-subjects design, we learned that the complications of gender differences and heritage backgrounds of learners may explain why the comparisons between the performance of Group 1 and 2 with visual aids were not statistically significant. It is also reasonable to think that cultural backgrounds, including their familiarity with the cultural practices, products and perspectives with better linguistic understanding of Chinese text, which might impact their ways of using the visual effects.

In the within-subjects design, we learned that students have different ways of using academic strategies coming from different cultural and gender backgrounds. Particularly, we discussed that heritage-male students in Group 2 are better aided by visual aids in translation, compared to their performance of multiple-choice tasks. And non-heritage-female students in Group 1 are better aided by visual aids in multiple choices. Lastly, the number of pictures did not matter in their significant impacts on reading.

This study builds on past research by incorporating a more complex analytical design. Future studies can look into the relationships among academic strategies, gender, and visual aids for reading.

This study has limitations. It adopts a small sample size due to the limit of one level of the CFL readers as participants. In the future, CFL research on visual effects on intermediate reading can try more than one institute to recruit readers at different proficiency levels from more geographical regions across the country to future test the postulations on gender, heritage, and strategies differences among readers of CFL. To clearly understand how these factors and their interactions with reading performance, more qualitative data such as in-depth interview might be needed from the learners' perspectives.

Conclusion

Overall, the divergence of the significant positive effects from visual aids were found at intermediate level of CFL reading. This might be due to the interactions among different backgrounds of the students in the two groups (e.g., gender, academic, and learning styles), the types of reading tasks, and the nature of visual aids. Future research is needed to answer questions about how and why reader backgrounds interact with reading task types.

Theoretically, this study extends Dual-Coding Theory (DCT) in reading research in cognitive theory in Chinese sector. The study supports DCT's claims about that the verbal (in this case, reading) and visual systems could both facilitate reading. When they are both activated, the reading results of a FL are optimal.

From a research perspective, this study found the complexities in reading comprehension among foreign language readers of Chinese. These factors include genders, heritage background, and ways of using strategies.

Lastly, pedagogically, this study supports the claim that simultaneous presentation of visual aids and reading texts are good reading strategies. In intermediate CFL classroom, this study supports such practice that Chinese teachers use pictures based on students' sociocultural backgrounds. This study also recommends that Chinese teachers could select different numbers of pictures to help students read. Using pictures with reading texts is a feasible strategy for Chinese teachers because there are abundant visual resources available online, given the growth of digital media.

Notes

1. Heritage Students refer to CFL learners who have family or Chinese communication backgrounds.
2. Multiple-choice and translations tasks could better cope with cognitive overload issues than memory tasks such as reading recalls. I made a choice of using multiple-choice and translations tasks for this consideration. Admittedly, the early development of reading research in both first language and FL languages situated in cognitive science tended to use reading recalls to measure visual effects (Gambrell & Bales, 1986; Pressley, 1976; Sadoski, 1983). In recent years, FL reading researchers have also used recall as a tool to assess the effects of visual aids on reading (Hou; 2006; Liu, 2004).
3. Chinese heritage background refers to the background of a CFL student who had Chinese family members and Chinese learning experiences before entering Chinese courses.
4. Future studies are needed to compare these interactions among variables in the reading groups. For example, future studies can test and compare variables including genders, non-heritage or heritage backgrounds, ways of using visual aids based on groups of different sociocultural backgrounds, and levels of adopting academic strategies.
5. Internet resources are constantly changing. Specifically, Article 1 was adapted from

enfang.com. This website is not available anymore. Article 2 was adapted from diyifanwen.com. This website is still available. The original articles and pictures on websites where story materials were adapted from could be no longer located. For details of the Articles 1 and 2 used in this study, please see appendices.

