

On the Function of Analogies in Informative Texts

RACHEL GIORA

Tel Aviv University

Following a previous research into the role of digressive material in informative texts (Giora, 1990), the present study concentrates on the contribution of analogies to text comprehension. In this study, analogy is taken to be a piece of new information which constitutes a topic change, and is consequently marked as a digression by an explicit semantic connector. This new information functions as an example from a distant domain and requires a between-domain comparison. Contrary to the view held by the main thrust of cognitive and discourse research (e.g., Esher, Raven, & Earl, 1942; Gentner, 1983; Labov, 1972; Polanyi, 1985; Reinhart, 1984, in press; R.J. Sternberg, 1977, 1985; Vosniadou & Ortony, 1983), this study demonstrates that analogies are not functional in text comprehension. Rather, they impair recall and inhibit processing. It is argued that a coherent informative text has a transparent structure which spells out both its topic of discourse and its importance hierarchy (Giora, 1985b, 1988). Hence the superfluity of analogies. In terms of ease of processing, then, analogies are redundant.

While analogies do not facilitate comprehension, they seem to contribute to the aesthetics of the informative text. Though readers find texts containing analogies more difficult to follow, they consider them more appealing. Analogies are not superfluous then. They are functional in embellishing the text (cf. Jakobson, 1960).

Various theories attempt a number of explanations for the function of analogies in texts. Most of the theories deal with the narrative and the poetic text (e.g., Jakobson, 1960; Labov, 1972; Reinhart, 1984, in press). Little attention has been paid to analogies in informative texts (e.g., Giora, 1990; Glynn, 1988; Vosniadou & Ortony, 1983). The present study investigates the role of analogies in texts whose main function is to convey information in the most economical way.

The texts in Examples 1 and 2 are samples of informative texts. Though very much alike, they differ from each other in that one (the original) contains an analogy (bold type in Example 2), while the other does not (Example 1):

I am indebted to Mira Ariel and Yeshayahu Shen for their insightful comments on an earlier draft, and to Roberta Kraemer, Yossi Glikson, and Ilana Galante for their help in the statistics.

Correspondence and requests for reprints should be sent to Rachel Giora, Department of Poetics and Comparative Literature, Tel Aviv University, Tel Aviv 69978, Israel.

- (1) It has often occurred in the history of science that an important discovery was come upon by chance. A scientist looking into one matter, unexpectedly came upon another which was far more important than the one he was looking into. Penicillin is a result of such a discovery.
- (2) It has often occurred in the history of science that an important discovery was come upon by chance. A scientist looking into one matter, unexpectedly came upon another which was far more important than the one he was looking into. **Such scientists resemble Saul who, while looking for donkeys, found a kingdom.** Penicillin is a result of such a discovery.

The analogy in Example 2 exemplifies the kind of analogy this research is concerned with. Within a given text, analogy is a piece of new information that constitutes a topic change and is consequently marked as a digression by an explicit semantic connector. It involves a between-domain comparison which should result in transferring the relevant relations from the source to the target domain (e.g., Gentner, 1983, 1989; Vosniadou & Ortony, 1989). Contrary to recent research into the role of analogy, this study, following a previous study on digressions in general (Giora, 1990), questions the claim that analogies are highly functional in text processing.

THEORETICAL BACKGROUND

A number of theories hold the view that analogical expressions are conducive to text understanding. Discourse theories of the narrative and nonnarrative text for example (see the Discourse Theories section), view analogies as functional in text comprehension. They attribute to analogies a **communicative** function. Recent cognitive research into analogy processing (see the Cognitive Research section) holds that analogies play a role in explanation and problem solving and that their understanding and production attest to human intelligence. Analogies, thus, have a **cognitive** function. Contrary to the communicative and cognitive views of analogy which can be taken to hold analogy functional in processing, classical theories of the literary text (see the Aesthetic Theories section) consider analogy to interfere with comprehension. Within this approach, analogy is a poetic device whose major function is to slow down processing so as to enable the reader to pay more attention to both the message and the form of the text. Classical theories of the literary text, thus, attribute to analogies an **aesthetic** function.

Discourse Theories

One of the distinct contributions of discourse research in the past 20 years has been to question the long-standing belief held by literary critics that analogies, like other "poetic devices," are functional primarily as an aesthetic device. For example, Labov (1972), Polanyi (1985), Reinhart (1984, in press), and others,

have argued that the so-called "poetic devices" (e.g., Jakobson, 1960) are functional in narrative comprehension. They termed analogies, metaphors, repetitions, and the like, "evaluative devices," whose function is to spell out the important material in the text so as to enable the reader to form the *raison d'être* or the topic of discourse. Labov, and particularly Reinhart, have shown that understanding what is important in an otherwise neutral, or indifferent to importance hierarchy, narrative sequence is underlined by evaluative material. Evaluative material highlights important narrative sequences so that they be functional in building up the main point or the topic of the narrative.

Though the function of evaluative material has been taken to signal the theme of the narrative, Meyer (1975), for one, can be taken to show that it does not, at least in nonnarrative texts. Meyer checked the effect of evaluative material on recall of nonnarrative texts. She found that the supposed facilitative effect of evaluative material on recall is insignificant. Similarly, Read, Cesa, Jones, and Collins (1990) show that analogy does not effect recall of informative text significantly.¹

A number of empirical studies attest that analogy does not help text comprehension. On the contrary, when tested, analogy, among other evaluative devices, was found to impair understanding of both newspaper stories (Thorondyke, 1979) and expository texts (Giora, 1990). Glynn (1988), as reported in Duit (1990), also shows that analogies may impair understanding of expository texts, since students are misled by those attributes in the analogy they should have ignored. However, a piece of evidence to the contrary comes from Vosniadou and Ortony (1983). In their study, analogy was shown to facilitate both recall and understanding (for a discussion of this study, see the Conclusions and Discussion section).

