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Spatial Descriptions and Referential Continuity

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Three experiments were carried out in which subjects drew diagrams to depict spatial layouts corresponding to such three-sentence verbal descriptions as: "The apple is on the left of the banana. The banana is in front of the carrot. The carrot is on the left of the doughnut." In Experiment 1, a referentially continuous description in which each adjacent pair of sentences had a referent in common required less listening time and elicited more correct diagrams than a referentially discontinuous description in which the first and second sentences had no referent in common. In Experiment 2, descriptions in which the second and third sentences had no referent in common were no more difficult to remember than continuous descriptions. Both, however, were considerably easier than the discontinuous descriptions. In Experiment 3, the subjects read the descriptions rather than heard them. Its results replicated the earlier findings, and the times taken to read the individual sentences in a description suggested that subjects try to integrate each incoming sentence into a single coherent mental model, and that those sentences which cannot be immediately integrated are represented in a propositional form.

INTRODUCTION

When people read or hear a story they are likely at some stage to come upon a description of a scene in which events of some significance to the story take place. From the description the author provides, a reader must build up some kind of representation that is faithful to the description and that has the richness to act as a base for generating inferences. The representation should also contain enough detail for the different entities in the scene to be distinguished and the spatial relations between them to be preserved. The need for such a representation is widely accepted but there is a controversy about the form it takes. Some theorists propose that all mental representations, whether based on perception, imagery, or language, have an underlying propositional form (e.g., Pylyshyn, 1973; Anderson, 1978), whereas others distinguish between a variety of mental representations including images that are analogical in form and verbal representations that are not (e.g., Paivio, 1971; Kosslyn & Pomerantz, 1977). One kind of distinction was drawn by Pylyshyn (1973). He pointed out an important difference between propositional and analog representations:

> It would be quite permissible . . . to have a (propositional) mental representation of two ob-

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> jects with a relation between them such as "besides". Such a representation need not contain a more specific spatial relation such as "to the left of" or "to the right of". It would seem an unreasonable use of the word "image" to speak of an image of two objects side by side, without the relation between them being either "to the left of" or "to the right of".

This difference, which has been alluded to by many philosophers from Hume onward, is useful because it has empirical consequences. A propositional representation will be able to handle both specific and nonspecific relations with equal ease, whereas an analog model will represent specific relations more readily than nonspecific ones—in an analog model it will be necessary to have a set of models to represent "besides." Moreover, whereas propositional representations correspond closely to the sentences in a description, analog models are poor at representing linguistic detail. These distinctions were put to the test in a recent study by Mani and Johnson-Laird (in press). They found that when given a brief description of a scene, people remembered determinate descriptions better than indeterminate ones. More crucially, they found that people remembered the semantic implications of the determinate descriptions. This result is consistent with the notion that propositional representations are used to encode nonspecific descriptions which cannot be easily represented analogically.

The Mani and Johnson-Laird study provides evidence for one kind of distinction between representations. In this paper we will examine further the form of mental representations by looking at a different kind of distinction, one that arises by considering the way people build up a representation of a scene from a verbal description.

Obviously, it is impossible to construct an integrated representation of a description unless its separate propositions make reference, explicitly or implicitly, to the same set of entities: a necessary condition for the coherence of discourse is that its constituent sentences should concern a set of referents in common. In order to combine information from separate sentences, an individual must be able to retain both a representation of the discourse so far and a representation of the current sentence long enough for the process of integration to occur. The problem is not simply to remember the discourse. The point is that representations of both the discourse and the sentence must be present in working memory if they are to be successfully amalgamated. It follows that number of factors should affect the construction of an integrated representation of discourse.

The main factor in which we are interested is referential continuity. If a sentence refers to an entity that was introduced in the immediately previous sentence, then it will be easy to integrate the information in the two sentences. If a sentence makes no reference to any previously mentioned entity, or to any entity that can be inferred from what has gone before, then it will be impossible to integrate its information. In this case the sentence will have to be stored independently of the text until reference is made to one of the entities in that sentence. However, what will happen if a sentence refers to an entity introduced, not in the immediately preceding sentence, but in an earlier part of the discourse? The answer depends on the nature of the mental representation of the text. In a propositional model such as that of Kintsch and van Dijk (1978) people represent the passage initially in the form of a series of linked propositions. Kintsch and van Dijk claim that:

> The model takes as its input a list of propositions that represent the meaning of a text. . . . Propositions are ordered in the text base according to the way in which they are expressed in the text itself. Specifically, their order is determined by the order of words in the text that correspond to the propositional predicates.

