Reading and Writing: An Interdisciplinary Journal **16:** 443–453, 2003.

New findings for concreteness and imagery effects in written composition

MARK SADOSKI[1], ERNEST T. GOETZ[1], ANDREW G. STRICKER[2] and THOMAS K. BURDENSKI, JR.[3]
[1]*Texas A&M University, College Station, Texas, USA;* [2]*Vanderbilt University, Nashville, Tennessee, USA;* [3]*University of Texas at Arlington, Arlington, Texas, USA*

Abstract. This experiment investigated the effects of word concreteness and either imagery, verbal, or control strategy instructions on the composition of written definitions. Results revealed significant effects of word concreteness on several quantity and quality variables, but no significant effect of strategy instructions or interaction between concreteness and strategy instructions. Results of self-ratings of strategies actually used in composing revealed that a mental imagery strategy was used with concrete words and a verbal strategy was used with abstract words regardless of strategy instructions. Findings replicated the results of Tirre, Manelis and Leicht [(1979) *Journal of Reading Behavior 11*, 99–106] in the production of written composition on word relationships, and partially replicated the results of Sadoski, Kealy, Goetz and Paivio [(1997) *Journal of Educational Psychology 89*, 518–526] in the timed written production of word definitions. Results are interpreted from Dual Coding Theory and levels of processing perspectives.

Key words: Concreteness, Dual Coding Theory, Imagery, Strategy instructions, Written composition

Introduction

Language concreteness and mental imagery effects are pervasive in performing verbal tasks. Concrete language invites the mental capacity of forming images (e.g., *glittering diamond*), whereas abstract language has relatively less capacity to do so (e.g., *conceptual thought*). These effects have been theoretically explained by Dual Coding Theory, which maintains that cognition involves the activity of two separate but interconnected mental codes, the verbal code and the nonverbal code (Paivio, 1971, 1986; Sadoski & Paivio, 2001). In reading, concrete language has been found to be more imageable, comprehensible, interesting, and memorable than abstract language even when contextual variables are controlled (e.g., Paivio, Walsh & Bons, 1994; Sadoski, Goetz & Avila, 1995; Sadoski, Goetz & Fritz, 1993a, b; Sadoski, Goetz & Rodriguez, 2000). Research on concreteness and imagery effects in written composition has received far less attention, however.

One study that included written composition (Tirre, Manelis & Leicht, 1979) had undergraduates study concrete or abstract science textbook passages of about 1400 words by using either an imagery strategy or a verbal strategy. The passages differed significantly in rated concreteness but not in rated comprehensibility. This study replicated and extended research by Paivio and Foth (1970) who investigated recall of matched concrete and abstract word pairs whose relationships were studied by having participants either draw a picture or write a sentence. Similarly, the imagery strategy instructions in the Tirre et al. study were to draw a picture of how 3–5 selected content words were related, and the verbal strategy instructions were to write a few sentences to explain the selected word relationships. Two days later, participants were asked to write a few sentences to explain the word relationships. Scores for the brief compositions involved the accuracy of reporting the word relationships as described in the passage. Results indicated that strategy assignment did not have an effect on scores, but the concrete passages and words produced higher scores than the abstract passages and words. The interaction was not significant. These results partially replicated the Paivio and Foth study where both a main effect of concreteness and an interaction of concreteness and strategy were found.

In a more recent study, Sadoski, Kealy, Goetz and Paivio (1997) presented concrete and abstract nouns matched for rated familiarity and meaningfulness to undergraduates who provided written definitions on microcomputers. The study replicated and extended a study by Reynolds and Paivio (1968) where oral language was used for the definitions. The concrete words in both studies were *library*, *prisoner*, *picture*, *hotel*, and *mother*. The matched abstract words were *crime*, *science*, *mind*, *fun*, and *death*.