Cognitive Research

Cognitive research into the function of analogies, both literal and metaphorical,² holds analogical thinking to be one of the measures for human intelligence (e.g., Esher, Raven, & Earl, 1942; Spearman, 1927; R.J. Sternberg, 1977, 1985). It is no wonder then that analogical reasoning ability is measured by many well-known psychometric ability tests.

Analogies are taken to be functional in various respects. Gentner (1983) discusses the use of analogies in explanation. The use of analogies in problem solving has been widely discussed by, for example, Gick and Holyoak (1980), Holland, Holyoak, Nisbett, and Thagard (1986), Clement (1988), and Holyoak

¹Read, Cesa, Jones, and Collins (1990) show that analogies can facilitate recall in oral rather than in written texts only under certain conditions. Recall is facilitated when the stimulus (the analogy) functions as priming.

²Processing for metaphoric and literal analogical reasoning does not seem to differ significantly (e.g., R.J. Sternberg, 1985).

and Thagard (1989). Various theorists discuss the use of analogy in theory formation (Brown, Collins, & Harris, 1978; Darden, 1983; diSessa, 1983; Dreistadt, 1968; Gentner, 1982; Hesse, 1966; Nagel, 1961; Rumelhart & Norman, 1980; VanLehn & Brown, 1979). And some went so far as to show that even two- (Gentner, 1977) and three-year-olds (Goswami & Brown, 1990a, 1990b) can use analogical reasoning. The view is that analogical thinking is an inductive mechanism which makes use of mapping between source and target domain and allows for inferencing and transfer of knowledge.

However, a number of studies show that analogy is not always functional in learning. Halasz and Moran (1982) argue that explanatory analogy may result in wrong mappings. Spiro, Feltovich, Coulson, and Anderson (1989) show that analogies may impede understanding as people tend to overgeneralize on the basis of single analogies. Reed, Ernst, and Banerji (1974) and Gick and Holyoak (1980, 1983) show that subjects do not access available analogies upon solving a very difficult problem. Glucksbeerg and McGlone (1992) attest to a similar behavior under limited time condition. Gentner and Gentner (1983), too, report that in some cases subjects failed to access analogies, and Gentner and Landers (1985) conclude that (true) analogies, though inferentially powerful, are the most difficult to notice.

Aesthetic Theories

The bulk of research into the literary text assigns to analogy the "poetic function" (e.g., Jakobson, 1960; Mukarovsky, 1940/1976; Perry, 1968; Sklovskij, 1925/1966; M. Sternberg, 1970, 1977). Analogy, among other poetic devices, serves to draw the reader's attention to the text and its structure. It is used to slow down processing so that the aesthetics of the text may be more prominent, its goal being the deautomatization of ordinary perception. The use of analogies "induces a mental shift in the reader. . . . The purpose is not to inform, suggest the solution of a problem or justify a position, but simply to refresh the attention by distracting it." (Nash, 1989, p. 55).

ANALOGY AND MEANING

The idea that analogy should contribute to text understanding (cf. the previous section on Discourse Theories) is plausible for several reasons. A certain amount of redundancy is known to be necessary for processing, since it guarantees a certain amount of order (see, for instance, Arnheim, 1971; Attneave, 1954; Barthes, 1970; Suleiman, 1980). Informatively, analogy is a redundant device, and as such it is rightly assumed to help assign meaning to texts.

A great deal of effort on the part of literary research has been made to show that analogy is the major principle of organization of narratives whose narrative order is either weakly established or distorted (Giora & Ne'eman, in press; Perry, 1968, 1980; M. Sternberg, 1970, 1977).

Analogy is thus functional in narrative understanding in that it induces redundancy and evaluates important material. However, in the informative text such material is superfluous. As will be shown in the next section, a well-formed informative text contains enough redundancy to ensure text understanding, and its linear ordering is indicative of importance hierarchy.

Informative Text Structure and Meaningfulness

Previous works (Giora, 1985b, 1988) have shown that the structure of informative texts is categorial.³ Since they lack narrative/schematic organization (in the sense established by, for example, Rumelhart, 1975, and Mandler, 1984), the principle of organization of informative texts is similarity. To be coherent, an informative text has to conform to both the relevance and the graded informativeness requirements. The relevance condition on text well-formedness requires that each proposition be related/similar to an underlying governing proposition, termed discourse topic. The discourse topic proposition is the least informative in the set, and it takes the form of a generalization. It occurs in the segment-initial position (the beginning of a paragraph or chapter), since cognitively it functions as the entry relative to which oncoming messages get assessed and stored. Since the measure for assessment and storage is the amount of similarity the various messages bear to the discourse topic, informative texts are highly redundant.

The graded informativeness condition, on the other hand, constrains ordering of information and is indicative of an importance hierarchy. It requires that the text proceed gradually along the informativeness axis, so that each message is more informative than the one it follows. In this way, a well-formed text unfolds gradually, repeating information in the segment-initial position, and ends with

³Categorial structure refers to the ordering of prototype-oriented categories. Research by Berlin and Kay (1969), Labov (1973), Rips, Shoben, and Smith (1973), Rosch (1973, 1978, 1981), Rosch, Gray, Johnson, and Boyes-Braem (1976), and Rosch and Mervis (1975), for example, show that natural categories have hierarchical internal structuring. They emerge out of probabilistic distributions of features. Thus, membership is not equal but graded. Some members are central or prototypical, while others are marginal. When a member shares a great number of features with other category members, it is a prototypical member, for example, "robin" in the following set of birds. When the number of dissimilar features exceeds the number of common features, this item, however, can be either a borderline member or excluded within the category under discussion, for example, "bat" in the following category of birds (taken from Rosch, 1973):

Bird
robin
eagle
wren
chicken
ostrich
bat

Where similarity is a measure, the internal structuring of the category is graded. It begins with the least informative, most common member and ends with the most informative, marginal one.

the most informative message. (Giora, 1983a, 1983b, 1985c, 1988). For illustration, consider again Example 1 (also discussed in Giora, 1990).

