

USING LISTS TO IMPROVE TEXT ACCESS:

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This paper describes two experiments that explore the effects of different ways of presenting a list in text on readers recall and reading processes. In the first experiment, participants read one of four styles of a list and then

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were asked to recall the content. The results showed that recall for the separately arranged lists was better than that for the continuously arranged lists, and that there was a difference in reading patterns between the two layouts. The second experiment examined individual reading processes for both separated and continuous layouts with the text presented by computer. It was found that the separated list allowed readers to reread the points selectively, while the continuous list made readers reread the text sequentially. Consequently, readers of the separated list understood the content faster than did those of the continuous list. These findings indicate that the layout of a list affects the way that it is read and understood.

INTRODUCTION

It is fairly common in many kinds of text to find lists of information. In each list, a number of items are arranged in a parallel or sequential structure. For example, the following is a piece of text containing a short list:

Scientific reports often have a structure called IMRAD, which consists of four components: introduction, method, results, and discussion.

In this example, the items listed are embedded within a sentence. The same text can be written as below:

Scientific reports often have a structure called IMRAD, which consists of four components:

1. Introduction
2. Method
3. Results
4. Discussion

In this list, each item is separated vertically and marked with a number.

Another style of arranging the list is as follows:

- Introduction
- Method
- Results
- Discussion

In this format, each separated item is marked with a 'bullet' instead of a number. Style manuals typically advise the use of numbers when there is an implied order in the sequence of the points and bullets when the order of the items is not important (e.g., Hartley, 1994).

It has been reported that readers prefer a vertically separated list to a continuous run-on list (Carliner, 1987; Hartley, 1994). Such separated lists seem to provide readers with visual cues to group and separate information in text; thus readers might read and understand the text more easily. However, there have been few empirical studies on the effectiveness of the format of presenting lists within the body of text, except for lists of contents, indexes and references (see Hartley, 1985; 1994).

Lorch and Chen (1986) examined the effects of numbering items on text recall. They found that number signals made items easier to recall. In their

experiment, however, sentences were displayed on a computer screen one by one, and the participants were allowed to read text only once. That is, the participants could not see the layout of the whole text, nor could they reread the text. The results, therefore, are not applicable to normal reading conditions in which we can see the whole page and reread text at will.

The purpose of the present research was to investigate empirically the effects of the format of presenting lists on reading and recall. Two experiments were conducted. Experiment one compared four styles of presenting a list in terms of readers recall. Experiment two examined the influence of the format of a list on reading processes.

EXPERIMENT 1

The aim of Experiment 1 was to explore the effects of the format of a list on readers recall.

Method

Materials. A passage, based on a book by Neustupny (1982), was prepared in Japanese discussing the purposes of language learning and teaching. This passage contained a list of information that explained the purposes of studying or teaching a foreign language in six items. The passage was seventeen sentences long in Japanese. Of this passage, four versions were prepared which were the same in every way except for the layout and the beginnings of each item. These four versions were as follows:

- text in which six items were preceded by bullets and were vertically separated (*bullet version*)
- text in which six items were preceded by numbers and were vertically separated (*number version*)
- text in which six items were preceded by ordinals and were continuously arranged within a paragraph (*ordinal version*)
- text in which six items were preceded by transitional phrases and were continuously arranged within a paragraph (*transition version*)

In the bullet and the number versions, each item started on a new line just as the list above; whereas in the ordinal and the transition versions, items were arranged in a continuous run-on format within a paragraph. In the ordinal version, each item was preceded by an ordinal, i.e., "first" "second" "third" etc.; while in the transition version, each item was preceded by a

transitional phrase such as “to begin with” “next” “in addition” “moreover” “then” and “finally” (see *appendix*). Each version of text was printed on a single page so that readers could see the layout of the whole text at a glance.

Participants. The participants were 78 college students enrolled in an educational technology course. The experiment was run in class.