Hence, in this form of representation it should be harder for people to establish coreference when the sentence does not refer to an entity introduced in the immediately preceding sentence. In a mental

model, by comparison, each incoming sentence is immediately integrated with the existing representation. The order in which sentences or referents occurred in the text has no bearing on the construction of the representation. Hence, if people construct a mental model they should have no difficulty in coping with any sentence that makes reference to an entity within the model, regardless of when the entity was first introduced in the text.

A second factor likely to affect the process of integration is the ease of establishing which entities referred to in a sentence have been introduced into the discourse representation before (the given information) and which have not (the new information)—a distinction which, as Clark and others have argued, is often reflected in the structural properties of sentences (e.g., Clark & Haviland, 1977; Haviland & Clark, 1974). Obviously, where there are clear linguistic cues to the role of an expression—whether it is introducing a new referent or referring back to a given referent—comprehension should be easier. Yekovich, Walker, and Blackman (1979) have argued that optimally the subject of a sentence should refer to a given entity and the object of the sentence should refer to a new entity, and they corroborated this claim in an experiment in which subjects read pairs of sentences in all four possible arrangements. However, this preferred order is also temporally convenient, because the two references to the same entity occur one after the other. Moreover, it is not at all clear that the same arrangement would be optimal in longer texts, where one sentence may contain both a reference back to a given entity and the introduction of a new entity.

Our first goal in this study was to investigate the effect of referential continuity on the task of drawing a diagram corresponding to the description of a spatial layout. This factor should help us to decide whether people build up a representation of the text in the form of models or propositions. Our second goal was to investigate whether sentences are easier to understand when the given information occurs at the beginning of one sentence and picks up a new reference made at the end of the previous sentence. This factor should help us to elucidate how people integrate information. We examined both these issues by varying the order of the sentences in a description, and the arrangement of the referring expressions within the sentences. In our first experiment, we used two kinds of descriptions; continuous and discontinuous. In a continuous description, every sentence after the first referred back to an item mentioned in the preceding sentence; in a discontinuous description, the first and second sentences had no referent in common, and the relations between them were only established in the third sentence. If subjects try to form a single mental representation of the sentences in the description, then their performance should obviously be worse with the discontinuous descriptions, because they will be unable to integrate the information in the second sentence immediately.

Experiment 1

Subjects

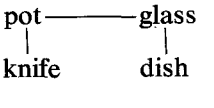
Twelve undergraduates from the University of Sussex took part in the experiment. They were paid £1. for their participation.

Method

On each trial, the subject heard three sentences describing the spatial layout of a set of four small objects. After the description the subject drew a diagram depicting the scene. For instance, given the description:

(1) The knife is in front of the pot
The pot is on the left of the glass
The glass is behind the dish

the correct form of the diagram would be (the lines are optional):



In each sentence, the referring terms can occur in one of two orders depending on which relational term is used. Hence, there are eight different ways in which the referring terms in the three sentences can be arranged. All eight arrangements were used, with each arrangement associated with a different spatial layout and consequently with different relational terms. The eight layouts used were: a ⌐¬ shape and its three 90° rotations and a ⌙¬ shape, its reflection about the vertical, and their two 90° rotations. We used these shapes because we wanted the layouts to be two-dimensional and symmetric. For each of the eight problems the sentences were ordered so that a representation could be built up continuously as in example (1) above, or so that there was a referential discontinuity between the first two sentences, as in example (2) below:

(2) The knife is in front of the pot
The glass is behind the dish
The pot is on the left of the glass.

Thus the layout and the relational terms were identical for both versions of each problem. A different set of objects was used for each of the 16 problems. Each subject received all 16 problems, presented in random order, following two practice trials. An example of a set of materials is given in the Appendix.

The sentences were read one at a time, and the subjects indicated when they were ready to hear the next sentence. Each sentence was spoken at the same speed. The total time to speak all three sentences of a description was recorded from the beginning of the first sentence to the time a subject began to draw the diagram. The subjects were not allowed to start drawing until after the final sentence in the description had been spoken. They were told that the diagram should depict a layout corresponding to the description.