- (1) It has often occurred in the history of science that an important discovery was come upon by chance. A scientist looking into one matter, unexpectedly came upon another which was far more important than the one he was looking into. Penicillin is a result of such a discovery.

This sequence obeys categorial constraints. It begins with a generalization which represents the redundancy structure of the text. It presents the set of properties shared by all the propositions in the text: scientific (1) chance (2) discovery (3) of some importance (4). ("It has often occurred in the history of science that an *important discovery* was come upon by *chance*.") The second proposition shares this set but adds another property, the relative importance of the scientific chance discovery. ("A scientist looking into one matter, unexpectedly came upon another which was *far more important* than the one he was looking into.") By sharing the paragraph common properties, the second proposition obeys the relevance requirement. By adding another one, it conforms to the graded informativeness requirement. With respect to these two, the propositions concerning the discovery of penicillin ("*Penicillin* is the result of such a discovery") is both relevant, sharing the set of common properties, and more informative, in that it adds a new property to the set. Important chance discovery in the history of science—the set of properties suggested by the first and the second propositions—alludes to a number of possibilities. The mention of the discovery of penicillin, which is a specific instance of the category "important scientific chance discovery," eliminates the other alternatives that can be included in this category and adds its specific property. In sum, this sequence reflects categorial organization whereby all the propositions are linked by similarity relation (shared properties) to the generalization in the beginning (the relevance requirement), while linearly, the more informative message follows the less informative one, in accordance with the graded informativeness requirement.

This is an example of a well-formed text consisting of a set of relevant and informative propositions. The coherence structure of this text is transparent since it explicitly states the discourse topic (the generalization in the beginning), and its ordering highlights informative messages. In other words, a well-formed informative text is easy to understand since it contains enough redundancy to be easily assigned meaning and its ordering is indicative of "importance," which I would rather term informativeness.

Coherent texts also allow for digressions, on condition they be marked as such (Giora, 1985a). Thus, Example 2, the original version of Example 1, is also coherent.

- (2) It has often occurred in the history of science that an important discovery was come upon by chance. A scientist looking into one matter, unexpectedly came upon

another which was far more important than the one he was looking into. **Such scientists resemble Saul who, while looking for donkeys, found a kingdom.** Penicillin is a result of such a discovery.

The additional analogy (in boldface type) on its own is irrelevant to the text (in the sense assigned to relevance here), since it is not about the topic of discourse under discussion: It is not about scientific chance discovery. However, since it is explicitly marked as a digression by the semantic connector "resemble," it can be considered coherent with the rest of the text (cf. Giora, 1985a).

The question is what is the function of such analogical digression in a well-formed informative text. Contrary to assumptions in the literature (cf. Theoretical Background section), the theory under discussion predicts that analogy will not be functional in comprehending a well-formed informative text. As shown previously, a coherent text is redundant enough and its order highlights importance, hence analogy is superfluous. Analogy, an example from a distant domain, is a digression from relevance and will therefore require extra processing.

To confirm this view, experiments in text comprehension were conducted, where the variable was the presence or absence of analogies. The objective was to test the effect of analogy on text understanding.

ANALOGY VIS-À-VIS UNDERSTANDING— EXPERIMENTAL APPROACH

In this section I will examine a few hypotheses, trying to confirm that analogies are digressions that do not facilitate understanding but rather impair it. The passages examined here are all well-formed informative texts (for a selection of the experimental material, see the Appendix). The variables examined are full-sentence analogies which are marked as digressions by an explicit semantic connector (cf. Giora, 1985a).

Since recall of relevant and informative material might be functional in comprehension, I start by examining the effect of analogy on recall (cf. Discourse Theories section).

EXPERIMENT 1

The purpose of this experiment was to test the hypothesis that analogy, explicitly marked as a digression, does not improve recall of relevant and informative material. Since analogy is an example from a distant domain—a piece of new information which digresses from the question under discussion—it requires extra processing. It is highly probable that in a well-formed text, readers will simply ignore it (see also Steen, 1992). However, readers who attempt the integration of such material into the topic of discourse might find it interfering with the set of relevant and informative propositions.

Method

Subjects. The subjects were 128 students from various schools (elementary, junior and senior high school, and college), varying in sex, age (13–30 years old), and environment. Most of them read the passages as part of their routine class work, and some were told they were participating in an experiment.

Materials. The materials consisted of four pairs of coherent informative texts as defined in Giora (1985a, 1985b, 1988), of various lengths, identical in every respect apart from the presence or absence of analogies in each. One version contained the analogy (as in Example 2), while the other did not (as in Example 1). The passages also varied in length of the analogy, in order to check the effect of amount on recall.

Procedure. The subjects were randomly divided into two groups: One was given the versions with the analogy and the other was given the one without it. Each subject read only one version of one text. They were asked to read each passage at their own natural speed so as to be able to answer questions afterwards. After they had read a passage once, they were no longer allowed to look at it. Immediately after reading, they were instructed to write down the passage as close to verbatim as possible. Unlimited recall time was provided. Measure was taken of the number of relevant and informative sentences (or predicates) (cf. Informative Text Structure section) recalled. The recall was scored as correct when subjects recalled at least 50% of the relevant and informative sentences or predicates and incorrect when they failed to do so.

Results

As shown in Table 1, analogy did not improve recall of relevant and informative sentences but rather impaired it. Recall deteriorated relative to the length of the digression: The passages with the highest amount of analogical digression (80% and 95%) show significant deterioration of recall ($\chi^2 > 3.84$). The correlation between the two normal (dichotomous) variables is moderately high for the 80% digression ($\pi = .60$) and high for the 95% digression ($\pi = .80$). Where the amount of digression was low (25%), recall did not deteriorate significantly, but it was nevertheless impaired.