The dependent measures involved the quality and ease of producing the definitions, and the use of imagery and verbal strategies in doing so. These measures included: latency (i.e., the time from the presentation of the word to the first keystroke), the number of words in the definition, the average length of the words in the definition, the number of T-units (i.e., an independent clause with all its modifiers including dependent clauses), the percentage of T-units with a final modifier (i.e., cumulative constructions, a syntactic variable consistently related to the rated quality of writing (Hillocks, 1986; Sadoski & Goetz, 1998)), a content score based on the criteria of a good definition, a style score based on the grammaticality and textuality of the definition, the rated use of an imagery strategy (1–4 scale for the use of mental pictures of objects, scenes, or events as a composing strategy), and the rated use of a verbal-associative strategy (1–4 scale for the use of other words, phrases, and related language as a composing strategy). Two experiments were conducted.

The first experiment used a restricted time limit in which participants had 90 seconds to write a definition for each word. Results showed that when participants composed definitions for the concrete terms, they began sooner, wrote longer definitions, wrote definitions judged higher in quality by reliable ratings, used more final modifiers, and reported more use of an imagery strategy. When they composed definitions for abstract terms, they used longer words and reported more use of a verbal-associative strategy.

The second experiment presented each participant with one concrete word and one abstract word from the original set, and used a more extended time limit (15 minutes per word) with instructions to write a complete and polished paragraph of definition in that time. Results showed that when participants composed definitions for the concrete terms, they began sooner, wrote marginally longer definitions, wrote definitions higher in quality, and reported more use of an imagery strategy. When they composed definitions for abstract terms, they reported more use of a verbal strategy. The results of the two experiments were generally replicative of Reynolds and Paivio (1968) and were interpreted as supportive of Dual Coding Theory (cf. Sadoski & Paivio, 2001).

The present study replicated and extended Sadoski et al. (1997) with a new set of words that were matched on more variables, and with instructions to use either an imagery strategy or a verbal strategy while composing, similar to Tirre et al. (1979). However, the imagery strategy used here involved mental imagery rather than drawing in order to emphasize purely cognitive processing and to be consistent with the strategy ratings used in Sadoski et al. and replicated here. A control condition with no assigned strategy was also included. Given that Sadoski et al. found that students tended to report use of an imagery strategy when defining concrete words, and that the definitions of these words tended to be superior to those of abstract words (replicating Reynold & Paivio's 1968 findings), it was of interest to see if imagery instructions would improve the definitions of abstract words. Selected dependent variables from Sadoski et al., Experiment 2, were included as well as two new dependent variables: words per sentence and time spent composing. A time limit of five minutes per word was used, part way between the more restricted 90 seconds and the more extended 15 minutes in the original study. Results of the original study indicated that this time limit was sufficient to produce complete definitions without haste.

In summary, two previous research approaches to investigating the effect of concreteness and imagery on composing written definitions for terms were combined here. One approach was to provide strategy instructions to either form images or use language associations while composing. A control condition was also used here. The other approach was to vary the concreteness

of the terms to be defined while experimentally controlling other semantic values of the terms. This combination of approaches replicated and extended previous experimental research in this area in a unified way.

Method

Participants

Ninety-two undergraduates from Texas A&M University participated. They were volunteers from an upperclass course on reading assessment and received extra credit for their participation. Their mean age was 20.7 years (range 19–38); their ethnicity was 95% Caucasian, 4% Hispanic, and 1% Black; their first language was 96% English and 4% Spanish; and their gender was 98% female. Familiarity with basic word processing was a condition of participation.

Materials

A set of four concrete words and another set of four abstract words were selected from the Toglia and Battig (1978) semantic word norms. The concrete words were *aisle*, *ceremony*, *scene*, and *pile*. The abstract words were *pride*, *theory*, *time*, and *truth*. On the 1–7 scales used in these norms, the mean concreteness rating for the concrete words was 4.59 and the mean imagery rating was 5.02. The respective mean ratings for the abstract words were 3.21 and 3.89 (i.e., more than one point average difference on both ratings). Differences on normed ratings for familiarity, meaningfulness, categorizability, and number of attributes were also assessed. Both sets of words were rated moderately high on these attributes with means ranging between 3.95 and 6.23 on the 1–7 scales. However, mean differences between the concrete and abstract sets on these attributes varied at most by 0.24. Therefore, the concrete and abstract word sets differed substantially on concreteness and imagery values but were more closely matched on four other semantic values.