Procedure. First, the participants were told that they were to read the text and then would be given a test on its content. Following these instructions, four versions of text were randomly assigned to them. They read the text for one minute. This reading time was deemed enough for them to read through the text based on a pilot study. After reading, text materials were collected and mathematics quiz sheets were given out. This quiz was interpolated for two minutes to reduce the effects of residual short-term memory for textual content. Then the recall test was administered. The participants were asked to write out the purposes of studying or teaching a foreign language based on the text. They were allowed three minutes to do this. Finally, the participants answered a questionnaire on the experiment.

Scoring. Each participant’s recall was checked with the six items explained in the text. For each item, two points were given when the main idea of it was recalled, and one point was given when only less important ideas (e.g., incidental elaborations) of the item were recalled. For instance, when a participant recalled that a foreign language was the means of communication, two points were given. In contrast, when a participant merely recalled that a foreign language was helpful in travel, one point was given. Substitutions accurately representing the text ideas were accepted as correct recall. A set of criteria for scoring participant’s recall was especially prepared and employed.

Results and discussion

The mean recall scores for the four conditions are shown in Table I.

	Separate layout		Continuous layout	
	Bullet	Number	Ordinal	Transition
M	6.6	7.1	5.8	5.4
SD	2.1	2.5	2.3	1.5
N	20	19	20	19

Table I.
Mean recall scores for the four text versions

First, to analyze the recall data, a one-way analysis of variance was performed for the four conditions. The results showed that there was a marginally significant effect for the conditions ($F(3,74) = 2.37, p = 0.077$).

Then, in order to examine the effect of the layout types on recall, four text versions were grouped into two types of layout: the bullet and the number versions were collapsed into the separate layout; the ordinal and the transition versions into the continuous layout. The mean recall score for the separate layout was 6.8 (SD 2.3), and that for the continuous layout was 5.6 (SD 1.9). A two-tailed t-test performed on this data revealed that the recall score for the separate layout was significantly better than that for the continuous layout ($t(76) = 2.54, p = 0.013$). Thus, the separate layout enabled readers to recall better than did the continuous layout.

The participants were also asked about their reading patterns in the questionnaire. They answered it by choosing one from the following choices:

1. I did not read through the text completely.
2. I read through the text just once.
3. I read through the text once and then reread a portion of it from the beginning.
4. I read through the text once and then reread the main points of it in particular.
5. I read through the text twice or more.

	Separate layout	Continuous layout
Less than once	2	4
Once	11	20
Once and a portion	2	1
Once and main points	22	13
Twice	2	1
N	39	39

Table II.
Reading patterns of participants for the two types of layout (in number)

The results are shown in Table II. Interestingly, more than half of the readers in the continuous condition read through the text only once; while more than half of those in the separate condition read through the text and then reread the main points of it. The mean recall score calculated for 31 readers who had only read through the text once was 5.6 (SD 1.8), and that for 35

readers who had read through the text and reread the main points was 7.0 (SD 2.4). A two-tailed t-test performed on this data indicated that the latter group recalled significantly better than the former ($t(64) = 2.72, p = 0.008$). Clearly, the participants reading patterns affected their recall.

In summary, Experiment 1 showed that the layout of a list affected readers recall and reading patterns. The vertically separated list was recalled better than the continuous list. Additionally, the separated list was read more efficiently in a limited time than the continuous list. The efficiency in reading seemed to have largely contributed to the difference in recall. Therefore, the reading processes for both layouts were further examined in the next experiment.

EXPERIMENT 2

The aim of Experiment 2 was to investigate the effects of the layout of a list on reading processes. In order to examine the reading process of each individual reader, this experiment employed a computer with a program devised for this purpose.

Several techniques have been developed to measure reading processes with a computer (e.g., rapid serial visual presentation, and moving window). Yet these techniques allow readers to see only a small portion of the text at a time and readers cannot see the layout of the whole text. In contrast, this study required that readers could see the layout of a page and could also have free access to any part of the text. Therefore, a computer program was devised for this experiment.