As predicted by the coherence theory proposed here, analogy does not improve recall but, in fact, impairs it. Given that a coherent text is informatively structured so that it enjoys enough redundancy to ensure recall (and comprehension), digressive material, even in the form of analogy, functions as a noise. It could be claimed, though, that recall is irrelevant to text comprehension. However, it seems plausible to assume that if recall of the analogy interferes with recall of relevant and informative material, it has consequences on understanding that material.

TABLE 1
Effect of Analogy (of Various Lengths) on Recall Classification of Responses

	Passage 1 (25%)			Passage 2 (80%)			Passage 3 (95%)		
	Right	Wrong	Total	Right	Wrong	Total	Right	Wrong	Total
With Analogy	9	3	12	5	13	18	8	28	36
Without Analogy	8	2	10	14	2	16	36	0	36
Total	17	5	22	19	15	34	44	28	72
χ^2 (df = 1)		.076			12.25*			45.82**	
ϕ					.60			.80	

* $p < .001$. ** $p < .0001$.

EXPERIMENT 2

Since the main issue here is not recall but rather comprehension, another experiment was designed to measure the effect of analogy on processing. The aim of Experiment 2 was to check the extent to which analogy effects comprehension. It was hypothesized that in a well-formed informative text, the presence of an analogy (marked as a digression) will not improve comprehension of what the text is about.

Method

Subjects. The subjects were 137 students of the same schools as in Experiment 1.

Materials. The materials were the same as in Experiment 1.

Procedure. Subjects were randomly divided into two groups: One group read the version with the analogy and the other read the one without it. Each subject read only one version of one text. They were asked to read the passage so as to be able to answer questions afterwards. They read the passage at their own speed. Immediately after reading a passage once, they were asked "What is the passage about?" They were asked to answer it by writing one or two sentences. Responses were scored dichotomously as correct or incorrect.

Results

As shown in Table 2, analogy did not improve text comprehension but rather impaired it. Comprehension deteriorated relative to the length of the digression: Passages with lengthy analogies (80% and 95%) score significantly better without them ($\chi^2 > 3.84$). The correlation between the two nominal (dichotomous) variables is moderate for the 80% digression ($\pi = .45$) and high for the 95%

TABLE 2

Effect of Analogy (of Various Lengths) on Comprehension Classification of Responses

	Passage 1 (25%)			Passage 2 (80%)			Passage 3 (95%)		
	Right	Wrong	Total	Right	Wrong	Total	Right	Wrong	Total
With Analogy	10	2	12	8	13	21	8	28	36
Without Analogy	10	0	10	18	4	22	36	0	36
Total	20	2	22	26	17	43	44	28	72
χ^2	1.8			8.59*			45.82**		
ϕ				.45			.80		

* $p < .005$. ** $p < .0001$.

digression ($\pi = .80$). Where the amount of digression was low (25%), comprehension did not deteriorate significantly, but it was nevertheless impaired.

Results show that analogies constitute digressions, and as such do not improve comprehension of well-formed informative texts but rather impair it. Note, however, that recall and comprehension were found to be only slightly effected when analogical digression was rather short (25%). This, however, could be a result of the small number of subjects tested for this condition.

EXPERIMENT 3

The aim of Experiment 3 was to ascertain that analogy of minimal length (one sentence only) marked as a digression, does not improve understanding of relevant and informative material. Since the number of subjects in the previous experiment who read texts with short analogies was too small to enable assessing the effect of analogy (of minimal length) on comprehension, the number of subjects was increased here.

Method

Subjects. The subjects were 283 junior-high-school students in the Tel Aviv area (13–15 years old).

Materials. The materials consisted of a new set of 4 pairs of coherent informative texts as defined in Giora (1985a, 1985b, 1988), identical in every respect apart from the presence or absence of analogies in each. One version contained the analogy, while the other did not. The passages did not vary in length of the analogies in each, which were rather short. Two of the passages (Passages 1 and 3) were highly abstract in content to enable an examination of the effect of analogy on the processing of highly "difficult" texts.

Procedure. Subjects were randomly divided into two groups: One group read the version with the analogy and the other read the version without it. Each subject read only one version of one text. They were asked to read the passage so as to be able to answer questions afterwards. They read each passage at their own speed. Immediately after reading it once, they were asked: "What is the passage about?" The students who read Passages 1 and 2 were asked to answer the question by writing one or two sentences, the other students responded by selecting an appropriate answer from a multiple-choice form. To negate the possibility of recognition testing rather than comprehension testing, the multiple answers in the second questionnaire were made-up paraphrases of three propositions that appeared in the text (the discourse topic proposition included). This form was designed to see if it is the type of questionnaire that might affect response, though no difference was really expected. Responses were scored dichotomously as correct or incorrect.

Results

As shown in Table 3, analogy did not improve text comprehension but rather impaired it. No difference was found for the different questionnaires. Comprehension of most of the passages (Passages 2–4) containing the analogy deteriorated significantly ($\chi^2 > 3.84$). The correlation between the two nominal (dichotomous) variables is moderate for Passage 2 ($\pi = .33$) and 4 ($\pi = .37$) and moderate to low for Passage 3 ($\pi = .21$).

Results show that even short (one-sentence long) analogies do not improve comprehension of well-formed informative texts but rather impair it. Comprehension of the versions without the analogy was significantly better than comprehension of the versions with the analogy, even for the more abstract texts. Even where the understanding of the passage without the analogy did not improve significantly (Passage 1), the difference was not far from significance.