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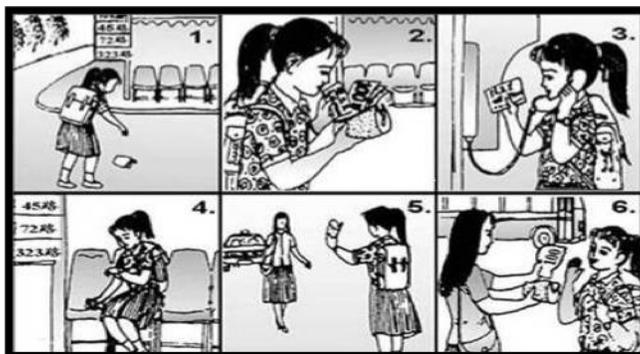
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Appendix A

Article 1 Storyboard



Article 1 Multiple-choice Task

Reading Comprehension Multiple-choice Task 阅读理解 (Student Version)

Name (Chinese and English) _____

Age _____

Class level _____

Gender _____

Nationality _____

Please choose only one answer for each question.

三月份的某一天下午，我高高兴兴地走在放学回家的路上。正要走到 323 号公交车站的时候，我突然发现前面有一个东西，我走近一看，原来是一个黑色的钱包。我打开钱包，发现里面有很多钱，还有失主的证件。我想钱包的失主一定很着急，怎么办呢？我灵机一动，想出了一个主意，我从钱包中找到了失主的名片上有失主的名字，地址和电话号码。我顾不上回家，马上跑到一个公用电话亭给失主打电话。我很快就联系上了焦急的失主。她就在不远处，我在公交电话亭边等她。当我把钱包还给失主的时候，她非常感谢我。她从钱包里掏出一百元人民币谢谢我，我礼貌地谢绝了。我觉得这是我应该做的。

1、下面哪一项文章中没有提到

A 这件事情发生的时间

B 钱包的颜色

C 失主叫什么名字

D 故事发生的地点

2、文章中“着急”的意思是

- A 小心
- B 不安
- C 失望
- D 开心

3、根据文章，钱包里面可能没有

- A 手机
- B 信用卡
- C 名片
- D 钱

4、这篇文章主要是讲

- A 作者拾金不昧的故事
- B 323号公交车上的故事
- C 信用卡的故事
- D 怎么打电话的故事

5、如果要给文章加个题目，下面哪个最合适？

- A 放学途中见闻
- B 归还捡到了的钱包
- C 信用卡
- D 钱包的用途

6、文章中“灵机一动”的意思不是

- A 急忙中转了一下念头
- B 临时想出了一个办法
- C 灵活的机遇
- D 灵活的心思

7、文章中失主想要给作者多少钱?

- A 20 元
- B 50 元
- C 60 元
- D 100 元

8、根据文章, 下面哪一项的说法不正确?

- A 失主的钱包里的钱超过 100 元
- B 失主是个女的
- C 我可能没有手机
- D 我经常捡到钱包

9、根据文章, 作者没接受失主的钱之后, 失主很可能会做什么?

- A 失主可能会去乘公共汽车
- B 失主可能会掉头走人
- C 失主可能会请我吃饭
- D 失主可能会再丢钱包

10、关于作者的说法, 哪项不能从文章中推测?

- A 作者的家和学校很近
- B 作者可能坐公交车回家
- C 作者是个学生
- D 作者捡到钱包时, 失主刚丢钱包不久

Article 1 Translation Task

Reading Translation Task 翻译 (Student Version)

Name (Chinese and English) _____

Age _____

Class level _____

Gender _____

Nationality _____

Translation Task:

Instruction:

Each sentence has a blank below. Please translate the sentences in Chinese into English, if you don't know certain word's meaning, please leave it blank or using a box or line in your English translation.

1、三月份的某一天下午，我高高兴兴地走在放学回家的路上。

English:

2、正要走到 323 号公交车站的时候，我突然发现前面有一个东西，我走近一看，原来是一个黑色的钱包。

English:

3、我打开钱包，发现里面有很多钱，还有失主的证件。

English:

4、我想钱包的失主一定很着急，怎么办呢？我灵机一动，想出了一个主意，我从钱包中找到了失主的名片上有失主的名字，地址和电话号码。

English:

5、我顾不上回家，马上跑到一个公用电话亭给失主打电话。

English:

6、我很快就联系上了焦急的失主。

English:

7、她就在不远处，我在公交电话亭边等她。

English:

8、当我把钱包还给失主的时候，她非常感谢我。

English:

9、她从钱包里掏出一百元人民币谢谢我，我礼貌地谢绝了。

English:

10、我觉得这是我应该做的。

English:

Appendix B*Article 2 Storyboard*

Article 2 Multiple-choice Task

Reading Comprehension Multiple-choice Task 阅读理解 (Student Version)

Name (Chinese and English) _____

Age _____

Class level _____

Gender _____

Nationality _____

Please choose only one answer for each question.

