Comprehension and Recall of Concrete and Abstract Texts with Reference to Dual-Coding and Context-Availability[*]

F. Fahandezh Sa'di[**]   **Dr. M. Yamini**[***]
Shiraz Islamic Azad University   Shiraz University

ABSTRACT

   The aim of the present study was to investigate the effect of context on the comprehension and recall of abstract and concrete sentences with respect to dual-coding and context-availability. To this end, one-hundred and forty students at Shiraz Azad University majoring in Translation were given the Oxford Placement Test. Two homogeneous groups of thirty students each were chosen. One group was given random-abstract and random-concrete texts, whereas the other group received thematic-abstract and thematic-concrete materials. The thematic texts presented the materials in a coherent way in paragraphs, whereas the random texts were sentences presented in an incoherent way. The participants read the texts and recorded what they recalled on answer sheets that included the first two words of each sentence. The recall protocols were scored based on the idea units. The scores were subjected to matched and independent t-tests. The results indicated a difference between concrete and abstract sentences, but the context showed no effect on abstract texts. That is to say, the participants performed similarly in reading and recalling thematic abstract and random abstract texts. In the case of concrete texts, context had a negative effect, that is, the students performed significantly better in random concrete texts than thematic concrete ones.

Keywords: 1. Comprehension 2. Recall 3. Texts 4. Dual-coding theory 5. Context-availability model.

1. Introduction

Reading is defined as "Perceiving a written text in order to understand its contents". (Richards, Platt and Platt, 1992: 306). It is also considered as "constructing meaning from a written text" (Ur, 1996: 141). Based on these definitions one can conclude that in reading at least two factors are at work: the text and the mental process. The former is independent of the reader but may include features that can make the job easy or difficult for him/her. As Chastain (1988) puts it, there are some within-the-text and inside-the-head factors that may influence our reading. Of within-the-text factors one can refer to typographical features, text topic and content, text readability, text type and certain other features as mentioned in Alderson (2000). Within-the-head factors involve different mental processes and approaches that are employed to extract meaning out of the written text. Different models have been suggested in relation to the processes that are carried out in one's head when one is reading something and trying to understand it. For example, one can mention bottom-up processing (Gough, 1972), top-down processing (Goodman, 1967), interactive model (Rumelhart, 1977), compensatory interactive model (Stanovich, 1980) and connectionist model (Rohde, 2002).

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[*] The paper was extracted from Mr. Fahandezh's M. A. thesis, supervised by Dr. Yamini.
[**] Instructor, English Department
[***] Assistant professor, Department of Foreign Languages and Linguistics

Different kinds of research have been reported in the literature that focus on different aspects of reading. Some explore text-related features and some others study reader-related elements. The present study is concerned with abstractness/concreteness dichotomy in relation to comprehension and recall.

The concreteness of the meaning expressed by the sentence can exert an influence on the comprehension of the text. Words referring to concrete concepts (e.g. book) are processed faster and more accurately than words referring to abstract concepts (e.g. honesty). This is referred to as *concreteness effect* (see Sadoski *et al*., 1993; Sadoski, Goetz & Avila, 1995 ; Holcomb *et al*., N. D.). This effect has consistently been observed in different experimental settings. However, the source has not yet been fully identified. There are two competing theories that claim to have recognized the source of concreteness effect, viz the ***Dual-coding theory*** (Paivio, 1971, 1983, 1986, 1991) and the ***context-availability model*** (See Schwanenflugel, 1991 for a review). These two theories constitute the framework for the present study and will be explained presently.

According to the dual-coding theory (DCT), concrete words are associated with two kinds of information–linguistic and imagistic. In other words, for each concrete word two pieces of information are stored in the brain, one as a verbal unit stored in the linguistic semantic system and the other as a nonverbal picture stored in the imagistic semantic system. Since the two systems are linked together, the activation of one may activate the other as well. For example, if a concrete word is encountered, it first activates linguistic information, and shortly afterwards the imagistic system is also activated. Abstract words, on the other hand, are not processed in this way. They are primarily associated with information stored in the linguistic system, and as no image or picture-like unit is associated with them, they solely rely on the linguistic system for processing/representation.