Results

The subjects found the continuous descriptions far easier than the discontinuous ones. Fifty-seven percent of the diagrams based on continuous descriptions were correct as compared with only 33% of those based on discontinuous descriptions, *min* $F'(1,11) = 7.22$, $p < 0.025$. The mean listening times (prior to a correct diagram) were 13.3 seconds for the continuous descriptions and 14.9 seconds for the discontinuous descriptions, and the difference was significant, *min* $F'(1,18) = 4.74$, $p < 0.05$. Most of the errors for the discontinuous descriptions consisted in the subjects forgetting one of the items. A total of 40 items from the discontinuous descriptions were forgotten as compared with only 13 items from the continuous descriptions (Wilcoxon's $T = 2$, $N = 10$, $p < 0.005$). Indeed, subjects often reported finding it difficult to remember the items as well as the relation between them for discontinuous descriptions.

Overall, the eight arrangements of terms had no reliable effect on performance with either the continuous (Friedman one-way analysis of variance, $\chi_r^2 = 2.6$, n.s.) or the discontinuous descriptions ($\chi_r^2 = 11.9$, n.s.). However, for continuous descriptions 69% of the diagrams were drawn correctly when the second sentence introduced the new item in its subject and 44% were drawn correctly when the second sentence introduced the new item in its object (Wilcoxon's $T = 10.5$, $n = 11$, $p < 0.05$, two-tailed). This result is contrary to Yekovich et al. (1979) who predicted that comprehension should be optimal when the new term is introduced as part of the object of a sentence and the old term as part of the subject. There was no evidence to suggest that performance was more accurate with one sort of spatial layout than with another, or with one sort of relational term than another, for either the continuous or the discontinuous descriptions.

Discussion

The results corroborated our hypothesis that referentially continuous descriptions would lead to more accurate diagrams than referentially discontinuous descriptions.

However, there was little evidence in support of an optimal arrangement of referring expressions within sentences, and none to support the claim that given information is best referred to first in a sentence (cf. Yekovich et al., 1979), though this factor was confounded with differences in spatial layout.

Although the majority of subjects reported that they had tried to form some sort of image of the relations between the objects (or the names of the objects) as they heard each sentence, it might be argued that they constructed a representation consisting of propositions linked coreferentially. This kind of representation would be disrupted by the occurrence of a sentence which had no entity in common with the previous text. However, this kind of theory and one based on mental models make different predictions for sentences where there is a discontinuity between the second and third premise, as in the following, semicontinuous description:

(3) The pot is on the left of the glass.
The knife is in front of the pot.
The glass is behind the dish.

If a coreferential link is to be established between the current sentence and a list of propositions held in a short-term memory buffer, then it is necessary to cycle through the propositions in the buffer searching for a proposition containing at least one of the arguments in the sentence (cf. Kintsch & van Dijk, 1978). Hence, regardless of the particular search strategy, the continuous descriptions should be easier to represent because the coreferential links are between successive sentences. Hence, coreferential links can be established in fewer cycles for the continuous descriptions than for the semicontinuous descriptions. Moreover, the semicontinuous and the discontinuous descriptions should be equally hard to represent because in both cases the order of the propositions is not optimal for establishing coreferential links. Alternatively, if subjects represent each incoming sentence in a mental model, there should be no difference in performance between the continuous and the semicontinuous descriptions; both sorts of description allow the sequence of referents to be immediately integrated within the model. Hence, the discontinuous descriptions, which prevent an incoming sentence from being immediately integrated into the model, should be harder to represent in a mental model than either of the other two kinds of descriptions. These predictions were tested in the next experiment.

Experiment 2

Subjects

Twenty-four undergraduates from the University of Sussex were paid £1. for participating in the experiment. None of them had previously taken part in any similar experiment.

Method

The subjects' task was the same as in the previous experiment, except that the presentation of the sentence was no longer self-paced. The descriptions were recorded on a tape-recorder at the rate of one sentence every 4 seconds.

There were three degrees of referential continuity in the descriptions: continuous, semicontinuous, and discontinuous. The same eight arrangments of terms within sentences were used as in the previous experiment. Each problem was presented in all three continuity conditions (with difference objects) making a total of 24 test trials. The same set of spatial layouts was used as in Experiment 1, but on this occasion, half the subjects had problems based on two of the  shapes and two of the  shapes, and the other half had problems based on the four remaining shapes. Each shape was used as the basis of two of the problems that a subject received. The assignment of shapes to premise arrangements were counterbalanced over subjects. There were two practice trials using entirely different layouts and materials, followed by the 24 test trials in random order.

Results and Discussion

The percentages of correct diagrams were as follows: 69% for the continuous premises, 61% for the semicontinuous premises, and 42% for the discontinuous premises. The discontinuous problems were indeed reliably harder than the other two sorts of problems, $t_{23} = 5.96, p < 0.01$), which did not differ in difficulty from one another, $t_{23} = 1.50, p > 0.05$.