Figure 1 illustrates a screen of this program displaying an experimental text. The text on the screen was subdivided into small segments; only a segment selected with a mouse operation was clearly displayed, while the other segments were dimmed and shaded. Readers could read the selected segment but could not read distinctly the other segments. Nevertheless, they could see the layout of a page, and could read text freely jumping from one segment to another. When any segment was selected to read, the program recorded the time and its segment number. Thus reading processes could be measured sequentially.

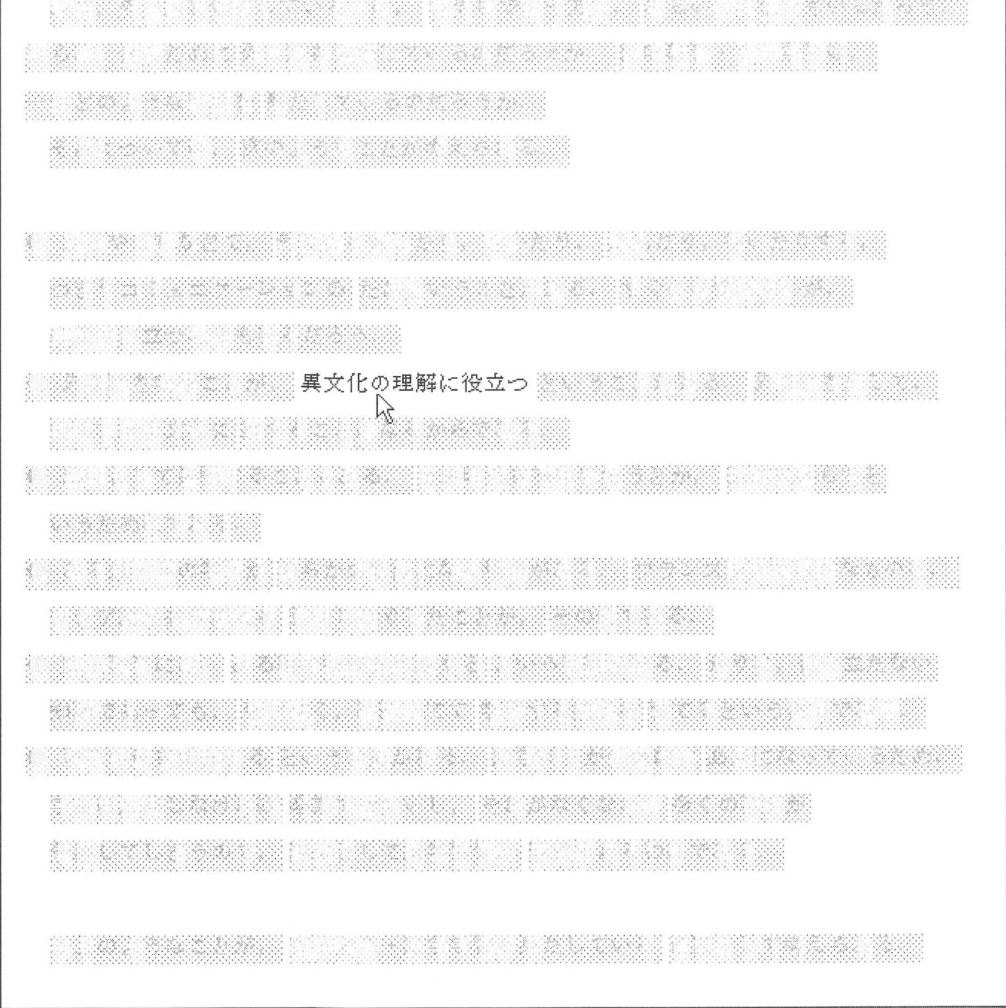


Figure 1
Screen of the experimental program
displaying the bullet version text

Method

Materials. Two versions of the text - the bullet and the transition versions - used in Experiment 1 were chosen to represent the two different styles of layout (i.e., separate and continuous) and used again in Experiment 2. Both versions of text were subdivided into 55 segments so that segment breaks came at the same places in the two. The positions of the breaks were determined by syntactic considerations. The average length of the segments was approximately 11 Japanese characters.