Therefore, concrete words have distinct processing advantages over abstract ones in the sense that they have multiple systems for accessing information. This makes the processing time shorter for concrete words. Abstract words, however, take longer to process perhaps because they make use of a single semantic system.

In short, DCT assumes two separate but interrelated codes for processing information-verbal and visual. Each system has its own function. The verbal (linguistic) system specializes in processing and storing linguistic information (words, phrases, etc.,) kept in the brain in sequential, discrete units, whereas the visual system processes and stores images or picture-like representations. Processing in this system is believed to be more holistic and based on continuous organizational units (Kieras, 1978)

The context-availability model (CAM) (Bransford & McCarrell, 1974; Kieras, 1978), on the other hand, does not recognize two separate systems in the mind. It assumes only one system and emphasizes the role of context, stating that "comprehension processes in language are aided in an important way by the addition of contextual information to the materials that are to be understood." (Schwanenflugel and Shoben 1983: 83). This additional information may come from either the comprehender's own mental knowledge or the preceding discourse (stimulus environment), and may enable the reader to perceive the needed relations between concepts in the incoming message. Concrete words are very closely related to the "contextual" knowledge stored in the semantic memory and this makes them distinct from abstract words that have weaker associative links to the mental knowledge. So, a word like "book" is classified faster by participants than "honesty" just because "book" activates more semantic information*.*

Comprehension, therefore, is related to the person's ability to provide a context for the linguistic message. Without an appropriate context, comprehension is not complete and it leads to a less detailed representation in memory for abstract materials, causing

individuals to show deficits in learning, recall and recognition (Schwanenflugel & Shoben, 1983).

Thus, one may say that both theories believe in the ease of representation and processing of concrete words and they confirm that in the case of concrete words some more information is available to the processing system. The difference lies in how and where this additional information is stored and processed. CAM argues for a single system in which there are quantitative differences between abstract and concrete words, while dual-coding argues for a double system where the difference between abstract and concrete words is qualitative.

2. Statement of the Problem

The present study investigates the comprehension and recall of abstract and concrete materials in relation to DCT and CAM. It tries to find out whether readers have different degrees of comprehension and recall when they are dealing with abstract and concrete materials. Furthermore, it tries to investigate whether a thematic context in contrast with non-thematic random context would affect comprehension and recall or not. Therefore, the following research questions are raised.

1. Is there a relationship between text type-abstract and concrete-and comprehension and recall?

2. If the answer to the first question is positive, which text type is easy to comprehend and recall?

3. Is there a relationship between context type-random and thematic-and comprehension and recall?

4. If context is related to comprehension and recall, which type is comprehended and recalled better?

3. Related Empirical Studies

The point that people find concrete verbal materials easier to process than abstract verbal materials has been substantiated by many studies that have used a variety of experimental tasks such as recall, lexical decision and sentence comprehension (Holmes and Langford, 1976; Schwanenflugel and Shoben, 1983; Wattenmaker and Shoben, 1987; Sadoski, Goetz and Avila, 1995). Concrete materials have demonstrated superiority over abstract materials in such tasks as learning (Paivio, 1971b, cited in Schwanenflugel and Shoben, 1983), recall (*ibid*), and comprehension (e.g. Holmes & Langford, 1976).

Concerning concrete and abstract texts and their comprehensibility, interestingness, familiarity, and memorability, Sadoski, *et al*, (1993) carried out four different experiments with two hundred and twenty one college students. The results indicated that concreteness (ease of imagery) is the variable overwhelmingly most related to comprehensibility and recall.

Holmes and Langford (1976) compared the performance of their students in the classification and free recall of abstract and concrete sentences. They found that concrete sentences were classified significantly faster than abstract ones. Their results also showed that in the recall task, the abstract materials were omitted more frequently than the concrete ones. These findings clearly support the differences in memory storage of abstract and concrete materials.

Schwanenflugel and Stowe (1989) studied the impact of sentence context on the processing of concrete and abstract words. The results indicated that abstract words took longer than concrete words to comprehend and in neutral contexts they took longer to judge for meaningfulness.

