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In 4 experiments, symbolic comparisons were investigated to test semantic-memory retrieval accounts espousing processing advantages for picture over word stimuli. In Experiment 1, participants judged pairs of animal names or pictures by responding to questions probing concrete or abstract attributes (texture or size, ferocity or intelligence). Per pair, attributes were salient or nonsalient concerning their prerated relevance to animals being compared. Distance (near or far) between attribute magnitudes was also varied. Pictures did not significantly speed responding relative to words across all other variables. Advantages were found for *far* attribute magnitudes (i.e., the distance effect) and salient attributes. The distance effect was much less for salient than nonsalient concrete-attribute comparisons. These results were consistently found in additional experiments with increased statistical power to detect modality effects. Our findings argue against dual-coding and some common-code accounts of conceptual attribute processing, urging reexamination of the assumption that pictures confer privileged access to long-term knowledge.

A central assumption that has apparently become accepted in theorizing about semantic-memory activation and retrieval of knowledge is that pictorial stimuli more readily contact semantic memory than do verbal stimuli (e.g., Arieh & Algom, 2002; Glaser, 1992; Shaki & Algom, 2002). Theories of semantic memory vary in terms of the extent to which the picture advantage generalizes across varying types of semantic features, however, most theories share the view that at least for some kinds of features, pictures confer privileged access. The basis for this widespread assumption is the experimental finding that latencies to respond to a judgment based on long-term knowledge are faster when pictures are presented than when words are presented (Banks & Flora, 1977; Paivio, 1978; Paivio & Marschark, 1980; Potter & Faulconer, 1975; Seifert, 1997; Smith & Magee, 1980). This picture-superiority effect is typically viewed as an established finding in the speeded picture–word processing literature (e.g., Glaser, 1992).

The picture-superiority effect in contacting meaning may be suspect, however. For example, Theios and Amrhein (1989b) found that by matching picture and word stimuli for area and horizontal visual angle, modality differences did not occur in a semantic-comparison task. Theios and Amrhein (1989b) argued that such results undermine the interpretation of most of the results ostensibly supporting the position that pictures have privileged access to semantic memory (e.g., Potter & Faulconer, 1975; Smith & Magee, 1980). One should note, however, that the Theios and Amrhein (1989b) findings do not unequivocally undercut the conclusions of the existing database (e.g., see Seifert, 1997). Theios and Amrhein (1989a, 1989b) used stimuli for which the lexical referents could be realized in primitive pictorial formats (e.g., ═══════ is pictured for the word *horizontal* and ○○○○○○○ is pictured for the word *CIRCLES*). It is not certain that their results extend to the kinds of concrete nouns (e.g., *ELEPHANT*, *TIGER*) and complex representational pictures (e.g., as found in Snodgrass & Vanderwart, 1980) that are typically used in the research informing long-term memory representation and access. For example, using representational pictures, Seifert (1997) found a picture-superiority effect (averaging approximately 75 ms) for category decisions when the visual angles subtended by word and picture stimuli were similar. Thus, it remains an open issue as to whether prior results suggesting stimulus-modality differences in the speed of access to semantic features should be reinterpreted in light of Theios and Amrhein's (1989a, 1989b) criticisms.

In four experiments, we addressed this critical issue of whether picture-superiority effects assumed by prominent theories of semantic-memory representation and access would be obtained with standard representational pictures and referents (like those used in the typical semantic-memory-judgment paradigms) when picture and word stimuli are controlled for horizontal visual angle. We chose the symbolic-comparison task to investigate the presence of picture-superiority effects in accessing semantic memory. In the usual implementation of this task, pairs of words or pictures denoting natural concepts are presented, and the participant judges which pair correctly answers the question posed for a given pair, such as "Which animal is larger in real life?" or "Which animal is

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more ferocious?" We focused on the symbolic-comparison task for several important reasons. First, large and robust picture-superiority effects have been reported for this task, and these effects have provided key support for the view that pictures have privileged access to semantic-memory representations (e.g., Banks & Flora, 1977; Paivio, 1975). We reasoned that the magnitude of the reported picture-superiority effect in this paradigm (typically on the order of hundreds of milliseconds) allows the possibility that a true picture superiority in accessing memory representations is reflected, along with an artifactual contribution as described above. That is, the size of the reported effects has been such that even if these effects were in part artifactual, a reduction in the effect (through eliminating the artifactual contribution) could still leave room for a detectable picture-superiority effect.

For our purposes, a second advantage of the symbolic-comparison task over other semantic-judgment tasks (e.g., categorization; Potter & Faulconer, 1975) is that it provides constraints that direct how conceptual comparisons are made by explicitly singling out specific attribute dimensions (e.g., attribute concreteness). Prominent approaches to knowledge representation make different assumptions regarding the extent to which privileged access for pictures extends across these attribute dimensions. Thus, any convincing test of picture-superiority effects must be sensitive to these different theoretical possibilities. Finally, there is a well-established literature on the symbolic-comparison task providing hallmark findings that are useful as comparisons for the present results. If we obtain these standard findings, then an absence of picture-superiority effects could not be discounted because of possible anomalies in our instantiation of the paradigm.

One general position assumes that pictures contact meaning faster than do words, with no distinction made as to the types of features comprising this meaning (for ease of exposition we label this the *common code* view). That is, in this view, pictures should provide quicker access to both concrete and abstract features than should words (Banks & Flora, 1977; Nelson, Reed, & McEvoy, 1977; Potter & Faulconer, 1975; Smith & Magee, 1980). In this assumption, the reaction times to perform a symbolic comparison should be faster for pictures than for words. As noted above, this kind of finding has been reported (e.g., Banks & Flora, 1977), but its interpretation is uncertain because of possible confounds with stimulus modality and visual angle.

Other theoretical positions also assume faster meaning access for pictures but in a more restricted fashion. Dual-coding theory (Paivio, 1986) posits that concrete features are stored in a nonverbal system,[1] whereas abstract features are stored in a verbal system. Further, pictures as stimuli will make contact with concrete features more readily than will word stimuli. Briefly, the logic for this assumption is that pictures but not words are akin to the imagery code presumed to support the nonverbal system. Recent findings from the event related potential literature have provided some support for this multiple-semantic-systems view (e.g., Federmeier & Kutas, 2001; Kounios & Holcomb, 1994). According to dual-coding theory, pictures should produce faster responses relative to words for concrete but not abstract features. Therefore, if the visual area of the word and picture stimuli were equated, then the advantage for pictures might be completely eliminated for abstract dimensions but should remain for concrete features.

A modification to the dual-coding position suggests the possibility of a slight alteration in the pattern of picture-superiority effects outlined above. Paivio (1978; see also Paivio & Marschark, 1980) speculated that decisions about abstract features like intelligence might be based in large part on access to concrete experiences that demonstrated the target feature (e.g., a dog acting "smart" by performing a trick at the circus). For these abstract features, there would be an advantage for pictures. For some referents used in the symbolic-comparison task, however, there would be a high likelihood that the verbal code could directly provide the abstract feature. As suggested by Paivio and Marschark (1980), these would be referents for which the abstract feature would have been frequently encoded from linguistic inputs (statements read or heard, like "chimps are smart" and "worms are dumb"). A picture-superiority effect would not be expected for these particular kind of abstract features (cf. Paivio & Marschark, 1980). It is uncertain how one might identify a priori which abstract features would be encoded as such; however, one possibility is the dimension of feature salience. Marschark (1983) established that some features are more salient for particular referents and other features are less salient. Salient features were those that were viewed (on the basis of normative judgments) as highly characteristic or highly related to the stimulus referent (animals), and nonsalient features were viewed as less characteristic or not strongly related. It might be the case that only salient abstract features would support responding directly from the putative verbal code storing that feature. If so, then picture superiority would be evidenced for all but salient abstract features.

To test these predictions, we manipulated the concreteness of the features being compared. Some comparisons required judgments based on concrete attributes (size or texture) and other comparisons required judgments based on abstract attributes (ferocity or intelligence). We also manipulated the salience of the feature being compared. Finally, we manipulated the distance between the items of a pair on the dimension being considered. That is, some items were close together in rated magnitude on the comparator dimension, and some were far apart. A benchmark finding in the literature is that latencies are slower in *near* than in *far* comparisons (the distance effect; Banks & Flora, 1977; Moyer, 1973; Moyer & Bayer, 1976). We wanted to replicate this standard distance effect to help establish that our procedures and materials were not atypical. By doing so, the theoretical currency of an elimination of the picture-superiority effect (if found) would be strengthened.

Experiment 1

Method

Materials, Design, and Apparatus

The procedure for developing the item pool is described first. An initial pool of 89 animal names was compiled using 78 animal names (*human* was omitted, and *polar bear* was replaced with *bear*) from Holyoak and Mah's

[1] Concrete features can also be stored in the verbal system. For purposes of quantitative judgments about stored features, the theory assumes that the nonverbal system will contribute preferentially over "dual" verbal codes.

(1981) study plus 11 more animal names.[2] Four dimensions (two concrete and two abstract) were chosen for the rating task, with each dimension represented by two adjectives representing conceptual endpoints of the dimension. The concrete dimensions were texture (softer or rougher) and size (smaller or larger); the abstract dimensions were ferocity (meeker or fiercer; see Kerst & Howard, 1977) and intelligence (dumber or smarter). Nine four-page booklets, each representing a different rating task, were constructed with the animal names placed in a different random order in each booklet. Each of 22 undergraduate students from Purdue University, West Lafayette, Indiana, participating in partial fulfillment of an introductory psychology course requirement, completed each of the nine rating-task booklets. In the first booklet, eight different adjectives (*large*, *small*, *fierce*, *meek*, *smart*, *dumb*, *soft*, and *rough*) were printed at the top of each page. Following Marschark's (1983) procedure, we told participants that the adjectives represented attributes commonly associated with different animals and that their task was to select which attribute best characterized each animal and write it on the line next to the animal's name. Participants were told that their responses should represent each species in general rather than a particular member with which the participant may have had a personal experience (e.g., *dog* referred to dogs in general and not Lassie or a family dog).