The arrangement of the terms within a description had no overall effect on the accuracy of the diagrams for continuous descriptions, Cochran's $Q = 12.9$, df 7, $0.1 > p > 0.05$, for semicontinuous descriptions, Cochran's $Q = 9.89$, df 7, $0.2 > p > 0.1$, or for the discontinuous descriptions, Cochran's $Q = 3.01$, df 7, $0.9 > p > 0.8$. However, with continuous descriptions there was a tendency for more accurate diagrams to be produced when the item to be referred to subsequently in the second sentence occurred as the subject of the first sentence (76% correct diagrams) rather than as the object of the first sentence (61% correct diagrams; Wilcoxon's $T = 26$, $n = 17$, $p < 0.02$, two-tailed). There were no other reliable effects of the arrangement of terms. Hence, once again there is no evidence to support the "given-new" strategy, and on this occasion the arrangement of terms was not confounded with spatial layout.

The results support the hypothesis that subjects attempt to construct a mental model that is built up premise by premise. Their performance deteriorates markedly when they are prevented from integrating information by a referential discontinuity in the description. Where the discontinuity does not interfere with the constructive process—as in the case of the semicontinuous descriptions—there is no reliable impairment in performance, contrary to a theory that assumes a representation that is built up from a series of linked propositions. Likewise, the subjects are not merely storing separate linguistic representations of the sentences and then attempting to reorder them after they have heard the final sentence of the description, because the semicontinuous descriptions would then be a source of considerable difficulty.

In drawing these conclusions, we have been assuming that any extra processing required to establish links between propositions or to reorder the sentences in memory should affect the accuracy of the diagrams: we have relied on errors in performance to make inferences about how descriptions are encoded. We redressed the balance in the next experiment by presenting the descriptions visually, a sentence at a time, and recording the time subjects took to read each sentence.

EXPERIMENT 3

If readers establish coreferential links between propositions, then they should take longer to cope with any referential discontinuity irrespective of where it occurs in the text. Hence, they should take longer to read the second sentence of the discontinuous description and the third sentence of the semicontinuous description. On the other hand, if subjects are trying to integrate the premises into a mental model, then they should spend a longer time reading the discontinuous description than the semicontinuous description, but they should spend no longer on the semicontinuous than on the continuous description. The extra time required to read the discontinuous descriptions should, of course, occur either in trying to represent the nonintegrable second sentence or in using the third sentence to integrate the representations of the first and second sentences.

Subjects

Eighteen undergraduates from the University of Texas participated in the experiment for course credit. Unfortunately, four of the subjects failed to follow the instructions, and their data had to be rejected from the analysis.

Method

The subjects read the descriptions a sentence at a time at their own pace. The same three degrees of continuity and eight ar-

rangements of terms within a description were used as before, making a total of 24 test trials. The same set of spatial layouts was used as in Experiment 1 so that subjects received all four of the shapes. The assignment shapes to premise arrangements was counterbalanced over subjects. There were 4 practice trials using entirely different materials and layouts, followed by the 24 test trials in a different random order for each subject.

The passages were presented a sentence at a time on a Tektronix video display terminal (uppercase only) connected to a PDP-8 computer. Only one sentence was on the screen at any one time and new sentences appeared successively down the screen. When the subjects finished reading a sentence they pressed a button causing that sentence to disappear and the next sentence to be displayed. The times between button presses were automatically recorded by the computer. After reading the third and last sentence of a description, the subjects then pressed the button, the screen went blank, and they then drew the diagram on a sheet of paper in front of them. Each description was preceded by the sentence, "Press the button when ready for text" to ensure that subjects were indeed ready to read the description.

Results and Discussion

The precentages of correct diagrams were as follows: 63% for continuous descriptions, 61% for semicontinuous descriptions, and 40% for discontinuous descriptions. The data confirmed our previous results: there was no difference between the continuous and semi-continuous descriptions, $t(13) < 1$, both, however, were reliably easier to recall than the discontinuous descriptions, $t(13) = 3.35$, $p < 0.005$.