Schwanenflugel and Shoben (1983) performed some experiments in relation to DCT and CAM. In one experiment, two types of sentences—abstract and concrete—were presented with and without a paragraph context. In without context condition, subjects took longer to read abstract sentences than concrete ones. The reading time, however, did not differ in sentences with context. In another experiment, they made use of lexical decision time. Similar results were obtained; in the absence of context, subjects took longer to make decisions on abstract words. For example, they classified "pen" faster than "honesty". However, when a context was provided, the lexical decision time for the two groups of words—abstract and concrete—was equal.

In discussing the results of the first experiment, Schwanenflugel and Shoben (1983) maintain that "comprehending a sentence involves accessing probable contextual information by which the sentence can be interpreted" (86). However, this processing is more difficult for abstract materials and thereby the processing takes longer. Nonetheless, when a context is provided, the difference between abstract and concrete disappears, which, they believe, is consistent with CAM.

With regard to the second experiment on lexical decision time, Schwanenflugel and Shoben (1983) state that "with context (where the retrieval of additional contextual information is not necessary), abstract and concrete word concepts should be equally accessible" (90). Therefore, the lexical decision task should be the same for both types. Again, this points to the support of CAM. According to this model, the difference in lexical decision time between abstract and concrete materials is due to the greater difficulty in retrieving contextual information for abstract words and if this information is already provided, the difference disappears. Nevertheless, the findings cannot be interpreted against the DCT, because as Holcomb, *et al* (N. D.) maintain, the DCT does not reject the idea that context can facilitate semantic processing, "nor does it argue that such contextual facilitation could not supersede or mask concreteness effects. It simply states that there are separate imaginal and linguistic systems" (6-7).

4. Methodology

4.1. Participants

To carry out the investigation, 140 students majoring in English Translation at Shiraz Islamic Azad University were given a placement test (Allan, 1985). Based on the results, 60 students whose scores fell within one standard deviation below and above the mean were chosen and assigned to two groups (A and B) in such a way that there was no statistically significant difference between them (See Table 1). Based on the manual of the placement test (Allan, 1985) and the way the participants were selected, it can be claimed that all the participants were at the intermediate level of proficiency.

Table 1: Independent t-test on the placement scores for groups A and B.

Groups	Mean	SD	t-value	d.f.	sig
A	30.86	4.10			
			0.69	58	0.493
B	30.13	4.12			

4.2. Instruments

Two kinds of instruments were used in this study. First there was the placement test (Allan, 1985) which consisted of 50 multiple-choice items. This instrument was used to select two homogeneous groups in terms of language proficiency as participants. The second instrument which was used to gather the needed data consisted of abstract and concrete texts with two kinds of contexts each—random and thematic—forming as a

whole four separate texts as shown schematically below.

thematic context { abstract text random context { abstract text
(Group A)   concrete text (Group B)   concrete text

The sentences in concrete and abstract texts were similar in length and complexity; however, in each case the thematic context consisted of sentences arranged in a coherent way in the form of a paragraph, whereas the random context included sentences presented in an incoherent way (See the appendix). In each instance there were twenty sentences on five separate pages, four sentences on each page. Table 2 presents information about the groups, context type, text type, and the number of idea units—an indicator of length.

Table 2: Groups, materials, and idea units.

Group	Context type	Text type	Idea units
A	1) Thematic	Concrete	66
	2) Thematic	Abstract	64
B	3) Random	Concrete	54
	4) Random	Abstract	60

The texts were taken from Schwanenflugel and Shoben (1983) and had been controlled for sentence length, surface structure, sentence plausibility, context length, and sentence comprehensibility. In this regard they assert that:

… the mean ratings for plausibility were 4.62 (SD = .27) for concrete sentences and 4.5 (SD = .26) for abstract sentences on a scale from –5 (not plausible) to 5 (very plausible). The mean ratings for comprehensibility were 6.32 (SD = .50) for concrete items and 6.17 (SD = .37) for abstract items on a scale from 1 (not comprehensible) to 7 (quite comprehensible). … the number of words in the context paragraph was very similar for the concrete … and abstract … sentences. (85)

4.3. Procedures and Data Analysis

The two groups of participants, A and B, were tested simultaneously. Group A received thematic context whereas Group B took the random context. In each case, the concrete texts preceded the abstract ones. The reading time allotted for each thematic text was 190 seconds and for random text 390 seconds.