EXPERIMENT 4

Given Experiments 1 to 3, it is still possible to claim that it is not necessarily the digressive material that inhibits understanding but rather the addition of information that makes the longer version (the one with analogy) more difficult to process. To test this claim, Experiment 4 was designed. It tested comprehension for texts of the same length, one containing an analogy (which is an example from a distant domain), while the other contained a relevant example (of the domain of the topic of discourse under discussion). The aim of Experiment 4 was to show that analogy (marked as a digression) does not improve understanding, while a relevant example does.

Method

Subjects. The subjects were 118 junior-high-school students, as in Experiment 3, 14 to 15 years old.

TABLE 3
Effect of Short Analogy (One-Sentence Long) on Comprehension Classification of Responses

	Passage 1			Passage 2			Passage 3			Passage 4		
	Right	Wrong	Total	Right	Wrong	Total	Right	Wrong	Total	Right	Wrong	Total
With Analogy	13	24	37	8	15	23	35	31	66	5	10	15
Without Analogy	22	18	40	15	7	22	46	17	63	12	5	17
Total	35	42	77	23	22	45	81	48	129	17	15	32
χ^2	3.06			5.02*			5.51*			4.44*		
ϕ				.33			.21			.37		

* $p < .05$.

Materials. The materials consisted of two passages from experiment 3, highly abstract in content: Passage 3, in which the analogy was found to impair comprehension significantly; and Passage 1, in which comprehension was not impaired significantly. The counterpart to the analogical versions were versions containing a relevant example. The two versions (with analogy and with relevant example) were of equal length (see the Appendix).

Procedure. Subjects were randomly divided into two groups: One group read the version with the analogical example and the other read the one with the relevant example. Each subject read only one version of one text. They were asked to read the passages so as to be able to answer questions afterwards. They read each passage at their own speed. Immediately after reading it once, they were asked: "What is the passage about?" They were asked to answer by writing one or two sentences. Responses were scored dichotomously as in the previous experiments.

Results

As shown in Table 4, analogy did not improve text comprehension but rather impaired it. Comprehension of the passages containing the relevant example was better, though only the comprehension of one passage (Passage 3) improved significantly ($\chi^2 > 3.84$). The correlation between the two nominal (dichotomous) variables is moderate ($\pi = .39$).

Texts with relevant examples are understood better than their counterparts containing an analogy. Even where the understanding of the passage without the analogy did not improve significantly (Passage 1), the difference was in the same direction. These results bear on the results of Experiment 3. They show that analogies impair understanding not because they add information, but because they digress from relevance.

In sum, results show that analogies do not improve comprehension of well-

TABLE 4
Effect of Analogy Versus Relevant Example on Comprehension Classification of Responses

	Passage 1			Passage 3		
	Right	Wrong	Total	Right	Wrong	Total
With Analogy	12	17	29	17	14	31
With Example	16	13	29	26	3	29
Total	28	30	58	43	17	60
χ^2	1.1			8.94*		
ϕ				.39		

* $p < .005$.

formed informative texts. Rather, comprehension of texts is significantly better where the text does not contain a digression in the form of an analogy. What then are analogies for? If analogies do not improve understanding as is widely assumed, is it possible that they contribute to the aesthetics of the informative text as might be deduced from the classical theories of the poetic text (see also Giora, 1990)?

ANALOGY VIS-À-VIS THE POETIC FUNCTION— EXPERIMENTAL APPROACH

To show that analogies function as an aesthetic device it is not enough to show that they inhibit understanding (cf. Aesthetic Theories section and Experiments 2–4). It needs to be shown that, despite the extra processing required by analogical digressions, the passages containing analogies are more appealing than those that do not. For that purpose Experiment 5 was designed.

EXPERIMENT 5

The aim of this experiment was to show that texts containing analogies are perceived as more aesthetic than texts that do not, despite (or due to?) their relative opaqueness.

Method

Subjects. The subjects were 244 students as in Experiment 3, 13 to 15 years old.

Materials. The materials consisted of two versions of three passages from Experiment 3. One version contained the analogy, while the other did not.

Procedure. Subjects were given the two versions, with and without the analogy. They were asked which version was more appealing, or more to their taste.

Results

As shown in Table 5, when the question of aesthetics was raised, texts that contained an analogy were preferred over texts that did not. The preference is significant ($\chi^2 > 3.84$).

Though processing texts without, as opposed to texts with, analogies is easier, texts containing analogies are more appealing. This shows that, while analogies are not functional in comprehension, they might have a poetic function.

CONCLUSIONS AND DISCUSSION

The present study questions the role of analogies in informative texts. Contrary to the view held by the main thrust of cognitive and discourse research (e.g.,

TABLE 5
Effect of Analogy on Aesthetic Preferences

	Passage 1	Passage 2	Passage 3
<i>N</i>	66	76	102
<i>N</i> Liked With Analogy	44	48	66
<i>N</i> Liked Without Analogy	22	28	36
χ^2	7.33*	5.26*	8.82**

* $p < .05$. ** $p < .01$.

Esher et al., 1942; Gentner, 1983; Labov, 1972; Polanyi, 1985; Reinhart, 1984, in press; R.J. Sternberg, 1977, 1985; Vosniadou & Ortony, 1983), this study suggests that analogies are not functional in comprehending a well-formed informative text. Rather, they impair recall and inhibit processing. It is argued that a coherent informative text has a transparent structure which spells out both its topic of discourse and its informativeness structure. Hence the superfluity of analogies to comprehension. In terms of ease of processing, then, analogies are redundant.

This is further supported by recent studies into metaphor reception. Gentner and Landers (1985) and Glucksberg and McGlone (1992), for example, showed that people do not access all available metaphors. Steen (1992), too, showed that, under certain reading conditions, readers tend to ignore metaphors. Steen investigated reading strategies of literary and nonliterary texts. By means of thinking-out-loud methods, he showed that readers tend to overlook metaphors while processing a nonliterary (journalistic) text. While metaphors attract more attention in a literary text, little attention is paid to metaphors when the text is nonliterary. These findings echo findings in Giora (1990) where the same method was used to attest that readers ignore digressive material (e.g., analogies) while processing an informative (nonliterary) text. In other words, when possible, readers do not process effort-consuming material.