After completing the salience-rating task, participants completed magnitude ratings on each of the eight dimensional adjectives. Each booklet represented a different adjective. The adjective to be rated was printed at the top of each page of its respective booklet along with a 9-point scale, ranging from 1 (*minimum magnitude*) to 9 (*maximum magnitude*). Participants were told to write the number corresponding to their rating on the line next to each animal's name. The eight booklets were given to each participant in a different random order, with the stipulation that booklets representing different ends of the same dimension (e.g., smaller and larger) were not presented sequentially. Participants completed the rating booklets at their own pace.

Pair selection. The results of the salience ratings were used to determine the degree of association of each animal with each of the eight adjectives. For each animal, the most salient adjective was identified on the basis of the adjective chosen by the most raters. The least salient adjective corresponded to the adjective chosen by the fewest (or none) of the raters. Animals for which the most frequently chosen adjective did not exceed the least frequently chosen adjective by at least 10 were eliminated from the item pool. The remaining items were used in this study and are presented in the Appendix. Using these items and their adjective magnitude ratings, we developed a final set of 32 animal pairs, 4 pairs for each of the eight comparative adjectives. For each adjective, 2 of the pairs represented animals for which the adjective was salient, and 2 pairs represented animals for which the adjective was nonsalient. In addition, for both the salient and nonsalient pairs, 1 pair represented animals with magnitude ratings on the attribute that were far apart from each other (mean difference = 3.44) and 1 pair represented animals with magnitude ratings on the attribute that were close together (mean difference = 1.33), $F(1, 16) = 41.95$, $p < .0001$, $MSE = 0.8521$. It is important to note that this difference in distance for *far* and *near* pairs did not vary among the various levels of the factors of concreteness, salience, or dimension (all $ps > .25$), allaying any concerns about differential distance scaling within *near*- and *far*-trial conditions of this experiment. Lastly, the *far* pairs (e.g., *chicken–dog*) were used twice for each dimension (e.g., intelligence): once for the adjective representing the low end of the dimension (e.g., *dumber*) and once for the adjective representing the high end (*smarter*). In this way, concrete and abstract dimensions were each represented by three unique pairs.

List construction. The 32 pairs were used to construct two 16-pair lists. Although the *far* pairs were repeated to represent both the ends of a dimension, each list presented each pair only once. Each list therefore represented a 2 (concrete vs. abstract) × 2 (salient vs. nonsalient) × 2 (far vs. near) × 2 (concrete dimensions: texture or size vs. abstract dimensions: ferocity or intelligence) factorial design. Specific dimension adjectives (e.g., for texture: *rougher* or *softer*) were nested in a balanced manner across the pairs of each list; these lists are given in the Appendix.[3] Two versions of each list were constructed. The versions contained the same items but with the left–right positions of the items reversed, resulting in four lists. Two versions of each of the four test lists were constructed, one containing the names of each animal, the other containing pictures. All stimuli were placed on 10 × 15 cm cards. The pictures were artist-drawn black-ink line drawings—some of which were patterned after those given in Snodgrass and Vanderwart (1980)—that were produced according to the featural constraints specified by design characteristics of this experiment. Specifically, featural diagnosticity (see Snodgrass & McCullough, 1986), concerning size and texture characteristics of the animals, was minimized in their depictions. To control for possible size effects in processing the picture and stimuli (see Theios & Amrhein, 1989b), we presented the words in 24-point Executive font in capitals. Figure 1 presents sample picture and word stimuli. All items in Experiment 1 were presented tachistoscopically, resulting in subtended horizontal visual angles for individual pictures to average 2.16° (range = .82°–3.61°) and for individual words to average 2.08° (range = .89°–4.29°; $F < 1$).[4] Both the picture and the word pairs were placed on the cards so the outer edges of the items were 11-cm apart, such that all picture–word-item pair stimuli subtended a visual angle of 7.46°. All stimuli were presented on a 3-channel mirror tachistoscope (Gerbrands Model No. T-38–1; Arlington, MA), and response times recorded on an automatic digital timer (Lafayette Instruments Model No. 54035; Lafayette, IN).

Participants

Participants in the symbolic-comparison task were 48 undergraduates who voluntarily participated as part of an undergraduate psychology course requirement at Purdue University. None of the participants in the comparison task had taken part in the norming task.

Procedure

Half of the participants received the picture condition, and the other half received the word condition. Within each stimulus-modality condition, 6 participants were randomly assigned to a given left–right order of one of

[2] We chose animals as our semantic category because calibration of their concrete and abstract attributes is readily available in the symbolic-comparison literature (Čech & Shoben, 2001; Holyoak & Mah, 1981; Marschark, 1983; Paivio & Marschark, 1980; Shoben & Wilson, 1998). Moreover, concrete–abstract attribute calibration is not readily available (or even possible) for other categories such as furniture, tools, food, and so forth.

[3] Lists for the remaining experiments are available from Paul C. Amrhein upon request.

[4] Equating picture and word stimuli on overall horizontal visual angle necessitated for many concepts that the height of the picture stimuli be greater than the word stimuli (see Figure 1), to preserve the natural shape and proportion of their depictions of real-world animals (see also Seifert, 1997, concerning related issues of trade-offs between stimulus size characteristics and stimulus perceptibility). This resulted in an overall difference in vertical visual angle between pictures (M =1.72°; range = .41°–2.73°) and words (.48° for all words). This also resulted in an overall difference in area between pictures (M = 2.89 cm^2; range = 1.06–4.94 cm^2) and words (M = 2.13 cm^2; range = .91–4.41 cm^2). (Exact stimulus areas were determined for each stimulus using a tracing algorithm implemented on a digitizer tablet.) However, there was considerable overlap in the distribution of the areas of the picture and word stimuli and, more important, the difference in mean areas did not result in any reliable picture advantage in our experiments—indicating that perceptibility of our picture and word stimuli was functionally equivalent.

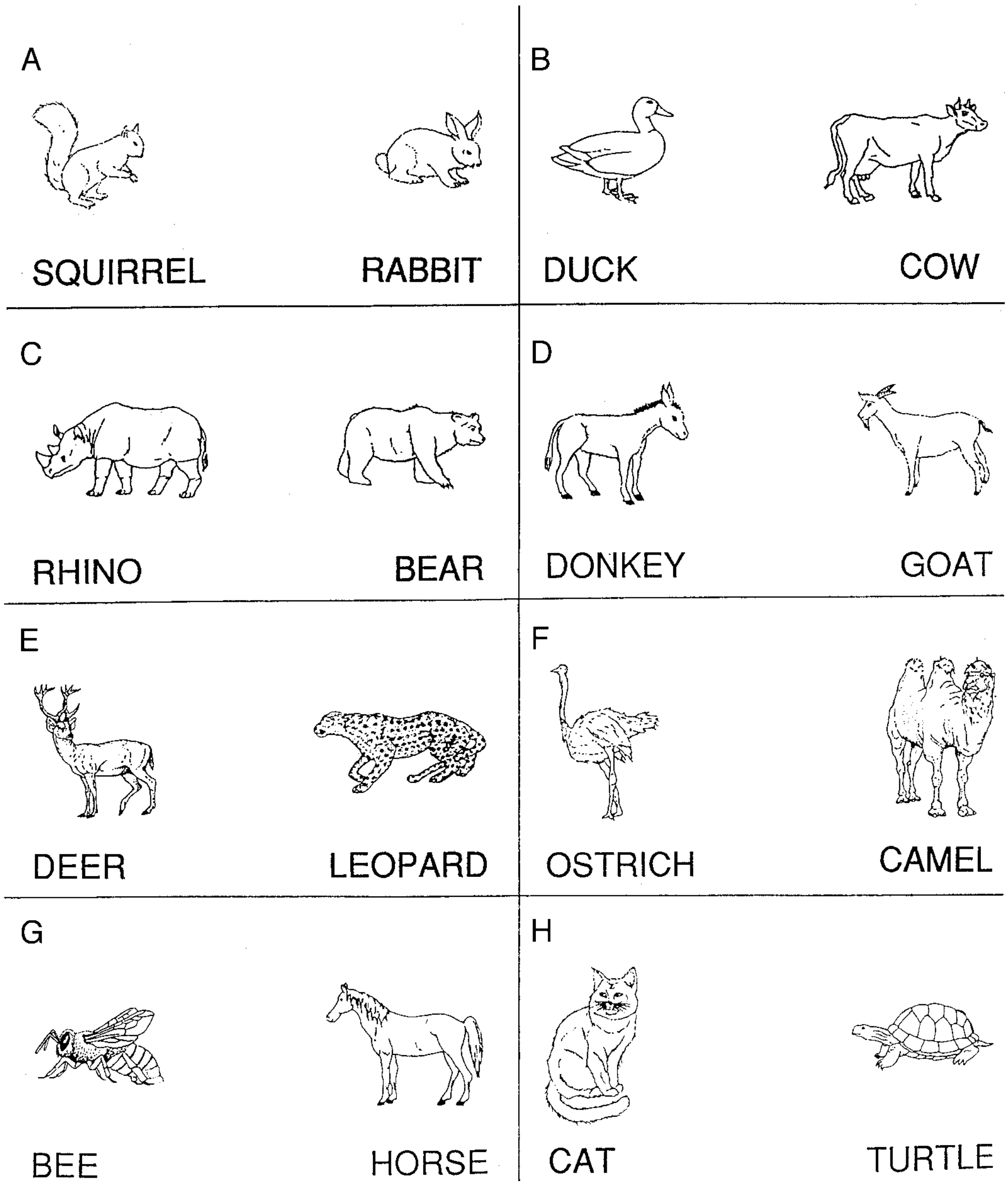

Figure 1. Sample picture and word stimuli used in Experiment 1. A: Concrete salient–*near* texture comparison; B: Concrete salient–*far* size comparison; C: Concrete nonsalient–*far* texture comparison; D: Concrete nonsalient–*near* size comparison; E: Abstract salient–*far* ferocity comparison; F: Abstract salient–*near* intelligence comparison; G: Abstract nonsalient–*near* ferocity comparison; H: Abstract nonsalient–*far* intelligence comparison. Stimuli are not presented to scale.