Procedure

The words were presented on microcomputers with word processing capability. Participants were tested in groups in a microcomputer classroom. Participants were each given a number that randomly assigned them to either the imagery strategy group ($n = 30$), the verbal strategy group ($n = 29$), or the control group ($n = 33$). Entry of the number brought a series of instructions to the computer screen explaining the definition task and giving strategy instructions. The initial instructions for all groups were "This task involves

defining and explaining common words. The computer will present the words one at a time. Please define and explain each word as fully as you can. You will have five minutes for each word. After five minutes, a new word will appear. There will be eight words in all. This is not a race to see how much you can say in the time period – just write at a normal rate and as clearly as you can." Strategy instructions were next provided for each group separately. The imagery strategy instructions were "When you are defining these words think of mental pictures of objects, scenes, or events." The verbal strategy instructions were "When you are defining these words think of other words, phrases, and related language." The control instructions were "Please define and explain the words, writing as clearly as you can." The instructions elicited no questions about procedures from the participants.

The eight words were presented on the screen in an individually randomized order with both strategy instructions and the word at the top of the screen throughout. An elapsed time line was visible at the bottom of the screen throughout. The computer's internal clock recorded the latency between the appearance of the word and the participant's first keystroke as well as the total time spent between the first and last keystrokes. The word processor recorded each definition as it was typed. Five minutes after each word appeared, the word processing capacity was temporarily terminated and the screen changed to prompt the next word. When participants were ready, a keystroke brought the next word to the screen for definition.

Immediately after the eight definitions were completed, a screen appeared with instructions that the words just defined would be shown again together with rating tasks for thinking strategies that might have been used while defining them. The words then appeared again in their original order without strategy instructions. Two rating tasks appeared beneath the word one at a time in random sequence. The imagery strategy rating task read "When I was defining this word, I thought of mental pictures of objects, scenes, or events." The verbal strategy rating task read "When I was defining this word, I thought of other words, phrases, and related language." Using the microcomputer's mouse, participants moved a slider along a continuous scale with spaced prompts that read "not at all," "very little," "somewhat," and "very much." The computer recorded the rating on a 0–40 scale. When the ratings were completed a screen of debriefing concluded the procedures.

Results

Scoring

Definitions were analyzed for letters per word, words per sentence, and total words per definition. Definitions were also scored for quality using the system

of Sadoski et al. (1997, Experiment 2). This is an open-ended scoring system that allots increasing points for: (a) one or more classes to which the concept belongs, (b) one or more defining properties or characteristics, and (c) an example. For example, the following definition of the concrete word *ceremony* received a score of 4: "A ceremony is an act performed in honor of something or someone. A wedding ceremony is an example." One point was awarded for the class relationship "an act." Two points were awarded for the defining properties "takes place in honor of something ... someone." A fourth point was awarded for the example "wedding ceremony." One of the researchers and an assistant naive to the design of the study independently scored a sample of 10 randomly selected definitions per word (i.e., 80 definitions, 11% of the data) to assess reliability. Interrater correlation was $r = 0.81$. Latency, total time spent on each definition in seconds, and the two strategy ratings were recorded directly by the computers.

Analysis

Table 1 shows means and standard deviations for the dependent variables averaged across participants by word set and strategy instruction group. These data were subjected to a 2 (word set: concrete or abstract) × 3 (strategy instruction group: control, imagery strategy, or verbal strategy) mixed MANOVA with word set as a within-participants factor and instruction group as a between-participants factor. A statistically significant multivariate effect for word set was found, $F(8,82) = 33.29$, $P < 0.0001$, $\eta^2 = 0.77$. Neither the effect for instruction group nor the interaction was statistically significant. Therefore, only the differences between the concrete and abstract word sets were analyzed further.