Though these findings seem to defy previous research into the function of analogy (cf. Theoretical Background section), they should not be really surprising. First, the communicative function of analogy has been only hypothesized for the narrative text and has not yet been empirically validated. However, when tested for newspapers stories, it was not confirmed (Steen, 1992; Thorndyke, 1979). Second, most cognitive research into the function of analogies does not deal with text comprehension but rather with problem-solving situations. But problem-solving situations differ drastically from the textual situation under discussion. The experiments reported here weigh the effect of analogy on understanding where the alternative—the relevant example (i.e., the looked-for solution in the problem-solving situation)—is present. The premise this study

questions is whether this additional piece of information facilitates understanding of information already present in the text. In real problem-solving situations, the relevant solution is obscure. Therefore, it is reasonable that where the relevant solution is not at hand, an analogical alternative is helpful. However, in the texts under discussion, this is not the case. What is examined here is not the understanding of a text without a relevant example as opposed to a text which contains an analogical example (which would simulate real problem-solving situations). The question addressed here is the effect of an analogical example on understanding a text that contains the relevant example (Experiments 2 and 3) and on the understanding of a text that contains an analogical example (without a relevant one) as opposed to one that contains a relevant example only (Experiment 4). Understanding informative texts, then, does not resemble problem solving. That the predictions of this study have been validated is not surprising after all.

One counter example needs be treated more specifically though. Contrary to my findings, Vosniadou and Ortony (1983) found analogy to facilitate understanding and improve recall of informative texts. However, their measure of comprehension was different from mine. While I checked global understanding, inquiring about the discourse topic, they checked local understanding by means of 20 questions assigned to each text. Ten questions concerned the facts reported in the passages, and another 10 ascertained that the children tested did not transfer irrelevant properties from the source to the target domain. Yet, when the same passages (translated into Hebrew) were assigned my measure of understanding, the results were drastically different from those reported in Vosniadou and Ortony (1983). Rather, they were along the lines reported here: Subjects performed worse on the analogy version than on the no analogy version (Giora, Meiran, & Oref, 1992). It might be deduced, then, that performance is relative to task.

If it is true, then, that analogies do not contribute to text understanding of well-formed informative texts, why are they there? This study proposes that analogies contribute to the aesthetics of the informative text. Though readers find texts containing analogies more difficult to follow, they consider them more appealing. Analogies are not superfluous after all. Though they do not facilitate understanding, they embellish the text (cf. Jakobson, 1960). "This is the pleasure of disorientation." (Nash, 1989, p. 57).

Note, however, that the contention supported here is limited to (well-formed informative) texts only, and does not take into account readers' individual differences. For instance, it does not distinguish between skilled and unskilled readers who might have different reading strategies. Indeed, further research (Giora et al., 1992) shows that individual differences matter, and that analogy might improve text comprehension for certain readers. Giora et al. show that, to gain from analogy, the text must be well-formed, with an explicit discourse-topic mention, and the reader must be intelligent but unskilled.

REFERENCES

- Arnheim, R. (1971). *Entropy and art: An essay on disorder and order*. Berkeley: University of California Press.
- Attneave, F. (1954). Some informational aspects of visual perception. *Psychology Review*, 61, 183-193.
- Barthes, R. (1970). *S/Z*. Paris: Seuil.
- Berlin, B., & Kay, P. (1969). *Basic color terms: Their universality and evolution*. Berkeley: University of California Press.
- Brown, J.S., Collins, A., & Harris, G. (1978). Artificial intelligence and learning strategies. In H.F. O'Neil (Ed.), *Learning strategies*. New York: Academic.
- Clement, J. (1988). Observed methods for generating analogies in scientific problem solving. *Cognitive Science*, 12, 563-586.
- Darden, L. (1983). Artificial intelligence and philosophy of science: Reasoning by analogy in theory construction. *Philosophy of Science Association*, 2, 147-165.
- diSessa, A. (1983). Phenomenology and the evolution of intuition. In D. Gentner & A. Stevens (Eds.), *Mental models*. Hillsdale, NJ: Erlbaum.
- Dreistadt, R. (1968). An analysis of the use of analogies and metaphors in science. *Journal of Psychology*, 68, 97-116.
- Duit, R. (1990). *On the role of analogies and metaphors in learning science*. Paper presented at the American Educational Research Association, Atlanta.
- Esher, F.J.S., Raven, J.C., & Earl, C.J.C. (1942). Discussion on testing intellectual capacity in adults. *Proceedings of the Royal Society of Medicine*, 35, 779-785.
- Gentner, D. (1977). If a tree had a knee, where would it be? Children's performance on simple spatial metaphors. *Papers and Reports on Child Language Development*, 13, 157-164.
- Gentner, D. (1982). Are scientific analogies metaphors? In D.S. Miall (Ed.), *Metaphor: Problems and perspectives*. Brighton, England: Harvest Press.
- Gentner, D. (1983). Structure mapping: A theoretical framework for analogy. *Cognitive Science*, 7, 155-170.
- Gentner, D. (1989). The mechanism of analogical reasoning. In S. Vosniadou & A. Ortony (Eds.), *Similarity and analogical reasoning*. Cambridge: Cambridge University Press.
- Gentner, D., & Gentner, D.R. (1983). Flowing waters or teeming crowds: Mental models of electricity. In D. Gentner & A.L. Stevens (Eds.), *Mental models*. Hillsdale, NJ: Erlbaum.
- Gentner, D., & Landers, R. (1985). Analogical reminding: A good match is hard to find. *Proceedings of the International Conference on Systems, Man and Cybernetics*. Tucson, AZ.
- Gick, M., & Holyoak, K.J. (1980). Analogical problem solving. *Cognitive Psychology*, 12, 306-355.
- Gick, M., & Holyoak, K.J. (1983). Schema induction and analogical transfer. *Cognitive Psychology*, 12, 306-355.
- Giora, R. (1983a). Segment cohesion: On the thematic organization of the text. *Text*, 3, 155-182.
- Giora, R. (1983b). Functional paragraph perspective. In J.S. Petöfi & E. Sözer (Eds.), *Micro and macro connexity of texts*. Hamburg: Buske.
- Giora, R. (1985a). Towards a theory of coherence. *Poetics Today*, 6, 699-715.
- Giora, R. (1985b). A text-based analysis of non-narrative texts. *Theoretical Linguistics*, 12, 115-135.
- Giora, R. (1985c). *Informational function of the linear ordering of texts*. Unpublished doctoral dissertation, Tel Aviv University.
- Giora, R. (1988). On the informativeness requirement. *Journal of Pragmatics*, 12, 547-565. [Reprinted in (1989). A. Kashner (Ed.), *Cognitive aspects of language use*. Amsterdam: North Holland.]
- Giora, R. (1990). On the so-called evaluative material in informative texts. *Text*, 10, 299-319.
- Giora, R., Meiran, N., & Oref, P. (1992). *Structure coherence and analogy. Strategies in comprehending informative text: General aspects and individual differences*. Paper presented at the International Conference on Metaphor and Cognition, Tel Aviv, Israel.