The bullet version text had 21 lines including two line spaces: one before and one after the list section. The transition version had 18 lines with no line spaces included. Both versions of text were displayed in a single page as a whole, with no justification (*see figure 1*).

To read the text on the screen, readers had to point to a segment with the mouse cursor and press the mouse button. Then, a selected segment turned distinctly legible in black characters on a white background. While they held down the mouse button, the selected segment kept legible. When they released the button, the segment turned dim in gray characters and shaded again. As participants read the text with mouse operations, the time of each operation and the serial number of the selected segment were recorded as a pair by the program. Thus the reading process of each participant was recorded sequentially.

The text was displayed in a window positioned on the center of a 17-inch diagonal screen with a resolution of 1024 x 768 pixels, and a Japanese font in a size of 11.5 point was used. The dimness of characters in unselected segments was adjusted so that readers could partly discern them, based on a pilot study. Thus even dimmed segments could act as marks in a way for rereading parts of the text.

Participants. The participants were again 20 college students. All of them used computers on a regular basis, and none of them had participated in Experiment 1. They were randomly assigned to either the bullet or the transition version of text.

Procedure. The participants were tested individually in an experimental room. First, an experimenter explained the task and demonstrated how to read a text on the computer screen with mouse operations. Then, the participants were allowed to familiarize themselves with reading in this manner using two practice texts. When they expressed confidence with reading, the experiment commenced. The participants were told that they

would be given a test on the content after reading. Then, each participant read one of the two versions of the experimental text on the screen. They were allowed to read and reread the text freely within five minutes. The time was set based on a pilot study to be enough for participants to read the text for understanding. After reading, they were administered a simple math quiz as an interpolated task. Then, they were asked to recall the purposes of studying or teaching a foreign language based on the text. Participants were given as much time as they needed for their recall. Finally, each participant was interviewed on the reading process by the experimenter.

Results and discussion

The participants recalls were scored in the same way as in Experiment 1. The mean recall score for the bullet version was 9.5 (SD 2.0), and that for the transition version was 9.6 (SD 2.0). Thus there was no difference in recall between the two versions. This was deemed to be due to the ample time the readers could take to read and reread text, in contrast with time pressure in Experiment 1. This result indicated that both versions of text were equally understood.

As for the reading processes, it was observed that the participants generally read through the text first, and then reread it as they wished, regardless of the text versions. Therefore, the reading times were examined in two ways. One was the time taken first to read through the text (initial reading time), and the other was the total time taken to read and reread it (total reading time). The results are shown in Table III.

		Separate layout	Continuous layout
Initial reading time	M	86.8	100.3
	SD	21.0	23.3
Total reading time	M	180.9	262.3
	SD	69.5	44.7
N		10	10

Table III.
Mean reading times for the two conditions (in seconds)

There was no significant difference between the initial reading times ($t(18) = 1.36, p = 0.190$; two-tailed). However, a significant difference was found between the total reading times ($t(18) = 2.27, p = 0.035$; two-tailed). The separated list was read and understood faster than the continuous list.

Next, the readers access to the text was compared between the two

conditions. Since there was no apparent difference in the initial reading patterns, the rereading patterns were examined. It was observed that basically the continuous list was reread sequentially, whereas the separated list was reread fairly selectively. To examine this difference, the readers text access was categorized into *sequential access* and *selective access*. Here, when an adjacent segment (i.e., a segment immediately after or before the one selected at the moment) was accessed, it was regarded as a sequential access. In contrast, when a segment other than adjacent ones was accessed, it was regarded as a selective access. The proportion of selective access in rereading was calculated for each reader by dividing the total frequency of access in rereading into that of selective access in rereading.

Table IV shows the mean proportions of selective access in rereading for both text versions. There was a significant difference between the two conditions ($t(13) = 2.23, p = 0.044$; unequal variance two-tailed test). Thus, the separated list was reread more selectively than the continuous list.