the two concept lists. The animal pairs were presented in a different random order for each participant. Participants were instructed that they would be seeing pairs of animals and would choose which member of each pair was the correct answer to a question the experimenter would ask about general characteristics of the real-life animals. The experimenter explained the procedure for responding and then told each participant what the possible questions would be and also explained that the questions "Which is softer?" and "Which is rougher" corresponded to questions about the texture of the animal. For each pair, the experimenter first asked the comparative question using the carrier phrase "Which is" followed by the comparative form of the adjective. Approximately 1 s after the end of the spoken question, a fixation cross appeared. The cross remained visible for 0.5 s and was immediately followed by a stimulus pair that remained visible until the participant indicated a response. Participants responded by using their right or left index finger to press a button corresponding to whether the correct animal was on the right or left side. As soon as the participant pressed a button, the stimulus pair disappeared and was replaced by a blank screen. The experimenter recorded the response time and the response before presenting the next comparative. Between responses, participants kept their index fingers on the response buttons to facilitate accurate, rapid responding. Although participants were not told that there would be practice items, the first 8 pairs in each list (one item for each comparative) were practice items and were followed immediately by the 16-pair test list. Prior to the practice trials, the stimulus pictures were shown singly to ensure that each participant was familiar with the appearance and name for each animal. The experimental session lasted approximately 30 min.

Results

Mixed factor analyses of variance (ANOVAs) were conducted on the correct judgment latencies and errors, with stimulus-pair modality (picture or word) as the between-participants factor and concreteness (concrete or abstract), salience (salient or nonsalient), and intrastimulus pair distance (near or far) as within-participants factors. Condition means and error rates are given according to these factors in Table 1. Two analyses of each measure were conducted. One analysis involved participants (F_1) as the random variable, with measures collapsed over (a) left–right order of like-stimulus pair items, (b) the two concept lists, (c) dimension (texture, size, ferocity, and intelligence),[5] and (d) intradimensional valence (as probed by the adjectives in the questions: *rougher* or *softer*, *larger* or *smaller*, *fiercer* or *meeker*, *smarter* or *dumber*, respectively). A second analysis involved stimulus concept pairs (F_2) as the random variable, with latencies collapsed over (a) participants, (b) left–right order of like-stimulus pair items, (c) dimension, and (d) intradimensional valence. The .05 level of statistical significance was used in reporting these analyses and those of the remaining experiments.

Table 1
Condition Means (in ms) and Error Rates for Experiment 1

	Salient		Nonsalient		Mean	
Distance and stimulus modality	*M*	Error rate	*M*	Error rate	*M*	Error rate
Concrete						
Near						
Picture	1,294	.021	1,652	.250	1,473	.136
Word	1,292	.083	1,648	.125	1,470	.104
Mean	1,293	.052	1,650	.188	1,472	.120
Far						
Picture	1,213	.000	1,264	.000	1,239	.000
Word	1,228	.021	1,313	.021	1,271	.021
Mean	1,221	.011	1,289	.011	1,255	.011
Overall	1,257	.032	1,470	.100	1,364	.066
Abstract						
Near						
Picture	1,533	.104	1,555	.021	1,544	.063
Word	1,514	.125	1,562	.063	1,538	.094
Mean	1,524	.115	1,559	.042	1,542	.079
Far						
Picture	1,372	.042	1,333	.021	1,353	.032
Word	1,315	.042	1,276	.021	1,296	.032
Mean	1,344	.042	1,305	.021	1,325	.032
Overall	1,434	.079	1,432	.032	1,433	.056

Comparison Latencies

Overall, picture (1,402 ms) and word (1,393 ms) stimuli provided statistically equivalent response speeds ($F_1 < 1$; $F_2 < 1$). Also, there were no significant interactions involving modality (all Fs < 1). Further, to test for the picture-superiority effects anticipated by dual-coding views, we conducted planned comparisons. Contrary to these views, stimulus modality did not vary reliably for concrete salient comparisons (pictures: 1,254 ms; words: 1,260 ms; $F_1 < 1$; $F_2 < 1$), for concrete nonsalient comparisons (pictures: 1,458 ms; words: 1,481 ms), $F_1 < 1$; $F_2(1, 4) = 1.43$, $p >$ .29, MSE = 56,184.80; abstract salient comparisons (pictures: 1,453 ms; words; 1,415 ms), $F_1 < 1$; $F_2(1, 4) = 2.85$, $p > .16$, MSE = 37,303.00; or for abstract nonsalient comparisons (pictures: 1,444 ms; words: 1,419 ms; $F_1 < 1$; $F_2 < 1$).

In contrast, all of the other independent variables significantly affected response speed. Comparison judgments for concrete dimensions (1,363 ms) were faster than for abstract dimensions (1,433 ms), $F_1(1, 44) = 10.66$, MSE = 87,075.07; $F_2(1, 16) = 6.33$, MSE = 131,302.23. Comparison judgments of salient dimensions (1,345 ms) were faster than those concerning nonsalient dimensions (1,450 ms), $F_1(1, 44) = 30.81$, MSE =69,102.21; $F_2(1, 16) = 17.91$, MSE = 131,302.23. Lastly, comparison judgments involving stimulus pairs near in dimensional distance (1,506 ms) were slower than those far in dimensional distance (1,289 ms), $F_1(1, 44) = 61.69$, MSE = 146,486.78; $F_2(1, 16) = 66.24$, MSE = 131,302.23.

These effects were qualified by three interactions that converge on the finding that attribute salience affects the latency pattern for concrete but not abstract patterns. The Concreteness × Salience interaction, $F_1(1, 44) = 19.28$, MSE = 114,537.97; $F_2(1, 16) = 17.43$, MSE = 131,302.23, was such that salient concrete judgments (1,257 ms) were faster than salient abstract judgments (1,433 ms), $F_1(1, 44) = 33.68$, MSE = 89,080.60; $F_2(1, 4) = 20.61$, MSE = 142,618.97, but that nonsalient concrete and abstract judgments (1,469 ms vs. 1,432 ms, respectively) were equivalent, $F_1(1, 44) = 1.21$, $p > .27$, MSE = 112,532.42; $F_2(1, 4) = 1.32$, $p > .31$, MSE = 137,183.00. The Salience × Distance interaction, $F_1(1, 44) = 18.66$, MSE = 84,721.29; $F_2(1, 16) = 14.67$, MSE = 131,302.23, showed that *near* comparisons were much faster for salient (1,408 ms) than nonsalient (1,604 ms) judgments, but *far* comparisons were equivalent for salient (1,282 ms) and nonsalient (1,297 ms) judgments. This pattern of latencies indicates a substantially smaller distance effect for salient (126 ms) than for nonsalient (307 ms) judgments.

Finally, there was a Concreteness × Salience × Distance interaction, $F_1(1, 44) = 6.31$, MSE = 87,831.33; $F_2(1, 16) = 3.72$, $p =$ .07, MSE = 131,302.23. As can be seen in Table 1, for concrete dimensions, *near* comparisons were much faster for salient (1,293 ms) than nonsalient (1,650 ms) judgments, but *far* comparisons were only somewhat faster for salient (1,221 ms) than nonsalient (1,289 ms) judgments—resulting in a substantially smaller distance effect for salient (72 ms) than for nonsalient (361 ms)

[5] Preliminary analysis revealed reliable latency differences among the four dimensions: texture (1,411 ms), size (1,315 ms), ferocity (1,441 ms) and intelligence (1,424 ms), $F_1(3, 132) = 7.80$, MSE = 78,704.57; $F_2(3, 16) = 4.62$, MSE = 131,302.23. However, these differences did not vary reliably with the levels of the variables included in the main analysis. A similar pattern was observed among the error rates, although the differences among the dimensions (texture: 7.29%; size: 5.73%; ferocity: 5.73%; intelligence: 5.21%) were not statistically significant (all ps $> .05$). Finally, there was no evidence of a speed–accuracy tradeoff in these data; the correlation of comparison latencies and error rates was positive ($r = .68$).

judgments, $F_1(1, 44) = 21.55$, $MSE = 92{,}961.62$; $F_2(1, 8) = 16.83$, $MSE = 129{,}404.66$. However, for abstract dimensions, *near* comparisons were similar for salient (1,524 ms) and nonsalient (1,559 ms) judgments, as were *far* comparisons for salient (1,343 ms) and nonsalient (1,304 ms) judgments—indicating equivalent distance effects for salient (181 ms) and nonsalient (255 ms) judgments, $F_1(1, 44) = 1.65$, $p > .20$, $MSE = 79{,}591.00$; $F_2(1, 8) = 1.78$, $p > .21$, $MSE = 133{,}199.80$.