When the first concrete text was distributed among the participants in each group and they were busy reading, the answer sheet related to the text was laid upside down beside each participant. The answer sheet included the first two words of each sentence. When the reading time was over, the participants were asked to take the answer sheet and write down the sentences as they could remember them. The texts were immediately taken away from the participants. The time allotted for the recall and completion task was 360 seconds and the recall protocols could be written in the target language, mother tongue or in a mixture of both. During the time the participants were busy completing the answer sheets, the second text was put upside down beside them. At the end of the answering time, the participants were asked to read the second text, and the proctors collected the answer sheets. The same procedure was carried out until all concrete and abstract texts were read and answered by the participants and the papers were collected.

4.4. Scoring

Scoring was based on the number of idea units in each paragraph. Each idea unit received one point and the total number of idea units written by the student constituted his/her score. Spelling mistakes were ignored and synonyms were scored as target

words. Furthermore, in order to make comparison easier, all the scores were converted into percentages.

To make sure of the reliability of scoring, the papers were corrected by two independent scorers and the inter-rater reliability was calculated. In each case a very high index of reliability (r > .95) was obtained.

4.5. Statistical analysis and results

Certain comparisons were made between and within groups. First, by keeping the context type constant in each group a matched t-test was run to compare the performance of the participants in different text types (abstract and concrete). Tables 3 and 4 present the results.

Table 3. Matched t-test on thematic context in group A.

Variable	Mean	SD	t-value	d.f	sig
Thematic Abstract	31.51	19.01			
Thematic Concrete	25.15	16.33	2.645	29	0.013

Table 4. Matched t-test on random context in group B.

Variable	Mean	SD	t-value	d.f	sig
Random Abstract	27.05	14.41	-10.57	29	0.000
Random Concrete	53.33	18.56			

The difference between abstract and concrete texts in both groups turns out to be statistically significant. But the participants' performance is not the same in the said groups. In Group A where context is provided, abstract texts are recalled better, whereas in group B it is quite contrary. The concrete texts are recalled significantly better. However, the first research question can be answered positively at this point. Text type had an influence on the comprehension and recall of the participants. Concerning the second question, one can state that in thematic contexts abstract texts were recalled better but in random contexts the concrete items were recalled significantly better.

The next computation was carried out by keeping text type constant and comparing the performance of the participants with regard to the context. For this purpose, two independent t-tests were run. The results are presented in Tables 5 and 6.

Table 5. Independent t-test on abstract texts.

Variable	Mean	SD	t-value	d.f	sig
thematic abstract	31.51	19.01	1.02	58	0.311
random abstract	27.05	14.41			

Table 6. Independent t-test on concrete texts.

Variable	Mean	SD	t-value	d.f	sig
thematic concrete	25.15	16.33	-6.24	58	0.000
random concrete	53.33	18.56			

The picture one gets here is different and complicates the point. When abstract texts are concerned, there is no difference in the performance of the participants. This indicates that context could not help readers to remember more of the abstract ideas. However, in the case of concrete texts a significant difference is observed, but contrary to the expectation, it is not the thematic text that is easier to remember, but the random one. This means that concrete texts do not necessarily rely on the context to be recalled.

To answer the related research questions at this point, it should be said that the answer to the third research question is not a definite yes or no. In the case of abstract

texts, the answer is negative. No effect of the context is observed on the performance of the participants. Consequently, the fourth question becomes irrelevant. However, in concrete texts the answer can be positive, and the fourth question can be answered in favor of random context.

5. Discussion and Conclusion

When studied in the light of the DCT and CAM, the findings do not definitely support one model against the other. The dual-coding theory predicts that concrete materials are easier to comprehend and recall regardless of the kind of context in which they appear (Wattenmaker and Shoben, 1987). They are easily recalled because they are supported by two mental systems. However, the context-availability model emphasizes the role of context and argues that appropriate contexts can enhance the comprehension of texts. The general superiority of concrete materials is due to the fact that they are associated with mental "contextual" knowledge that provides extra information to the processing system, whereas abstract materials lack this possibility and need extra contextual information within the text to be processed easily. (Kieras, 1978; Wattenmaker and Shoben, 1987; Schwanenflugel and Shoben, 1983). As an example, consider the following two sentences:

(1) The burning forest was observed through binoculars
(2) The group's success was achieved through persistence.