The arrangement of terms within a description had no overall effect on the accuracy of the diagrams for the continuous descriptions, Cochran's $Q = 14.00$, $df\,7$, $0.1 > p > 0.05$, or for the semicontinuous descriptions, Cochran's $Q = 12.26$, $df\,7$, $0.1 > p > 0.5$, but it did affect accuracy for the discontinuous descriptions, Cochran's $Q = 19.43$, $df\ 7$, $p < 0.01$. Discontinuous descriptions yielded a more accurate performance if the object of the first sentence rather than the subject introduced the item that was referred to in the third sentence (54% accuracy versus 27% accuracy; Wilcoxon's $T = 3.5$, $n = 11$, $p < 0.01$, two-tailed). With continuous descriptions, as in the previous experiment, there was a tendency for more accurate diagrams to be produced when the item to be referred to subsequently in the second sentence occurred as the subject of the first sentence (73% correct diagrams) rather than as the object of the first sentence (52% correct diagrams; Wilcoxon's $T = 0, n = 8, p < 0.01$, two-tailed). There were no other reliable effects of the arrangement of terms on the accuracy of performance.

The reading times for the descriptions that yielded correct diagrams are shown in Table 1. The overall times are similar in pattern to the accuracy data. There was no difference between the semicontinuous and the continuous descriptions, $t(13) < 1$; both required less reading time than the discontinuous descriptions, $t(13) = 3.60$, $p < 0.005$. This result demonstrates that the effects we are getting are not dependent on the modality in which the descriptions are presented, on particularities of task demands, or on the nationality of the subjects.

The main data of interest in this experiment, however, are the reading times for each sentence as a function of the degree of continuity of the description. These data are also shown in Table 1. There was no reliable effect of sentence position on reading time, but there was a reliable interaction between sentence position and the continuity of the description ($min\ F'(4,74) = 4.46$, $p < 0.01$). The interaction arises mainly because the continuous and semicontinuous descriptions yield no marked increase in reading time over the three sentences, whereas there is such an effect for discontinuous descriptions. Page's L

TABLE 1
THE EFFECT OF REFERENTIAL CONTINUITY ON READING TIMES IN EXPERIMENT 3: THE MEAN READING TIMES (in seconds) FOR THE SENTENCE IN THE DESCRIPTION THAT YIELDED CORRECT DIAGRAMS. STANDARD ERRORS ARE SHOWN IN PARENTHESES

	Continuous	Semicontinuous	Discontinuous
First sentence	5.7 (.48)	6.1 (.50)	5.6 (.38)
Second sentence	7.1 (.84)	6.3 (.47)	6.5 (.48)
Third sentence	5.4 (.59)	6.5 (.72)	9.4 (1.37)
Overall mean	6.1	6.3	7.1

trend tests applied to the data within each degree of continuity were as follows: continuous, $L = 167$, $p > 0.05$; semicontinuous, $L = 171$, $p > 0.05$; discontinuous, $L = 180$, $p < 0.05$. A closer examination of the data reveals that the reading time for the third sentence of the discontinuous description is particularly long: it is reliably longer than that for the semicontinuous description, $t(13) = 3.34$, $p < 0.005$.

The overall reading times and the pattern of reading times for individual sentences support the hypothesis that subjects try to construct an integrated representation sentence by sentence. The trend over the discontinuous sentences suggests that the second sentence slows subjects down because it fails to refer to any previous item, and that the third sentence takes still longer because not only must it be interpreted but it must also be used to integrate the information conveyed by the two previous sentences—only at this point can the subjects construct a unitary representation. The results cannot be explained by assuming that subjects form coreferential links between ordered propositions, because the cyclical process of searching through the propositions in the buffer should yield a systematic difference in the times taken to interpret continuous and semicontinuous descriptions. Similarly, subjects cannot be merely reordering linguistic representations of the premises prior to translating them into diagrams, because this process would yield a similar pattern of reading times for both discontinuous and semicontinuous descriptions.

GENERAL DISCUSSION

Referential continuity evidently exerts a profound effect on the interpretation of discourse. If a sentence disrupts continuity by referring only to novel items, which have not been introduced in the previous discourse, then it is much harder to retain the information in the description within working memory. A natural explanation for this phenomenon is that people try to build up an integrated representation of discourse, sentence by sentence, as they read or hear it. This view is consistent with the hypothesis that discourse is often mentally represented in a form akin to that of perceived or imagined events. Skilled narrators have the power to elicit such representation; likewise, our subjects seem to go beyond a propositional representation to create a *mental model* of the spatial layout that is described. When they were unable to integrate a premise because it had no item in common with their current mental model, they were forced to keep the information in working memory independently with the consequent danger of forgetting it.