Errors

The results of the error analyses revealed a pattern highly consistent with the latency analyses. Overall, incorrect judgments occurred on 5.99% of the experimental trials. Differences were not found between picture (5.73%) and word (6.25%) stimuli ($F_1 < 1$; $F_2 < 1$), between concrete (6.51%) and abstract (5.47%) dimensions ($F_1 < 1$; $F_2 < 1$), nor between salient (5.47%) and nonsalient (6.51%) dimensions ($F_1 < 1$; $F_2 < 1$). However, *near* comparisons (9.90%) incurred more errors than did *far* comparisons (2.08%), $F_1(1, 44) = 22.30$, $MSE = 0.0526$; $F_2(1, 16) = 18.00$, $MSE = 0.0651$. There also were two interactions. A Concreteness $\times$ Salience interaction, $F_1(1, 44) = 16.04$, $MSE = 0.0393$; $F_2(1, 16) = 9.68$, $MSE = 0.06510$, showed that for concrete dimensions, fewer errors occurred for salient (3.31%) than for nonsalient judgments (9.90%); however, for abstract dimensions, more errors occurred for salient judgments (7.81%) than for nonsalient dimensions (3.13%). Also, there was a Concreteness $\times$ Salience $\times$ Distance interaction, $F_1(1, 44) = 6.60$, $MSE = 0.0639$; $F_2(1, 16) = 6.48$, $MSE = 0.0651$. As can be seen in Table 1, for concrete dimensions, *near* comparisons exhibited fewer errors for salient (5.21%) than nonsalient (18.75%) judgments, but *far* comparisons exhibited identical errors for salient (1.04%) and nonsalient (1.04%) judgments—indicating a substantially smaller distance effect for salient (4.67%) than for nonsalient (17.71%) judgments, $F_1(1, 44) = 7.53$, $MSE = 0.0584$; $F_2(1, 8) = 6.76$, $MSE = 0.0651$. However, for abstract dimensions, *near* comparisons were somewhat similar in errors for salient (11.46%) and nonsalient (4.17%) judgments, as were *far* comparisons, for salient (4.17%) and nonsalient (2.08%) judgments—indicating statistically nonsignificant differences in the distance effects for salient (7.29%) and nonsalient (2.08%) judgments, $F_1(1, 44) = 1.05$, $p > .31$, $MSE = 0.0618$; $F_2(1, 8) = 1.00$, $p > .34$, $MSE = 0.0651$. All remaining interactions from these analyses were nonsignificant.

Discussion

The results are inconsistent with theoretical assumptions regarding the privileged role of pictures relative to words that are embraced in prominent views of how knowledge is represented and accessed. One assumption incorporated into some views is that pictures have more direct access to conceptual information than do words (e.g., Banks & Flora, 1977; Nelson et al., 1977; Potter & Faulconer, 1975). In opposition to this assumption, we found that pictures produced nominally slower responding than did words. Theios and Amrhein (1989b) demonstrated that uncontrolled perceptual dimensions like visual angle can produce picture-superiority effects and suggested that past findings implicating picture superiority for semantic access could have been compromised by such artifacts. In the present experiment we controlled for visual angle across pictures and words, and under these conditions we did not find general picture-superiority effects. It is also noteworthy that other standard effects like the symbolic-distance effect (Banks & Flora, 1977; Moyer, 1973; Moyer & Bayer, 1976) and the attribute-salience effect (Marschark, 1983) were obtained.

Dual-coding theory (Paivio, 1986) anticipated a more complex pattern, such that pictures should be faster than words only for concrete features. This pattern is based on the dual-coding idea that pictures having privileged access to an imagery system wherein concrete features are presumed to be stored. Yet, words and pictures produced statistically equivalent responding for concrete features as well as for abstract features. This latter finding is buttressed by Paivio and Marschark's (1980, Experiment 1) report of equivalent responding across pictures and words for intelligence comparisons.

A more complex variant of the dual-coding approach is also not supported by the present findings. We thought it possible that the imagery system might be involved in reflecting on nonsalient abstract characteristics of a particular animal (the images would be constructed to assess the target animals' behaviors for evidence of the requisite abstract characteristic; Paivio & Marschark, 1980) but that salient abstract characteristics would have been previously extracted from experience with the target animals and therefore would be directly stored in the verbal system (e.g., "chimps are smart"). However, the three-way interaction between feature concreteness, stimulus modality, and salience was not close to significance. Nor did the planned comparisons support the predicted pattern. That is, it was not the case that pictures produced statistically faster responding than did words for nonsalient abstract features.

Several less important findings emerged from this experiment. Concrete features generally supported faster responding than did abstract features, but this effect was limited to salient features. For nonsalient features, concrete features did not produce significantly faster comparisons than did abstract features. Marschark (1983, p. 197) also reported a significant Salience $\times$ Concreteness interaction (using the dimensions of size and ferocity only and using words only) in which the advantage of size (concrete) relative to ferocity (abstract) comparisons was greater for salient than for nonsalient pairs. The Salience $\times$ Concreteness interaction must be viewed with caution, however, because there is uncertainty in both studies about whether the salience values are equivalent across concrete and abstract features.

A related issue concerns the three-way Distance $\times$ Salience $\times$ Feature Concreteness interaction. This interaction reflected the fact that salient concrete features especially facilitated response speed relative to other features for near comparisons. Stated another way, as indicated in Table 1, the standard distance effect was substantially reduced for salient concrete features. We know of no published report in the symbolic-comparison literature in which such an attenuation in the distance effect because of attribute salience has been observed. It is possible that this effect also reflects artifacts, however. We address this concern in Experiment 3B and accordingly delay discussion of this issue until then. More important, we first present three additional experiments to establish the stability of our finding that when visual angle is equated, there is no picture-superiority effect. Previous reports of stimulus-modality effects have found variable patterns depending on whether stimulus modality is manipulated between- or within-participants (e.g., see Paivio & Marschark, 1980). Relatedly, the null stimulus-modality finding of Experiment 1 could reflect an insensitivity in the between-participants manipulation of modality or be otherwise spurious—the power to reject the null hypothesis of no modality difference with an obtained picture–word difference of 75 ms (e.g., the approximate obtained-difference mean reported by Seifert, 1997) averages to be only .25 for participants-analysis comparisons (although .74 for concepts-analysis comparisons; see Keppel, 1973). Therefore, before further considering the theoretical implications of the findings of Experiment 1, we present three related, additional experiments that test for modality effects in the symbolic-comparison task.

Experiment 2

The main changes from Experiment 1 were that stimulus modality was manipulated within-participant, and distance was not included as a variable. The focus was again on the effects of stimulus modality. By increasing the number of participants in the within-participant manipulation of stimulus modality, we attempted to increase the power to detect stimulus-modality effects, if present. An absence of a modality main effect would discredit the idea that pictures give privileged access to semantic memory. If there were also no Stimulus Modality $\times$ Concreteness interaction nor a three-way interaction with salience, then more restrictive approaches (e.g., dual coding) would be discredited as well.

Method

Materials and Design

Two master 16-pair lists were constructed using the same item pairs as in Experiment 1. Each list consisted of 16 pairs reflecting a 2 (concrete or abstract) $\times$ 2 (salient or nonsalient) $\times$ 2 (concrete dimensions: texture or size vs. abstract dimensions: ferocity or intelligence) $\times$ 2 (intradimensional valence; e.g., texture: rougher vs. softer) factorial design. Pairs were selected to balance distance differences explicitly measured in Experiment 1, resulting in a mean distance value of 2.25 (the mean distance value for Experiment 1 was 2.39). It is important to note that the mean distance value for this experiment did not vary reliably among the levels of the concreteness or salience factors or between dimensions within the concreteness levels (all *p*s $>$ .31), which allays concerns of differences in average distance values confounding the interpretation of the main effects and interactions in the latency and error analyses. Across the two master lists, some items appeared twice; however each appearance was nonredundantly distributed across the levels of the concreteness, salience, dimension, and dimension valence. Four final-item lists were created by reversing the order of the item-pair members of the two master lists. In a counterbalanced fashion, each participant received one master item list appearing (in either normal or reversed order) as picture stimuli and the other appearing (in either normal or reversed order) as word stimuli. Two practice lists of eight animal pairs were devised from animal names not used in the experimental stimuli. Half appeared as picture pairs and the other half as word pairs and represented examples of the levels of concreteness, salience factors, and dimensions.

Participants

Participants were 32 undergraduates enrolled in introductory psychology courses at the University of New Mexico, Albuquerque, New Mexico.

Apparatus and Procedure

Apparatus and procedure were the same as in Experiment 1, with the exception that participants received both picture and word stimuli (from different lists). Randomly determined, half of the participants received the picture stimuli first and the other half received the word stimuli first. Like-modality practice stimuli were presented prior to the presentation of the experiment stimuli for each participant. The experimental session lasted approximately 45 min.

Results

ANOVAs were conducted on correct judgment latencies and errors, with stimulus-pair modality (picture or word) and conceptual characteristics of concreteness (concrete or abstract) and salience (salient or nonsalient) as fixed factors. Condition means and error rates are given according to these factors in Table 2. Two analyses of each measure were conducted. One involved participants (F_1) as the random variable, with measures collapsed over (a) left–right order of like-stimulus pair items, (b) the two item lists, (c) dimension (texture, size, ferocity, or intelligence),[6] and (d) intradimensional valence (rougher or softer, larger or smaller, fiercer or meeker, smarter or dumber, respectively). A second analysis involved stimulus item-pairs (F_2) as the random variable, with latencies collapsed over (a) participants, (b) left–right order of like-stimulus pair items, (c) dimension, and (d) intradimensional valence.

Comparison Latencies

Replicating Experiment 1, picture (1,255 ms) and word (1,249 ms) stimuli were responded to similarly ($F_1 < 1$; $F_2 < 1$), and there were no significant interactions involving stimulus modality (all *p*s $>$ .26). As in Experiment 1, planned comparisons were conducted to test for the picture-superiority effects anticipated by dual-coding views. Again, contrary to these views, stimulus modality did not vary reliably for concrete salient comparisons (pictures: 1,073 ms; words: 1,131 ms), $F_1(1,30) = 1.72$, $p > .19$, $MSE = 123{,}222.00$; $F_2(1, 7) = 1.13$, $p > .32$, $MSE = 188{,}575.00$); for concrete nonsalient comparisons (pictures: 1,261 ms; words: 1,253 ms; $F_1 < 1$; $F_2 < 1$), for abstract salient comparisons (pictures: 1,349 ms; words: 1,318 ms; $F_1 < 1$; $F_2 < 1$), or for abstract nonsalient comparisons (pictures: 1,337 ms; words: 1,294 ms; $F_1 < 1$; $F_2 < 1$). Indeed, although statistically nonsignificant, the differences between pictures and words for concrete nonsalient and abstract nonsalient comparisons are in the opposite direction of that predicted from one dual-coding account (Paivio, 1978).