A mental context can be easily provided for sentence (1), whereas for sentence (2) many different contexts may be thought of. For instance, there may be a group of engineers who did their job well, a group of athletes who worked hard to be successful or a group of managers who could enhance the efficiency of their department. Different interpretations are possible, and if the texts provide the context, the processing can be easier.

With these points in mind one can consider the results of the study again. In Group A where a context was provided for the texts, the participants did better in abstract materials. This can be used in support of CAM. The extra context provided for the abstract texts has helped the students comprehend and recall better. This extra context, however, was not beneficial in the case of concrete materials. In Group B the situation is different. There is no context and concrete materials have been recalled better than the abstract ones. This can be interpreted in favor of both models. The absence of an extra context has led to a low performance in abstract texts, which is in line with CAM. This model indicates that abstract materials need a context whereas concrete ones can do without one. The participants' better performance in random concrete texts supports this point. On the other hand, the results can be interpreted within the framework of DCT as well. The dual coding in the mind has made processing easier for concrete materials.

Nonetheless, a look at Table 5 reveals a kind of imbalance against CAM. Context is expected to help comprehension and recall of abstract materials, but this expectation does not materialize. The two groups are similar in their performance on abstract texts with and without a context. In other words, the context is not helpful, and CAM fails to provide the needed explanation. However, the results do not pose a problem for DCT which predicts difficulty in processing abstract materials because they lack the dual coding system.

Finally, consider the data presented in Table 6. Here concrete texts are under focus. According to the data, random concrete materials were recalled much better than the thematic concrete ones. The findings are clearly against CAM. Materials should be recalled better and more easily in the context (thematic) than out of it (random). However, the significant difference between random texts and thematic texts reveals the inadequacy of CAM in explaining the concreteness effect. DCT also falls short of an adequate explanation here. If the dual system did help the readers, what is it then that causes the difference in the performance of the two groups when the dual system is present for both?

An interesting point that should be noted about the results in Table 6 is the negative effect of context. When the texts are coherent, the performance of the students deteriorates. This is contrary to the expectations and obviously against CAM. It is against DCT as well just in the same way as was pointed out in the previous paragraph. This poses an important question which needs to be investigated further in future studies.

An explanation that can be given here is that the coherent paragraphs present material in a connected form resulting in a macro-structure which may cause the reader to disregard the details in the micro-structure. In the random text, however, no macro-structure as such exists and instead of focusing on the global points, the reader pays attention to local ideas and remembers the details of the sentences.

However, there might be certain other possible explanations as well and different factors may be involved. For example, the participants in the study were chosen according to their performance on a placement test which was of multiple-choice type. There might be certain individual differences in terms of cognitive styles and reading strategies that the test was unable to detect. However, the differences were revealed in the actual research. Therefore, it is advisable to make use of different test types in grouping students so that the test results would not be biased towards one type of individuals. One can also suggest the replication of the study with different groups by taking different cognitive styles, hemisphericity, and strategy use into consideration.

6. Implications

From a pedagogical viewpoint, it is plausible to recommend language teachers to take advantage of appropriate contexts so that the teaching could be effective for abstract materials. For further studies the following suggestions can be made:

1. In the present study, sex was not included in the variables. The effect of sex on recall and comprehension of certain materials would be a good point to investigate.

2. The participants of the study were university students. Performing the same research on high school or pre-university students is another prospective to consider.

3. In the present study, familiarity of materials was not taken into consideration. Sadoski, Goetz, and Avila (1995) carried on a research based on familiarity of two sorts of materials--abstract and concrete. Eager researchers might conduct a similar study in Iran in EFL situations.

4. The same study could be done with Persian materials which would be beneficial to teachers of Persian to the speakers of other languages.

5. In this study, the contexts were either thematic or random. The effects of partially integrated or fully integrated context (Wattenmaker and Shoben, 1987) would be a worthy topic to handle.

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