Individual within-participants contrasts were performed between the concrete and abstract word sets on each dependent variable. Statistically significant differences favoring the abstract word set were found for total words in the definition, $F(1,89) = 14.30$, $P < 0.0001$, $\eta^2 = 0.14$; average letters per word, $F(1,89) = 4.20$, $P < 0.05$, $\eta^2 = 0.05$; and verbal strategy rating, $F(1,89) = 37.52$, $P < 0.0001$, $\eta^2 = 0.30$. A statistically significant difference favoring the concrete word set was found for the imagery strategy rating, $F(1,89) = 176.12$, $P < 0.0001$, $\eta^2 = 0.66$; and a marginally significant difference favoring the concrete set was found for quality score, $F(1,89) = 3.06$, $P = 0.08$, $\eta^2 = 0.09$. Because quality scores for written composition are affected by length in words (Hillocks, 1986; Sadoski & Goetz, 1998), an analysis of covariance was undertaken to determine if the concrete word set had significantly higher quality scores when the variance attributable to length in words was statistically controlled. The results of the ANCOVA indicated that this was the case, $F(1,88) = 8.73$, $P < 0.004$, $\eta^2 = 0.09$.

Table 1. Means and standard deviations for characteristics of definitions of concrete and abstract words under three sets of instructions.

	Concrete words								Abstract words							
	Imagery		Verbal		Control		Total		Imagery		Verbal		Control		Total	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Latency (sec.)	8.58	3.51	9.77	4.40	11.35	8.31	9.94	5.96	8.98	6.60	9.53	4.63	9.99	7.47	9.52	6.35
Letters/word	4.40	0.27	4.46	0.26	4.55	0.42	4.47	0.33	4.44	0.22	4.57	0.32	4.61	0.42	4.54	0.34
Words/sentence	17.77	15.56	13.92	4.55	14.89	6.03	15.52	9.95	17.85	14.36	15.18	6.09	14.91	6.11	15.95	9.59
Total words	48.92	22.81	41.45	22.10	33.76	20.77	41.12	22.53	54.78	27.81	46.39	26.64	36.23	20.74	45.48	26.00
Total time (min.)	3.64	0.85	3.41	0.95	3.10	1.04	3.38	0.97	3.81	0.83	3.48	0.88	3.10	1.03	3.45	0.96
Quality	6.41	1.80	6.00	1.60	5.49	1.86	5.95	1.78	6.41	2.10	5.82	2.25	4.92	1.96	5.69	2.17
Imagery strategy	34.04	4.77	31.85	6.00	35.31	4.22	33.81	5.16	21.66	7.47	19.11	8.70	21.42	8.27	20.77	8.15
Verbal strategy	23.62	6.92	22.18	6.06	23.46	6.74	23.11	6.55	27.37	7.23	27.58	6.31	28.25	6.41	27.75	6.59

Discussion

This study investigated the effects of word concreteness and either verbal, imagery, or control strategy instructions on written composition. It replicated and extended two earlier studies involving these variables. Results replicated those of Tirre et al. (1979) in the production of written composition on word relationships and partially replicated the results of Sadoski et al. (1997) in the timed written production of word definitions. Specific comparisons between these studies and the present results will be discussed in turn, followed by a general summation and discussion.

The present study found significant effects of concreteness on several quantity and quality variables in the writing of word definitions but no significant effect of strategy assignment or interaction between concreteness and strategy assignment. Similarly, Tirre et al. (1979) found significant concreteness effects on the quality of written compositions involving relationships between the meanings of key words from text passages, but no significant effect of strategy assignment or interaction between concreteness and strategy assignment. In turn, the Tirre et al. study partially replicated Paivio and Foth (1970), where concrete word pairs were recalled better than abstract word pairs. However, Paivio and Foth found an interaction between concreteness and strategy assignment, unlike either the Tirre et al. study or the present study. Overall, a common finding in these three studies is that the concreteness of the stimulus words had a significant effect on either their recall or the quality of written composition about their meanings. However, there was no main effect of strategy or interaction of strategy and concreteness where written composition was the dependent measure rather than recall.