一天上午，小宝和爸爸上街玩。突然，有一栏杆拦住了去路，小宝拉拉爸爸的衣服，对爸爸说：“爸爸，我不知道该怎么过去，怎么办呀？”爸爸听了，笑着对小宝说：“乖小宝，看看你爸爸是怎么过去的。”刚说完，“咚”得一声，一下子，小宝的爸爸从栏杆跳了过去。小宝正为他爸爸高兴时，被巡逻的警察发现了。警察严肃地对小宝爸爸说：“先生，你知道这种行为是不对的，如果发生了什么意外，后果不堪设想的，你这样还会教坏下一代。下次不准再犯了，听清楚了吗？”小宝的爸爸听了，不好意思得低下了头。小宝的爸爸从今以后，改过自新，并教好了下一代。

1、下面哪一项文章中没有提到

A 小宝

B 爸爸

C 警察

D 游客

2、文章中“严肃”的意思是

- A 不随和
- B 生气
- C 失望
- D 开心

3、根据文章，栏杆是用来做什么的

- A 让人跨越的
- B 拦住去路的
- C 保护行人的
- D 锻炼身体的

4、这篇文章主要是讲

- A 做栏杆的故事
- B 警察的故事
- C 巡逻的故事
- D 改过自新的故事

5、如果要给文章加个题目，下面哪个最合适？

- A 跳栏杆的运动
- B 小宝和爸爸
- C 爸爸改正错误的事
- D 当警察的爸爸

6、文章中“巡逻”的意思是

- A 办案
- B 办法
- C 灵活
- D 来回查看

7、文章中警察是什么样警察

- A 交通警察
- B 民事警察
- C 刑事警察
- D 铁路警察

8、根据文章，下面哪一项的说法不一定正确

- A 爸爸是为了给儿子示范才跳栏杆
- B 警察是女的
- C 小宝可能比较小
- D 爸爸知错就改

9、你觉得在这之后爸爸不会做什么？

- A 接受警察的批评
- B 爸爸遵守交通规则
- C 会回家
- D 继续跳栏杆

10、根据文章推测下面哪项可能是对的

- A 警察和小宝爸爸是朋友
- B 小宝不跟他爸爸说话了
- C 小宝会去跳栏杆
- D 小宝的爸爸不再做坏事了

Article 2 Translation Task

Reading Translation Test 翻译 (Student Version)

Name (Chinese and English) _____

Age _____

Class level _____

Gender _____

With or without the story board _____

Nationality _____

Translation Task:

Instruction:

Each sentence has a blank below. Please translate the sentences into English, if you don't know certain word's meaning, please leave it blank or using a box or line in your English translation.

1、一天上午，小宝和爸爸上街玩。

English:

2、突然，有一栏杆拦住了去路，小宝拉拉爸爸的衣服，对爸爸说：“爸爸，我不知道该怎么过去，怎么办呀？”

English:

3、爸爸听了，笑着对小宝说：“乖小宝，看看你爸爸是怎么过去的。”

English:

4、刚说完，“咚”得一声，一下子，小宝的爸爸从栏杆跳了过去。

English:

5、小宝正为他爸爸高兴时，被巡逻的警察发现了。

English:

6、警察严肃地对小宝爸爸说：“先生，你知道这种行为是不对的，如果发生了什么意外，后果不堪设想的，你这样还会教坏下一代。下次不准再犯了，听清楚了吗？”

English:

7、小宝的爸爸从今以后，改过自新，并教好了下一代。

English:

About the Author

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