Why are discontinuous descriptions harder to remember? One factor is plainly that when the discontinuity occurs, it places a greater load on working memory: a subject in our experiments is obliged to retain two independent representations, each containing two items, as opposed to a single

representation containing three items. Another potential factor is that a discontinuous sentence may not be translated into a mental model but may be stored in a relatively superficial linguistic or propositional format (cf. Kintsch, 1974; Fodor, Fodor, & Garrett, 1975). There is certainly evidence for two different sorts of mental representation, one linguistic and the other akin to a model, and for the poorer retention of linguistic representations. Mani and Johnson-Laird (in press) found, for example, that subjects remembered the gist of spatially determinate descriptions from which a model could be constructed very much better than spatially indeterminate descriptions from which no single model could be constructed. Yet, indeterminate descriptions gave rise to a better memory for *verbatim* detail, suggesting that they are probably represented linguistically.

The effects of the arrangement of terms within a description failed to lend strong support to any form of optimal order. Certainly, there was no increase in accuracy when a reference made at the end of one sentence was picked up again at the start of the next. On the contrary, in Experiments 2 and 3, the task was easier when a reference was made at the *start* of the first sentence to the item to be referred to in the second sentence. However, there was some support for the "given-new" strategy in the performance with the discontinuous descriptions in Experiment 3: the task was easier when a reference was made at the end of the first sentence (as opposed to the beginning) to the item to be referred to again in the third sentence. However, such effects must be treated with caution since they were not uniformly obtained in all three experiments.

The notion that discourse can be represented in a format similar to that of perceived or imagined events was mooted by Johnson-Laird (1970), and is similar to the ideas of Bransford and his colleagues (e.g., Bransford, Barclay, & Franks, 1972). It leads naturally to the view that there are two stages in comprehension (see Johnson-Laird, 1980). First, discourse must be translated into a linguistic or propositional representation based on knowledge of the language—a process that appears to be automatic, rapid, and involuntary for a native speaker. Second, the resulting propositional representation may be used as the basis for the inferential construction of a mental model. Our results imply that this step is not merely a process of establishing coreferential links between propositions. The construction of a mental model from the description of a scene requires both referential coherence and some degree of spatial determinacy. The evidence suggests that if either of these conditions is lacking, then the process of construction is suspended, but referential continuity need not be restricted to successive sentences.

Appendix

Continuous Descriptions

The sugar is on the left of the mustard
The mustard is in front of the knife
The knife is on the left of the spoon

The calf is behind the deer
The deer is on the left of the goat
The rabbit is in front of the goat

The cracker is on the right of the eggs
The macaroni is in front of the eggs
The macaroni is on the left of the cake

The bluejay is in front of the duck
The owl is on the right of the duck
The hawk is in front of the owl

The apple is on the right of the peach
The apple is behind the cherry
The cherry is on the left of the lemon

The fiddle is behind the banjo
The fiddle is on the left of the guitar
The mandolin is behind the guitar

The whiskey is on the right of the coffee
The milk is in front of the whiskey
The milk is on the right of the wine

The pants are in front of the tie
The coat is on the right of the pants
The suit is behind the coat

Semicontinuous Descriptions

The bread is in front of the chocolate
The chocolate is on the left of the meat
The cheese is on the left of the bread

The sparrow is on the left of the eagle
The robin is in front of the eagle
The chicken is behind the sparrow

The nails are in front of the pencil
The nails are on the left of the eraser
The drill is on the right of the pencil

The rose is on the right of the iris
The violet is in front of the rose
The carnation is in front of the iris

The beer is behind the water
The water is on the left of the brandy
The beer is on the right of the scotch

The bed is on the left of the table
The lamp is behind the table
The bed is behind the stool

The lettuce is in front of the tomatoes
The lettuce is on the right of the carrot
The tomatoes are on the right of the corn

The clarinet is on the right of the flute
The trumpet is behind the clarinet
The flute is in front of the saxophone

Discontinuous Descriptions

The hammer is on the left of the pins
The ruler is on the left of the paper
The paper is in front of the hammer

The tulip is in front of the orchid
The daffodil is behind the lily
The lily is on the left of the orchid

The pepper is on the left of the fork
The mug is on the right of the spoon
The pepper is in front of the spoon

The cat is in front of the horse
The fox is in front of the dog
The horse is on the right of the dog

The beans are on the left of the cabbage
The peas are on the right of the potatoes
The peas are behind the beans

The blouse is behind the skirt
The gloves are behind the hat
The gloves are on the left of the skirt

The orange is on the right of the prune
The pear is on the right of the banana
The orange is in front of the pear

The desk is behind the stool
The sofa is in front of the radio
The stool is on the right of the sofa

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