The results of the present study partially replicated Sadoski et al. (1997) using a different set of concrete and abstract words matched on more semantic values. Sadoski et al. performed two experiments with different time limits, whereas the present study used a single experiment with a time limit between the other two. A strong finding across all the experiments in both studies was that ratings of the use of an imagery strategy were much greater for the concrete words, whereas ratings of the use of a verbal strategy were much greater for the abstract words. Concrete words produced definitions rated higher in quality in all the experiments in both these studies, although the difference in the present experiment was marginal except when controlling for length. Abstract words produced definitions with longer words in all the experiments in both these studies, although that difference did not reach significance in Sadoski et al., Experiment 2. In turn, the foregoing results for quality and word length replicated the results of Reynolds and Paivio (1968), who used oral language in producing definitions.

There were differences as well. Concrete words had longer definitions in both experiments in Sadoski et al. (1997) and in Reynolds and Paivio (1968), whereas abstract words had longer definitions in the present experiment. Latencies were shorter for concrete words in both experiments in Sadoski et al. and in Reynolds and Paivio, whereas abstract words had shorter latencies in the present experiment, although the difference was not significant. In comparing latencies across the three time limits used in Sadoski et al. and the present experiment, latency increased as time to write the definition increased. This implies that the latencies reflect, at least in part, strategic planning that is responsive to time constraints. No effects were found on the two new variables used in the present study, average words per sentence and total time spent composing.

In sum, two overall trends may be identified across these studies. One clear trend is that language concreteness is strongly associated with meaningful composing as well as recall. This can be explained by the Dual Coding Theory assumption that meaning and memory are enhanced by referential connections between the verbal and nonverbal codes (Paivio, 1971, 1986; Sadoski & Paivio, 2001). Another trend is that an imagery strategy is used in writing about concrete words and a verbal strategy is used in writing about abstract words *regardless* of which strategy is assigned or whether any strategy is assigned. With tasks as cognitively complex as composing, the spontaneous or preferred use of strategies may tend to override any strategy instructions. Such a finding is not unique. Sadoski, Goetz, Olivarez, Lee and Roberts (1990) were unable to manipulate the processing depth of students reading a literary story through assignment to read for theme, for pleasure, or to detect typos inserted in the text for that group. Both verbal recall and reports of mental imagery were the same for all groups at both immediate and delayed time intervals, leading the researchers to conclude that a strict levels of processing view as demonstrated in some laboratory tasks may be untenable for more realistic encounters with reading text (cf. Craik, 1979). The same may be true for composing text.

These trends should be subject to further investigation because of differences in methodology across studies. Different sets of words were used in several studies. Drawing was used as the imagery strategy in some studies, whereas mental imagery was used as a strategy in other studies. Other methodological variations include timed vs. untimed composing, word meanings derived from passage contexts vs. general word meanings, and the use of experimentally matched stimuli rather than random selection of stimuli from some established population. While the identification of theoretically predictable general effects is important, further research would be useful in specifying more precisely the conditions of the effects.

Another extension of this research might involve the effects of different orthographies. Word imageability has been found to interact with spelling-sound regularity and/or decoding skill in word naming times in English (Strain, Patterson, & Seidenberg, 1995, 2002; Strain & Herdman, 1999), Turkish (Raman & Baluch, 2001), and Persian (Baluch & Besner, 2001). Such orthography and decoding effects could affect latencies and possibly other variables. How written definitions are composed in different languages is a subject of interest in itself.

References

Baluch, B. & Besner, D. (2001). Basic processes in reading: Semantics affects speeded naming of high-frequency words in an alphabetic script. *Canadian Journal of Experimental Psychology, 55*, 63–69.

Craik, F.I.M. (1979). Levels of processing: Overview and closing comments. In L.S. Cermak & F.I.M. Craik (Eds.), *Levels of processing in human memory* (pp. 447–461). Hillsdale, New Jersey: Lawrence Erlbaum.