[6] Preliminary analysis revealed reliable latency differences among the four dimensions: texture (1,298 ms), size (1,138 ms), ferocity (1,307 ms), and intelligence (1,266 ms), $F_1(3, 90) = 11.04$, $MSE = 142{,}097.22$; $F_2(3, 24) = 6.34$, $MSE = 247{,}467.69$. Significant error-rate differences were also observed among the dimensions (texture: 16.40%; size: 8.20%; ferocity: 12.11%; intelligence: 8.20%) in the participants analysis, $F_1(3, 90) = 3.97$, $MSE = 0.0986$; but not in the concepts analysis, $F_2(3, 24) = 1.70$, $p > .19$, $MSE = 0.2308$. These differences did not vary reliably with the levels of the variables included in the main analyses (all *p*s $>$ .05). Finally, there was no evidence of a speed–accuracy tradeoff in these data; indeed, the correlation of comparison latencies and error rates was highly positive ($r = .78$).

Table 2
Condition Means (in ms) and Error Rates for Experiment 2

Stimulus modality	Salient *M*	Salient Error rate	Nonsalient *M*	Nonsalient Error rate	Mean *M*	Mean Error rate
			Concrete			
Picture	1,073	.047	1,349	.219	1,211	.133
Word	1,131	.070	1,318	.156	1,225	.113
M	1,102	.059	1,333	.188	1,218	.123
			Abstract			
Picture	1,261	.086	1,337	.125	1,299	.106
Word	1,253	.086	1,294	.109	1,274	.098
M	1,257	.086	1,316	.117	1,287	.102
Overall	1,180	.073	1,325	.153		

The other variables did significantly influence response speed. Comparison judgments of salient dimensions (1,180 ms) were faster than those concerning nonsalient dimensions (1,324 ms), $F_1(1, 30) = 33.46$, MSE =160,344.34; $F_2(1, 28) = 14.78$, MSE = 362,899.50. Comparison judgments involving concrete dimensions (1,218 ms) were faster than those concerning abstract dimensions (1,286 ms), $F_1(1, 30) = 7.55$, MSE = 159,597.56; $F_2(1, 28) = 3.32$, $p < .08$, MSE = 362,899.50. This concreteness effect was qualified by a Concreteness × Salience interaction, $F_1(1, 30)$ = 15.06, MSE = 126,486.81; $F_2(1, 28) = 5.25$, MSE = 362,899.50. Whereas salient concrete judgments (1,102 ms) were much faster than salient abstract judgments (1,257 ms), $F_1(1, 30) = 20.14$, MSE = 152,492.00; $F_2(1, 14) = 6.98$, MSE = 439,925.00, nonsalient concrete judgments (1,333 ms) and nonsalient abstract judgments (1,316 ms) were equivalent ($F_1 < 1$; $F_2 < 1$).

Errors

Errors occurred on 11.23% of the experimental trials. Significant differences were not found between picture (11.91%) and word (10.55%) stimuli (F_1 and $F_2 < 1$). Also, concrete (12.31%) and abstract (10.16%) comparisons incurred equivalent errors (F_1 and $F_2 < 1$). However, salient judgments (7.23%) incurred fewer errors than did nonsalient judgments (15.23%), $F_1(1, 30) = 15.69$, MSE = 0.1064; $F_2(1, 28) = 6.24$, MSE = 0.2633. There was a Salience × Concreteness interaction that was significant over participants, $F_1(1, 30) = 6.44$, MSE = 0.0947; but not over concepts, $F_2(1, 28) = 2.32$, $p = .14$, MSE = 0.2633. For concrete comparisons, far fewer errors were exhibited for salient (5.86%) than nonsalient (18.75%) judgments, but for abstract comparisons, approximately the same proportion of errors occurred for salient (8.59%) than nonsalient (11.72%) judgments. Remaining interactions were nonsignificant.

Discussion

The patterns were completely in line with those of Experiment 1. There was neither an effect of stimulus modality nor an interaction between stimulus modality and concreteness nor an interaction between stimulus modality, concreteness, and salience. These effects did not emerge even though this experiment increased the statistical sensitivity for revealing such an effect if present (by using a within-participants design). Thus, once again there is no statistical support for the idea that pictures afford privileged access to semantic memory nor is there support for more restricted effects of pictures as anticipated by dual-coding theory. Attribute concreteness and salience again facilitated response speeds equally for the two stimulus modalities.

Experiments 3A and 3B

All existing views that anticipate picture-superiority effects agree that such effects should be observed at least for concrete features. To provide an even more methodologically sensitive test for these possible effects than may have been allowed in Experiments 1 and 2, we designed the comparisons in Experiments 3A and 3B to involve only concrete attribute dimensions (with stimulus modality again manipulated within-participants). It is important to note that this allowed each participant to receive twice as many picture and word trials for concrete features as were presented in Experiment 2. Power indices for the modality effects of the concrete salient and nonsalient trials in Experiment 2 yielded only moderate values: To reject the null hypothesis of no modality difference with an obtained picture–word difference of 75 ms, respective power values were .65 and .30 for participants-analysis comparisons, and respective power values were .43 and .50 for concepts-analysis comparisons. Specifically, though statistically nonsignificant, the concrete salient comparison latencies in Experiment 2 (see Table 2) suggest that there may be a picture advantage for concrete salient comparisons. We hypothesized that if this is an actual effect, then additional stimulus items for that condition in the present experiment should increase the power of the modality comparison for that condition and reveal a reliable difference. Contrariwise, if such a picture advantage for this condition does not exist, then the reduction in variance afforded a larger stimulus trial set should result in smaller disparities between picture and word latencies and provide further statistical evidence against the picture-superiority effect. In addition to the issue of limited power, requiring participants to respond to abstract items in Experiments 1 and 2 may have encouraged a strategy that masked picture-superiority effects. We reasoned that if there were an advantage for pictures, it could be fully exploited when participants only had to make concrete judgments. Finally, distance was included as a variable to investigate the reliability of the moderating effects of salience for distance effects with concrete features found in Experiment 1.

Experiment 3A

Method

Materials and Design

Pair selection. The same set of animals used in Experiments 1 and 2 was used, with the concepts "kangaroo," "bee," "frog," "worm," "fly," and "eagle" replaced by "hippo," "buffalo," "turkey," "zebra," and "armadillo." This change negligibly affected the average horizontal visual angles of the picture and word stimuli; for this set of animal concepts, pictures subtended 2.18° (range = .82°–3.61°) and words subtended 2.14° (range =

.89°–4.29°; $F < 1$).[7] Like Experiment 1, a set of 32 animal pairs was developed, 4 pairs for each of the four concrete comparative adjectives (*smaller* and *larger* for size; *smoother* and *rougher* for texture). For each adjective, two of the pairs represented animals for which the adjective was salient and two pairs represented animals for which the adjective was nonsalient. In addition, for both the salient and nonsalient pairs, one pair represented animals whose magnitude ratings on the attribute were far from each other (mean difference = 3.63) and one pair represented animals whose magnitude ratings on the attribute were near each other (mean difference = 1.08), $F(1, 24) = 80.49$, $p < .0001$, $MSE = 0.6447$. It is important to note that these average distance values for *far* and *near* stimuli did not vary reliably among the levels of the salience factor or dimension (all ps $> .16$), which allays concerns about differential distance scaling within *near* and *far* trial conditions of this experiment.

List construction. The 32 pairs were used to construct two 16-pair lists. Each list presented each pair only once. Across the two lists, some items appeared twice; however each appearance was nonredundantly distributed across the levels of the concreteness, distance, and dimension. Each list therefore represented a 2 (salient vs. nonsalient) × 2 (far vs. near) × 2 (texture vs. size) × 2 (intradimensional valence; e.g., texture: rougher vs. softer) factorial design. Two versions of each list were constructed. The versions contained the same items but with the left–right positions of the items reversed, resulting in four test lists. Two versions of each of the four lists were constructed, one containing the names of each animal, the other containing line drawings. Two practice lists of eight animal pairs each were devised from animal names not used in the experimental stimuli. One list appeared as picture pairs and the other list as word pairs; both lists represented examples of the levels of salience, distance, and dimension factors.

Participants

Participants were 32 undergraduates enrolled in introductory psychology courses at the University of New Mexico. None had participated in Experiment 2.

Apparatus and Procedure

The apparatus was identical to that used in Experiments 1 and 2. Each participant received two stimulus lists, one appearing as pictures, and the other appearing as words. Eight participants were randomly assigned in a counterbalanced manner to a given left–right order of the two concept lists. Within each list, animal pairs were presented in a different random order for each participant; the order of picture- and word-stimulus lists was counterbalanced across participants. Prior to each list, participants received a set of eight practice stimuli, appearing in the modality of the immediately following experimental stimuli; animal pairs represented were different from those used in the experimental trials. Remaining aspects of the procedure were the same as those in Experiments 1 and 2. The experimental session lasted approximately 45 min.

Results

ANOVAs were conducted on the correct judgment latencies and errors, with (a) conceptual characteristics of salience (salient or nonsalient), (b) intrastimulus pair distance (near or far), and (c) stimulus-pair modality (picture or word) as fixed, within-participants factors. Condition means and error rates are given according to these factors in Table 3. Two analyses of each measure were conducted. One involved participants (F_1) as the random variable, with measures collapsed over (a) left–right order of like-stimulus pair items, (b) the two item lists, (c) dimension (texture, size)[8], and (d) intradimensional valence (rougher or softer, larger or smaller, respectively). A second analysis involved stimulus-concept pairs (F_2) as the random variable, with latencies collapsing over (a) participants, (b) left–right order of like-stimulus pair items, (c) dimension, and (d) intradimensional valence.

Comparison Latencies

Overall, picture (1,232 ms) and word (1,232 ms) stimuli produced identical response speeds ($F_1 < 1$; $F_2 < 1$). Further, stimulus modality did not significantly interact with any other variable (all ps $> .14$). As in the previous experiments, planned comparisons were conducted to test for the picture-superiority effects anticipated by dual-coding theory. Again, contrary to that view, stimulus modality did not vary reliably for concrete salient comparisons (pictures: 1,133 ms; words: 1,162 ms; $F_1 < 1$; $F_2 < 1$) nor for concrete nonsalient comparisons (pictures: 1,330 ms; words: 1,302 ms; $F_1 < 1$; $F_2 < 1$).