- Giora, R., & Ne'eman, J. (in press). Categorical organization in the narrative text: A semantic analysis of *The Conformist*. *Journal of Pragmatics*.
- Glucksberg, S., & McGlons, M.S. (1992). *Do conceptual analogies underlie metaphor comprehension*. Paper presented at the International Conference on Metaphor and Cognition, Tel Aviv, Israel.
- Glynn, S.M. (1988). The teaching with analogies model: Explaining concepts in expository texts. In K.D. Muth (Ed.), *Children's comprehensions of narrative and expository text*. Newark, DE: International Reading Association.
- Goswami, U., & Brown, A.L. (1990a). Melting chocolate and melting snowmen: Analogical reasoning and causal relations. *Cognition*, 35, 69–95.
- Goswami, U., & Brown, A.L. (1990b). Higher-order structure and relational reasoning: Contrasting analogical and thematic relations. *Cognition*, 36, 207–226.
- Halasz, F., & Moran, T.P. (1982). Analogy considered harmful. *Proceedings of the Human Factors in Computer Systems Conference*. Gaithersburg, MD.
- Hesse, M. (1966). *Models and analogies in science*. Notre Dame, IN: University of Notre Dame Press.
- Holland, J.H., Holyoak, K.J., Nisbett, R.E., & Thagard, P. (1986). *Induction: Processes of inference, learning and discovery*. Cambridge, MA: MIT Press.
- Holyoak, K.J., & Thagard, P. (1989). Analogical mapping by constraint satisfaction. *Cognitive Science*, 13, 295–355.
- Jakobson, R. (1960). Closing statement: Linguistics and poetics. In T.A. Seboek (Ed.), *Style in language*. Cambridge, MA: MIT Press.
- Labov, W. (1972). *Language in the inner city*. Philadelphia: University of Pennsylvania Press.
- Labov, W. (1973). The boundaries of words and their meanings. In C.J.N. Bailey & R.W. Shuy (Eds.), *New ways of analyzing variation in English* (Vol. 1). Washington, DC: Georgetown University Press.
- Mandler, J. (1984). *Stories, scripts and scenes: Aspects of schema theory*. Hillsdale, NJ: Erlbaum.
- Meyer, B.J.F. (1975). *The organization of prose and its effects on memory*. Amsterdam: North Holland.
- Mukarovskij, J. (1976). On poetic language. *Slovo a Slovenost*, 6, 113–145. (Original work published 1940)
- Nagel, E. (1961). *The structure of science: Problems in the logic of scientific explanation*. New York: Harcourt, Brace & World.
- Nash, W. (1989). *Rhetoric: The wit of persuasion*. Oxford: Blackwell.
- Perry, M. (1968). Analogy and its role as a structural principle in the novels of Mendele Moykher-Sforim. *Hasifrut*, 1, 65–100. (Hebrew)
- Perry, M. (1980). *The metaphor behind mytonymy: Fictional world as a network of similarities*. Unpublished manuscript.
- Polanyi, L. (1985). *Telling the American story*. Norwood, NJ: Ablex.
- Read, S.J., Cesa, I.L., Jones, D.K., & Collins, N.L. (1990). When is the federal budget like a baby? Metaphors in political rhetoric. *Metaphor and Symbolic Activity*, 5, 125–149.
- Reed, S.K., Ernst, G.W., & Banerji, R. (1974). The role of analogy in transfer between similar problem states. *Cognitive Psychology*, 6, 436–450.
- Reinhart, T. (1984). Principles of gestalt perception in the temporal organization of narrative texts. *Linguistics*, 22, 779–809.
- Reinhart, T. (in press). A functionalist approach to the poetic function. *Hasifrut*. (Hebrew)
- Rips, L.J., Shoben, E.J., & Smith, E.E. (1973). Semantic distance and the verification of semantic relations. *Journal of Verbal Learning and Verbal Behavior*, 12, 1–20.
- Rosch, E. (1973). On the internal structure of perceptual and semantic categories. In T.E. Moore (Ed.), *Cognitive development and the acquisition of language*. New York: Academic.
- Rosch, E. (1978). Principles of categorization. In E. Rosch & B.B. Lloyd (Eds.), *Cognition and categorization*. Hillsdale, NJ: Erlbaum.