Hillocks Jr., G. (1986). *Research on written composition: New directions for teaching*. Urbana, Illinois: ERIC Clearinghouse on Reading and Communication Skills and the National Conference on Research in English.

Paivio, A. (1971). *Imagery and verbal processes*. New York: Holt, Rinehart, and Winston (reprinted 1979, Hillsdale, New Jersey: Lawrence Erlbaum).

Paivio, A. (1986). *Mental representations: A dual coding approach*. New York: Oxford University Press.

Paivio, A. & Foth, D. (1970). Imaginal and verbal mediators and noun concreteness in paired associate learning: The elusive interaction. *Journal of Verbal Learning and Verbal Behavior, 9*, 384–390.

Paivio, A., Walsh, M. & Bons, T. (1994). Concreteness effects in memory: When and why? *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20*, 1196–1204.

Raman, I. & Baluch, B. (2001). Semantic effects as a function of reading skill in word naming of a transparent orthography. *Reading and Writing: An Interdisciplinary Journal, 14*, 599–614.

Reynolds, A. & Paivio, A. (1968). Cognitive and emotional determinants of speech. *Canadian Journal of Psychology, 22*, 164–175.

Sadoski, M. & Goetz, E.T. (1998). Concreteness effects and syntactic modification in written composition. *Scientific Studies of Reading, 2*, 341–352.

Sadoski, M. & Paivio, A. (2001). *Imagery and text: A dual coding theory of reading and writing*. Mahwah, New Jersey: Lawrence Erlbaum.

Sadoski, M., Goetz, E.T., Olivarez, A., Lee, S. & Roberts, N.M. (1990). Imagination in story reading: The role of imagery, verbal recall, story analysis, and processing levels. *Journal of Reading Behavior, 22*, 55–70.

Sadoski, M., Goetz, E.T. & Fritz, J. (1993a). A causal model of sentence recall: Effects of familiarity, concreteness, comprehensibility, and interestingness. *Journal of Reading Behavior, 25*, 5–16.

Sadoski, M., Goetz, E.T. & Fritz, J. (1993b). Impact of concreteness on comprehensibility, interest, and memory for text: Implications for dual coding theory and text design. *Journal of Educational Psychology, 85*, 291–304.

Sadoski, M., Goetz, E.T. & Avila, E. (1995). Concreteness effects in text recall: Dual coding or context availability? *Reading Research Quarterly, 30*, 278–288.

Sadoski, M., Kealy, W.A., Goetz, E.T. & Paivio, A. (1997). Concreteness and imagery effects in the written composition of definitions. *Journal of Educational Psychology, 89*, 518–526.

Sadoski, M., Goetz, E.T. & Rodriguez, M. (2000). Engaging texts: Effects of concreteness on comprehensibility, interest, and recall in four text types. *Journal of Educational Psychology, 92*, 85–95.

Strain, E. & Herdman, C.M. (1999). Imageability effects in word naming: An individual differences analysis. *Canadian Journal of Experimental Psychology, 53*, 347–359.

Strain, E., Patterson, K. & Seidenberg, M. S. (1995). Semantic effects in single-word naming. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21*, 1140–1154.

Strain, E., Patterson, K. & Seidenberg, M. S. (2002). Theories of word naming interact with spelling-sound consistency. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 28*, 207–214.

Tirre, W.C., Manelis, L. & Leicht, K.L. (1979). The effects of imaginal and verbal strategies on prose comprehension by adults. *Journal of Reading Behavior, 11*, 99–106.

Toglia, M.P. & Battig, W.F. (1978). *Handbook of semantic word norms*. Hillsdale, New Jersey: Lawrence Erlbaum.

Address for correspondence: Mark Sadoski, Department of Teaching, Learning, and Culture, 4232 TAMU, Texas A&M University, College Station, TX 77843-4232, USA
Phone: +1-979-845-8234; Fax: +1-979-845-9663; E-mail: msadoski@tamu.edu