In contrast, the other variables significantly affected response speed. Comparison judgments for salient dimensions (1,148 ms) were faster than those for nonsalient dimensions (1,316 ms), $F_1(1, 30) = 49.62$, MSE =146,848.44; $F_2(1, 28) = 44.65$, MSE = 163,184.96. Comparison judgments for stimulus pairs near in dimensional distance (1,304 ms) were slower than those far in dimensional distance (1,160 ms), $F_1(1, 30) = 41.93$, MSE = 128,137.08; $F_2(1, 28) = 32.93$, MSE = 163,184.96. These effects were qualified by a Salience × Distance interaction, $F_1(1, 30) = 14.21$, MSE = 87,535.33; $F_2(1, 28) = 7.62$, MSE = 163,184.96, such that *near* comparisons were much faster for salient (1,185 ms) than nonsalient (1,424 ms) judgments, but *far* comparisons were only somewhat faster for salient (1,110 ms) than nonsalient (1,209 ms) judgments. As was found in Experiment 1 for concrete dimensions, this pattern of latencies indicates a substantially smaller distance effect for salient (75 ms) than for nonsalient (215 ms) judgments (see Table 3). All other interactions were nonsignificant in this analysis.

Errors

Errors occurred on 9.18% of the experimental trials. There was no difference in errors found between picture (9.18%) and word (9.18%) stimuli ($F_1 < 1$; $F_2 < 1$). However, salient judgments

[7] For the same reasons stated for Experiment 1, there was an overall difference in vertical visual angle between pictures (M = 1.75°; range = .82°–2.73°) and words (.48° for all words). There was also an overall area difference between pictures (M = 3.08 cm^2; range = 1.06–4.94 cm^2) and words (mean=2.20 cm^2; range = .91–4.41 cm^2). Again, there was considerable overlap in the distribution of the areas of the picture and word stimuli and, more important, the difference in mean areas did not result in any reliable picture advantage in our experiments—indicating that the perceptibility of our picture and word stimuli was functionally equivalent in Experiment 3A.

[8] Preliminary analysis did not reveal reliable latency differences between the two dimensions: texture (1,249 ms) and size (1,215 ms; both ps $> .05$). Moreover, this small difference did not vary reliably with the levels of the variables included in the main analysis. A similar pattern was observed among the error rates, with the difference in the dimensions (texture: 10.35%; size: 8.01%) being statistically nonsignificant (ps $> .05$). Lastly, comparison latencies and error rates were positively correlated, indicating no speed–accuracy tradeoff in the data (r = .75).

Table 3
Condition Means (in ms) and Error Rates for Experiment 3A

Distance and stimulus modality	Salient *M*	Salient Error rate	Nonsalient *M*	Nonsalient Error rate	Mean *M*	Mean Error rate
Concrete						
Near						
Picture	1,172	.070	1,431	.211	1,302	.141
Word	1,199	.125	1,417	.180	1,308	.153
M	1,186	.098	1,424	.200	1,305	.149
Far						
Picture	1,095	.023	1,230	.063	1,163	.043
Word	1,125	.031	1,188	.031	1,157	.031
M	1,110	.027	1,209	.047	1,160	.037
Overall	1,148	.063	1,317	.124		

(6.25%) incurred fewer errors than did nonsalient judgments (12.11%), $F_1(1, 30) = 13.89$, $MSE = 0.0633$; $F_2(1, 28) = 6.83$, $MSE = 0.1286$. *Near* comparisons (14.65%) incurred more errors than did *far* comparisons (3.71%), $F_1(1, 30) = 29.40$, $MSE = 0.1042$; $F_2(1, 28) = 23.81$, $MSE = 0.1286$. Also, there was a Salience × Distance interaction, $F_1(1, 30) = 6.36$, $MSE = 0.0615$; $F_2(1, 28) = 3.04$, $p < .10$, $MSE = 0.1286$. As can be seen in Table 3, for near comparisons, fewer errors were exhibited for salient (9.77%) than nonsalient (19.53%) judgments, but for *far* comparisons, only slightly fewer errors were exhibited for salient (2.73%) than nonsalient (4.69%) judgments—indicating a smaller distance effect for salient (7.03%) than for nonsalient (14.84%) judgments. All remaining interactions were nonsignificant.

Discussion

In this experiment, a picture-superiority effect was again not evident. This pattern was found in both the latency and error analyses, and it provides clear, within-participant support for a claim of modality-independent processing of conceptual attributes in symbolic comparisons when nominal control over physical stimulus characteristics of pictures and words is exercised. It is important to note that this independence was revealed under conditions of adequate statistical power for the comparisons involving stimulus modality. To reject the null hypothesis of no modality difference with an obtained picture–word difference of 75 ms, power values for concrete salient comparisons were .87 for the participants analysis and .80 for the concepts analysis; corresponding values for concrete nonsalient comparisons were .70 for the participants analysis and .80 for the concepts analysis. Also, the reduction in the distance effect afforded concrete salient attribute comparisons that was found in Experiment 1 was replicated.

Experiment 3B

The purpose of Experiment 3B was to replicate the findings of Experiment 3A using salient and nonsalient pairs that were matched on dimensional magnitude. Specifically, the locus of the Salience × Distance interaction observed in Experiments 1 and 3A may be due to a confound in the stimulus materials. Inadvertently, stimulus construction in Experiments 1 and 3A resulted in salient *near* pairs having higher overall dimension magnitudes than nonsalient *near* pairs but with salient *far* and nonsalient *far* having equivalent values.[9] In Experiment 1, salient *near* and salient *far* pairs had average dimension magnitudes of 6.72 and 4.44, respectively, whereas nonsalient *near* and nonsalient *far* pairs had average values of 4.61 and 4.77, respectively. Likewise, in Experiment 3A, salient *near* and salient *far* pairs had average dimension magnitudes of 6.82 and 3.75, respectively, whereas nonsalient *near* and nonsalient *far* pairs had average values of 4.11 and 4.58, respectively.[10] This asymmetry may have promoted the Salience × Distance interaction because of a differential serial position effect in the symbolic comparisons (Čech & Shoben, 2001; Moyer & Dumais, 1978; Shoben & Wilson, 1998). This effect is such that comparisons involving concepts both high (or low) in magnitude on a given dimension are facilitated relative to those that are both intermediate on that dimension. Accordingly, relative to salient *far* and nonsalient *far* comparisons, salient *near* comparisons should be faster than nonsalient *near* comparisons. Replication of the Salience × Distance interaction with dimension magnitude controlled would indicate that it is not a methodological artifact, but it is indeed evidence of a basic distinction in the processing of salient and nonsalient magnitude information. Moreover, this experiment allowed a final opportunity, under somewhat different stimulus pairings, for a picture-superiority effect to reveal itself.

Method

Materials and Design

Pair selection. The same set of animals used in Experiment 3A was used, with concepts “buffalo,” “turkey,” “gorilla,” “snail,” “leopard,” “goat,” and “donkey” replaced by “weasel,” “lizard,” “antelope,” “monkey,” “bee,” “frog,” “fly,” and “seal.” This change negligibly affected the average horizontal visual angles of the picture and word stimuli; for this set of animal concepts, pictures subtended 2.19° (range = .82°–3.61°) and words subtended 2.07° (range = .89°–4.29°; $F < 1$).[11] As in Experiment 3A, a set of 32 animal pairs was constructed, 4 pairs for each of the four concrete comparative adjectives (*smaller* and *larger* for size; *smoother* and *rougher* for texture). For each adjective, 2 of the pairs represented animals for which the adjective was salient, and two pairs represented animals for which the adjective was nonsalient. In addition, for both the salient and nonsalient pairs, 1 pair represented animals whose magnitude ratings on the attribute were far from each other (mean difference = 3.76), and 1 pair represented animals whose magnitude ratings on the attribute were near each other (mean difference = 1.05), $F(1, 24) = 433.97$, $p < .0001$,

[9] We thank an anonymous reviewer for this astute observation.

[10] Although distance was not manipulated in Experiment 2, dimension magnitudes were equivalent across the salient concrete and abstract pairs (5.68 and 5.08) and nonsalient concrete and abstract pairs (4.74 and 4.79; all *ps* > .26).

[11] For the same reasons stated for Experiments 1 and 3A, there was an overall difference in vertical visual angle between pictures ($M = 1.73°$; range = .82°–2.73°) and words (.48° for all words). There was also an overall area difference between pictures ($M = 2.99$ cm^2; range = 1.06–4.94 cm^2) and words ($M = 2.14$ cm^2; range = .91–4.41 cm^2). Again, there was considerable overlap in the distribution of the areas of the picture and word stimuli and, more important, the difference in mean areas did not result in any reliable picture advantage in our experiments—indicating that the perceptibility of our picture and word stimuli was functionally equivalent in Experiment 3B.

$MSE = 0.1356$. It is important to note that these average distance values for *far* and *near* stimuli did not vary reliably among the levels of the salience factor or dimension (all $ps > .11$), which allays concerns about differential distance scaling within *near* and *far* trial conditions of this experiment. Finally, pair stimuli were selected to equate overall dimensional magnitude across salient and nonsalient comparisons. For salient *near* and nonsalient *near* pairs, dimension magnitude averaged 4.18 and 4.36, respectively ($F < 1$). For salient *far* and nonsalient *far* pairs, dimension magnitude averaged 4.38 and 4.74, respectively ($F < 1$).

List construction. The procedure of list construction was identical to that in Experimental 3A.

Participants

Participants were 32 undergraduates enrolled in introductory psychology courses at the University of New Mexico. None had participated in Experiments 2 or 3A.

Apparatus and Procedure

The apparatus and procedure were identical to that used in Experiment 3A.