- Rosch, E. (1981). Prototype classification and logical classification: The two systems. In E. Scholnick (Eds.), *New trends in cognitive representation: Challenges to Piaget's theory*. Hillsdale, NJ: Erlbaum.
- Rosch, E., Gray, W.D., Johnson, D.M., & Boyes-Braem, P. (1976). Basic objects in natural categories. *Cognitive Psychology*, 8, 382–439.
- Rosch, E., & Mervis, C.B. (1975). Family resemblance in internal structure of categories. *Cognitive Psychology*, 7, 573–605.
- Rumelhart, D. (1975). Notes on a schema for stories. In D. Bobrow & A. Coins (Eds.), *Representation and understanding*. New York: Academic.
- Rumelhart, D., & Norman, D. (1980). Analogical processes in learning. In J.R. Anderson (Ed.), *Cognitive skills and their acquisition*. Hillsdale, NJ: Erlbaum.
- Sklovskij, V. (1966). *Theorie der Prosa*. Frankfurt am Main: Fischer. (Original work published 1925)
- Spearman, C. (1927). *The abilities of man*. New York: Macmillan.
- Spiro, R.J., Feltovich, P.J., Coulson R.L., & Anderson, D.K. (1989). Multiple analogies for complex concepts: Antidotes for analogy-induced misconception in advanced knowledge acquisition. In S. Vosniadou & A. Ortony (Eds.), *Similarity and analogical reasoning*. Cambridge: Cambridge University Press.
- Steen, G. (1992). *Metaphor in literary reception*. Unpublished doctoral dissertation, University of Amsterdam.
- Sternberg, M. (1970). The compositional principles of Faulkner's "Light in August" and the poetics of the modern novel. *Hasifrut*, 2, 498–537. (Hebrew)
- Sternberg, M. (1977). The repetition structure in the biblical narrative. *Hasifrut*, 25, 109–150. (Hebrew)
- Sternberg, R.J. (1977). Component process in analogical reasoning. *Psychological Review*, 84, 353–378.
- Sternberg, R.J. (1985). *Beyond IQ*. Cambridge: Cambridge University Press.
- Suleiman, S.R. (1980). Redundancy and the "readable" text. *Poetics Today*, 1, 119–142.
- Thorndyke, P.W. (1979). Knowledge acquisition from newspaper stories. *Discourse Processes*, 2, 95–112.
- VanLehn, K., & Brown, J.S. (1979). Planning nets: A representation for formalizing analogies and semantic models of procedural skills. In R.E. Snow, P.A. Frederico, & W.E. Montague (Eds.), *Aptitude learning and the instruction: Cognition analysis*. Hillsdale, NJ: Erlbaum.
- Vosniadou, S., & Ortony, A. (1983). The influence of analogy in children's acquisition of new information from text: An explanatory study. In J.A. Niles (Ed.), *Searches for meaning in reading/language processing and instruction* (Thirty-Second Yearbook of the National Reading Center).
- Vosniadou, S., & Ortony, A. (Eds.). (1989). *Similarity and analogical reasoning*. Cambridge: Cambridge University Press.

APPENDIX

Texts 1a and 1b form a pair where the analogical digression (in boldface type in 1b) is short:

- (1a) Until something happens, which disables bodily functions, humans do not show interest in their body. Understanding of what is going on under the skin involves an entrance into a very sophisticated system. Only a deep investigation can yield understanding of this part or another of our body.
- (1b) Until something happens, which disables bodily functions, humans do not show interest in their body. **The body is like a car.** Understanding of what is going on

under the skin, **like understanding of what is going on inside the engine**, involves an entrance into a very sophisticated system. Only a deep investigation can yield understanding of this part of another of our body.

Texts 2a and 2b form a pair where the analogical digression (in boldface type in 2b) is rather long:

- (2a) When we want to classify the living organisms in terms of the amount of similarity and difference which they share, the question that arises immediately is which features constitute the basis for establishing similarity and difference between animals: the external shape, their place of habitat, their internal structure or the activity?
- (2b) When we want to classify the living organisms in terms of the amount of similarity and difference which they share, the question that arises immediately is which features constitute the basis for establishing similarity and difference between animals: the external shape, their place of habitat, their internal structure or the activity? **A stamp collector, for example, faces a similar problem when he wants to catalogue his stamp collection independently. Some collectors will probably categorize their stamps by topics such as transportation, animals, plants or portraits. Others will prefer to categorize them according to their countries of origin. Another topic could be their date of issue. Each of these categorizing methods allows primary and secondary classifications. For instance: Transportation: planes, boats, trains and other vehicles; Countries of origin: parts of the world like Asia, geographical areas like the Middle East; States: Israel, Lebanon, Syria.**

Texts 3a to 3c form two pairs (3a and 3b, 3b and 3c) where the analogical digressions (in boldface type in 3b) are short and have relevant counterparts of the same length in 3c (the italicized examples):

- (3a) According to traditional psychological schools, the connection between a word and its meaning is associative. The association is a result of co-occurrence of sound and object. The word evokes its meaning in memory. The development in meaning was attributed to the changes of association between single words and single objects. A word can refer to one object in the beginning and be associated with another one at a later stage.
- (3b) According to traditional psychological schools, the connection between a word and its meaning is associative. The association is a result of co-occurrence of sound and object. The word evokes its meaning in memory **as a friend's coat reminds us of its owner and a house of its tenants**. The development in meaning was attributed to the changes of association between single words and single objects. A word can refer to one object in the beginning and be associated with another one at a later stage **as a coat, changing its owner, reminds us first of its first owner and then of its second**.
- (3c) According to traditional psychological schools, the connection between a word and its meaning is associative. The association is a result of co-occurrence of sound

and object. The word evokes its meaning in memory. *For instance, the sound of the word "ball" is associated in our memory with the object we play with.* The development in meaning was attributed to the changes of association between single words and single objects. A word can refer to one object in the beginning and be associated with another one at a later stage. *For instance, the word "ball" (in Hebrew) was first associated with the object we play with, and then denoted a pill.*