Results

ANOVAs were conducted on the correct judgment latencies and errors, with conceptual characteristics of (a) salience (salient or nonsalient), (b) intrastimulus pair distance (near or far), and (c) stimulus pair modality (picture or word) as fixed, within-participants factors. Condition means and error rates are given according to these factors in Table 4. Two analyses of each measure were conducted. One involved participants (F_1) as the random variable, with measures collapsed over (a) left-right order of like-stimulus pair items, (b) the two item lists, (c) dimension (texture or size),[12] and (d) intradimensional valence (rougher or softer, larger or smaller, respectively). A second analysis involved stimulus concept-pairs (F_2) as the random variable, with latencies collapsed over (a) participants, (b) left-right order of like-stimulus pair items, (c) dimension, and (d) intradimensional valence.

Comparison Latencies

Overall, picture (1,234 ms) and word (1,241 ms) stimuli produced equivalent response speeds ($F_1 < 1$; $F_2 < 1$). Further, stimulus modality did not significantly interact with any other variable (all $ps > .10$). As in the previous experiments, planned comparisons were conducted to test for the picture-superiority effects anticipated by dual-coding theory. Again, contrary to that view, stimulus modality did not vary reliably for concrete salient comparisons (pictures: 1,156 ms, words: 1,170 ms; $F_1 < 1$; $F_2 < 1$), nor for concrete nonsalient comparisons (pictures: 1,312 ms, words: 1,313 ms; $F_1 < 1$; $F_2 < 1$).

In contrast, the other variables significantly affected response speed. Comparison judgments of salient dimensions (1,163 ms) were faster than those concerning nonsalient dimensions (1,312 ms), $F_1(1, 30) = 29.60$, $MSE = 193{,}721.50$; $F_2(1, 28) = 12.62$, $MSE = 454{,}262.37$. Comparison judgments involving stimulus pairs near in dimensional distance (1,359 ms) were slower than those far in dimensional distance (1,116 ms), $F_1(1, 30) = 47.49$, $MSE = 319{,}335.07$; $F_2(1, 28) = 33.39$, $MSE = 454{,}262.37$. These effects were qualified by a Salience × Distance interaction, $F_1(1, 30) = 9.75$, $MSE = 208{,}269.35$; $F_2(1, 28) = 4.47$, $MSE = 454{,}262.37$, such that *near* comparisons were much faster for salient (1,240 ms) than nonsalient (1,479 ms) judgments, but *far* comparisons were only somewhat faster for salient (1,086 ms) than nonsalient (1,146 ms) judgments. As was found in Experiments 1 and 3A, for concrete dimensions, this pattern of latencies indicates a substantially smaller distance effect for salient (154 ms) than for nonsalient (333 ms) judgments (see Table 4). All other interactions were nonsignificant in this analysis.

Table 4
Condition Means (in ms) and Error Rates for Experiment 3B

Distance and stimulus modality	Salient		Nonsalient		Mean	
	M	Error rate	*M*	Error rate	*M*	Error rate
Concrete						
Near						
Picture	1,251	.070	1,498	.188	1,375	.129
Word	1,229	.133	1,459	.180	1,344	.157
M	1,240	.102	1,479	.184	1,360	.143
Far						
Picture	1,061	.008	1,126	.063	1,094	.036
Word	1,110	.023	1,167	.055	1,139	.039
M	1,086	.016	1,147	.059	1,117	.038
Overall	1,163	.059	1,313	.122		

Errors

Errors occurred on 8.98% of the experimental trials. There was no difference in errors found between picture (8.20%) and word (9.77%) stimuli ($F_1 < 1$; $F_2 < 1$). However, salient judgments (5.86%) incurred fewer errors than did nonsalient judgments (12.11%), $F_1(1, 30) = 9.52$, $MSE = 0.1051$; $F_2(1, 28) = 6.68$, $MSE = 0.1497$. *Near* comparisons (14.26%) incurred more errors than did *far* comparisons (3.71%), F_1 $(1, 30) = 38.85$, $MSE = 0.0733$; $F_2(1, 28) = 19.02$, $MSE = 0.1497$. As can be seen in Table 4, there is a pattern of errors consistent with the Salience × Distance interaction reported for Experiments 1 and 3A (although this time, both $ps > .05$). For *near* comparisons, fewer errors were exhibited for salient (10.16%) than nonsalient (18.36%) judgments, but for *far* comparisons, relatively speaking, only marginally fewer errors were exhibited for salient (1.62%) than nonsalient (5.86%) judgments—indicating a smaller distance effect for salient (8.59%) than for nonsalient (12.5%) judgments. All remaining interactions were nonsignificant.

[12] Preliminary analysis revealed reliable latency differences between the two dimensions: texture (1,306 ms) and size (1,194 ms), $F_1(1, 30) = 31.17$, $MSE = 134{,}549.04$; $F_2(1, 24) = 12.49$, $MSE = 335{,}751.92$. A significant error-rate difference was also observed between the dimensions (texture: 11.91%; size: 6.06%), $F_1(1, 30) = 12.16$, $MSE = 0.0723$; $F_2(1, 24) = 5.87$, $MSE = 0.1497$. However, these differences did not vary reliably with the levels of the variables included in the main analyses (all $ps > .05$). Lastly, comparison latencies and error rates were highly and positively correlated, indicating no speed–accuracy tradeoff in the data ($r = .86$).

Discussion

The pattern of results revealed in this experiment corroborate those found in Experiments 1 and 3A, showing that salient attributes speed relatively difficult *near* comparisons. Put another way, salient concrete attributes reduced the standard distance effect. It is important to note that this effect was obtained even when comparison magnitude was controlled, and thus the potential influence of a differential serial position effect (see Čech & Shoben, 2001; Shoben & Wilson, 1998) on the response latencies was removed. The other important finding is that a picture-superiority effect was again not evident. This pattern was found in both the latency and error analyses and provides consistently replicated support for modality-independent processing of conceptual attributes in symbolic comparisons when nominal control over physical stimulus characteristics of pictures and words is exercised. Like Experiment 3A, this independence was revealed under conditions of ample statistical power for comparisons concerning stimulus modality. To reject the null hypothesis of no modality difference with an obtained picture–word difference of 75 ms, power values for concrete salient comparisons were .96 for the participants analysis and .82 for the concepts analysis; corresponding values for concrete nonsalient comparisons were .73 for the participants analysis and .88 for the concepts analysis.

General Discussion

The results reported in this study sound a strong cautionary note for theories of semantic memory with regard to their assumptions about the advantage of pictorial stimuli in speed of retrieving semantic information. The findings also have important implications for dual-coding theory's treatment of concrete and abstract information. Finally, the consistent interaction of salience with distance represents a new finding that warrants consideration. We discuss each of these findings in turn.

The Picture-Privilege Hypothesis

Prominent theoretical accounts of semantic-memory retrieval assume that pictures afford privileged access to particular kinds of information in semantic memory (concrete information; Paivio, 1986) or to semantic memory in general (Banks & Flora, 1977; Glaser, 1992; Glaser & Glaser, 1989; Potter & Faulconer, 1975). This broadly accepted assumption is based on a corpus of work in which pictures produced faster responding than did words on tasks that require access to semantic memory, such as symbolic comparisons, semantic-relatedness judgments, and category decisions (Glaser, 1992; Paivio, 1975; Potter & Faulconer, 1975; Seifert, 1997; Smith & Magee, 1980). The explanation given by these researchers for this effect is that pictures need not be named first to be understood, but words do; thus, even when controlling for perceptibility across stimulus modality, this difference should persist (see, e.g., Snodgrass, 1984). However, the database supporting this effect may be subject to artifacts in which the advantage associated with pictures is a perceptual facilitation afforded by larger visual angles for the pictorial stimuli than for the word stimuli (see Theios & Amrhein, 1989b, for details). In line with this possibility, Theios and Amrhein (1989a, 1989b) showed that equating the visual angle for pictures and words eliminated latency differences on various perceptual tasks. Though suggestive, their data did not directly indicate that modality effects for access of semantic features would be eliminated if visual angle was tightly controlled.

The present findings are unambiguous in this regard. With visual angles equated across picture and word stimuli, pictures did not facilitate the speed with which symbolic comparisons are produced. Not only was there an absence of significant modality effects in four experiments but the overall differences were quite small, revealing an average difference of only 2 ms (from Experiments 1 and 2: a 9-ms and 6-ms advantage for words; from Experiment 3A: no difference [0 ms]; and from Experiment 3B: a 7-ms picture advantage). It is important to note that the absence of a modality effect was observed across a variety of methodological conditions, including within- and between-participants presentation of pictures and words, lists composed of abstract and concrete comparisons, judgments for dimensions differing in salience, and lists of only concrete comparisons (for which, in some views, the pictures ought to be especially facilitating; e.g., Paivio, 1978, 1986). Further, the absence of modality effects was confirmed in analyses with materials as the random variable throughout and with more than adequate power in Experiments 3A and 3B. Thus, it is unlikely that the absence of an advantage for pictures rests on some unique feature of our experimental methodology.

Nor does it appear that the absence of picture superiority is limited to symbolic-comparison judgments. Using a semantic-judgment task (item-relation judgments on noncategorically related items), consistent with our results, Seifert (1997, Experiment 3) reported no advantage for pictures when visual angle was equated. Using a picture–word interference paradigm, recent studies (Amrhein & Hamilton, 1997; Hamilton & Amrhein, 1998) have supported this stimulus-modality independence of variables associated with the conceptual organization and retrieval of information from semantic memory. In those studies, when distractor stimuli flanked a target stimulus appearing in a different modality (e.g., a picture distractor presented on either side of a word target), substantial interference was observed when the distractors and target were categorically related and the task required translation of that target (i.e., either drawing from a word target or writing from a picture target). It is important to note that the magnitude of this interference did not vary with the modalities of the distractors or target. That is, the same interference increment was obtained when picture distractors flanked a word target and when word distractors flanked a picture target. Taken together, these results strongly suggest a reexamination of the empirical literature that has spurred theoretical assumptions about pictorial advantages in access of semantic memory. As a start, arguments for a temporally more direct route for word access or a less direct route for picture access to semantic memory should be considered (see, e.g., Snodgrass, 1984; Theios & Amrhein, 1989b).

A brief consideration of past categorization and symbolic-comparison studies raises several concerns about the reliability and validity of the picture advantage reported. First, the effect is not as consistent as may be assumed, with some experiments reporting it (e.g., Banks & Flora, 1977; Durso & Johnson, 1979; Glaser & Dungelhoff, 1984; Nelson et al., 1977; Pellegrino, Rosinski, Chiesi, & Siegel, 1977; Potter & Faulconer, 1975; Seifert, 1997; Snodgrass & McCullough, 1986) but not others (Harris, Morris, & Bassett, 1977; Nelson et al., 1977; Smith & Magee, 1980;

Snodgrass & McCullough, 1986; Theios & Amrhein, 1989b). More critically, interpretation of this equivocal evidence is often hampered by incomplete or nonstandardized specification of the physical characteristics of the picture and word stimuli used in terms of subtended visual angle and stimulus area (compare, e.g., Durso & Johnson, 1979; Nelson et al., 1977; Seifert, 1997; and Theios & Amrhein, 1989b), although a size advantage for pictures is readily inferable from some stimulus descriptions (e.g., Pellegrino et al., 1977) or is given directly by some sample stimulus depictions (e.g., Banks & Flora, 1977; Glaser & Dungelhoff, 1984; Smith & Magee, 1980).

A second potential methodological confound is the possible perceptual similarity present in pictures but not words. For example, in her Experiment 2, Seifert (1997) contrasted two types of attribute-stimulus pairs: external and internal. External attributes are concrete and perceptually verifiable in their pictorial form (at least for a given set of stimuli) (e.g., *finger–hand*, *stripes–tiger*), whereas internal attributes, although also concrete, are not so perceptually verifiable (e.g., *springs–couch*, *wires–toaster*). In a verification task in which both types of attribute trials were intermixed, "yes" responses were faster for pictures than words for both attribute types. Although the picture advantage for external attributes is likely due to facilitated perceptual, rather than conceptual, analysis of the pictorial stimuli (see Seifert, 1997; Snodgrass & McCullough, 1986), this picture advantage was presumed to be more conceptual for the internal attributes. However, a number of the internal attributes were actually perceptually verifiable in the pictorial stimuli used by Seifert, such as *pupil–eye*, *gills–fish*, and *nostril–nose* (see Snodgrass & Vanderwart, 1980, for corresponding pictures). Given that only 18 internal attribute stimuli were used, it is possible that the picture advantage found by Seifert for this condition was due to the same facilitated perceptual processing for pictures that led to the results of the external attribute condition, rather than to an advantage for pictures in accessing conceptual information.

A final troubling feature of the picture-superiority-effect literature is that often the apparent finding of a difference favoring pictures over words is not accompanied by the report of a direct statistical test (see, e.g., Bajo, 1988; Durso & Johnson, 1979; Potter & Faulconer, 1975[13]). In addition, only recently have statistical tests using participants and stimulus items–concepts as error estimates been reported for this stimulus-modality comparison (e.g., Seifert, 1997). In sum, the present study, other recent evidence, and methodological confounds in some past studies pose a serious challenge to the common theoretical claim that pictures afford privileged access to semantic information in general.

Dual-Coding Theory

The dual-coding theory of semantic memory assumes that words are afforded faster access to abstract semantic information than are pictures (Paivio, 1986). One objective of the present study was to examine this assumption in more detail than has been previously attempted. In Experiments 1 and 2, even for abstract salient features that presumably would be directly stored in a putative linguistic system, words did not confer a significant advantage over pictures. Indeed, there was no influence of modality on the symbolic-comparison task, suggesting that access to featural information about concepts in semantic memory may have little dependence on stimulus modality. Most fundamental for dual-coding theory is the idea that concrete features are represented in a nonverbal (imaginal) code or format in semantic memory, a code that is not available for abstract features. This central assumption of dual-coding theory, along with the assumption that pictures should favor access to the imaginal code, firmly predicts a picture-superiority effect for concrete target information. Yet, in two experiments (Experiments 3A and 3B) that focused only on concrete features—and evidenced ample statistical power—no effect of stimulus modality on comparison latencies was observed.

The Distance Effect

Less central to the main thrust of the current study was the unexpected finding that salient features showed a significantly diminished distance effect relative to nonsalient features. As mentioned earlier, one possibility is that salient *near* comparisons may have reflected extreme positions on the target dimension, whereas nonsalient *near* comparisons reflected more intermediate positions on the dimension. As mentioned earlier, extreme pairs tend to be responded to more quickly than intermediate pairs (Čech & Shoben, 2001; Moyer & Dumais, 1978; Shoben & Wilson, 1998). Thus, the interaction revealed in Experiments 1 and 3A might have been due to salient *near* pairs being facilitated because they fell at the extreme of their dimensions (cf. Shoben & Wilson, 1998). However, this possibility seems unlikely given that in Experiment 3B we again found this interaction even when we expressly equated the dimension-magnitude serial positions of the concept pairs for salient and nonsalient comparisons. Barring some unforeseen additional artifact, the present modulation of the distance effect may represent an important extension to the symbolic-comparison literature (see also Sailor & Shoben, 2000, for the attenuation of distance effects for part–whole pairs in a paired-comparison task).

Although we know of no account from the symbolic-comparison literature for this particular—apparently robust—finding, one possible explanation is that salient features can be categorized more quickly in terms of the anchors of the target dimension (e.g., smaller or larger); categorization speed is related to symbolic-comparison latencies (Shoben & Wilson, 1998), which would accordingly provide a general advantage for salient attributes. This interpretation, however, would not clarify why the advantage for salient attributes is amplified on *near* relative to *far* comparisons.

Summary

Given the findings reported here and by Theios and Amrhein (1989b), Amrhein and Hamilton (1997), and Hamilton and Amrhein (1998), we believe that the presence of the picture "advantage" in the literature has benefited from two primary methodological confounds: physical stimulus size (Theios & Amrhein, 1989a,

[13] In the classic Potter and Faulconer (1975) article, the apparent picture advantage over words in their categorization task is supported by separate sign tests of the proportion of participant and concept items exhibiting the effect in the same direction. However, using their reported standard error of the mean difference, one finds that this advantage is nonsignificant by the more conventional matched-samples *t* test.

1989b) and featural diagnosticity (Snodgrass & McCullough, 1986). Our findings indicate that under reasonable constraints in which (a) horizontal visual angles are equivalent for picture and word stimuli (and fall below 8°), (b) their vertical visual angles are roughly equivalent (and fall below 6°[14]), (c) their areas are roughly equivalent, and (d) featural diagnosticity is controlled for picture stimuli, stimulus modality does not reliably influence the time to contact conceptual meaning. Finally, the absence of Modality × Feature Concreteness interactions under these properly controlled conditions counters views that posit different representational formats for concrete relative to abstract features (e.g., dual-coding theory).

[14] See, for example, Johnson, Keltner, and Balestrery (1978) on the different horizontal and vertical limits of the visual field.

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Appendix

Stimulus Pairs for Experiment 1

Concept pair	Concreteness	Salience	Distance	Dimension	Adjective	Correct response
			List 1			
lizard–porcupine	Concrete	Salient	Near	Texture	Rougher	Right
gorilla–walrus	Concrete	Nonsalient	Near	Texture	Softer	Left
lobster–sheep	Concrete	Salient	Far	Texture	Softer	Right
rhino–bear	Concrete	Nonsalient	Far	Texture	Rougher	Left
hummingbird–snail	Concrete	Salient	Near	Size	Smaller	Right
alligator–pig	Concrete	Nonsalient	Near	Size	Larger	Left
duck–cow	Concrete	Salient	Far	Size	Larger	Right
owl–panda	Concrete	Nonsalient	Far	Size	Smaller	Left
kangaroo–penguin	Abstract	Salient	Near	Ferocity	Meeker	Right
bee–horse	Abstract	Nonsalient	Near	Ferocity	Fiercer	Left
deer–leopard	Abstract	Salient	Far	Ferocity	Fiercer	Right
frog–fox	Abstract	Nonsalient	Far	Ferocity	Meeker	Left
beaver–dolphin	Abstract	Salient	Near	Intelligence	Smarter	Right
worm–snake	Abstract	Nonsalient	Near	Intelligence	Dumber	Left
dog–chicken	Abstract	Salient	Far	Intelligence	Dumber	Right
cat–turtle	Abstract	Nonsalient	Far	Intelligence	Smarter	Left
			List 2			
rabbit–squirrel	Concrete	Salient	Near	Texture	Softer	Left
robin–giraffe	Concrete	Nonsalient	Near	Texture	Rougher	Right
lobster–sheep	Concrete	Salient	Far	Texture	Rougher	Left
rhino–bear	Concrete	Nonsalient	Far	Texture	Softer	Right
elephant–moose	Concrete	Salient	Near	Size	Larger	Left
donkey–goat	Concrete	Nonsalient	Near	Size	Smaller	Right
duck–cow	Concrete	Salient	Far	Size	Smaller	Left
owl–panda	Concrete	Nonsalient	Far	Size	Larger	Right
lion–wolf	Abstract	Salient	Near	Ferocity	Fiercer	Left
eagle–fly	Abstract	Nonsalient	Near	Ferocity	Meeker	Right
deer–leopard	Abstract	Salient	Far	Ferocity	Meeker	Left
frog–fox	Abstract	Nonsalient	Far	Ferocity	Fiercer	Right
ostrich–camel	Abstract	Salient	Near	Intelligence	Dumber	Left
grasshopper–mouse	Abstract	Nonsalient	Near	Intelligence	Smarter	Right
dog–chicken	Abstract	Salient	Far	Intelligence	Smarter	Left
cat–turtle	Abstract	Nonsalient	Far	Intelligence	Dumber	Right

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