	Separate layout %	Continuous layout %
M	32.0	17.5
SD	18.3	9.5

Table IV.
Mean proportions of selective access in rereading for the two text versions

The typical reading patterns for both text versions are illustrated in Figure 2. This graph demonstrates that a reader of the bulleted list selectively reread the points skipping from one item to another, while a reader of the continuous list reread the text mainly in a sequential manner. In addition, total reading time of reader A of the separated list was much shorter than that of reader B of the continuous list.

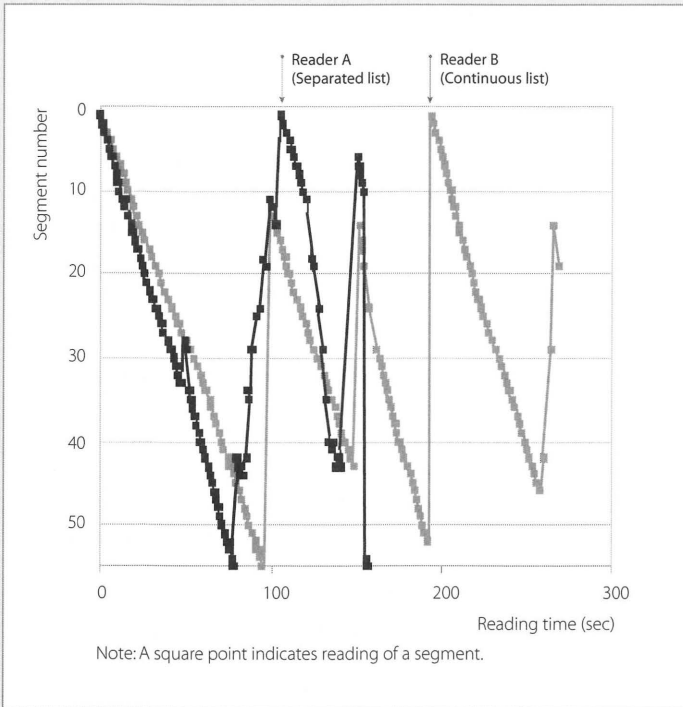


Figure 2
Typical reading patterns for the two layouts of the list

In the interview, many readers of the separated list reported that space and bullets in the text acted as landmarks for rereading. Clearly, these layout features guided readers through the text.

In summary, Experiment 2 showed that there was a notable difference in reading patterns between the separated list and the continuous one. Both lists were initially read through in a sequential manner. However, the separated list was reread more selectively than the continuous list. As a result, the separated list was read and understood faster than the continuous one. There was no difference in recall between the two layouts, which indicated that both lists were understood equally. These results showed that the separate layout allowed readers to access the points more easily and to understand the content faster than the continuous layout.

GENERAL DISCUSSION

The results of this research confirm the critical role of the layout of lists in reading and understanding them. In Experiment 1, participants read one of four styles of a list and recalled. It was found that a separately arranged list was recalled better than a continuously arranged list and that the former was read more efficiently than the latter. The efficiency in reading was deemed to have affected the recall. Experiment 2 further examined reading processes for both text layouts. It was found that the separated list was reread more selectively and was thus understood faster than the continuous one. The layout of a list clearly affected readers access to information in text.

One of the advantages of a separately arranged list is that it displays the internal structure of the text explicitly to readers. For example, when readers see a bulleted or a numbered list on a page, they immediately know that a series of points is presented at that point before they begin reading the words. That is, such a list provides readers with a visible structure of the text and this allows them to assimilate the information smoothly. In contrast, when a list is embedded within a paragraph, readers cannot see its underlying structure until they read the words. Therefore, the readers of such a list need more time to understand it than do those of a separated list.

Another advantage of a separated list is that it explicitly divides or chunks information into meaningful units with space and markers. This feature enables readers to easily discern the units or items of a list, and to access information in each item easily and selectively. This is consistent with readers comments in Experiment 2 indicating that space and bullets acted as landmarks for accessing information.

In addition, a better understanding of text structure may enable readers to review the text faster and more selectively (Dee-Lucas and Larkin, 1995; Hartley, 1993). This could be another reason for the efficiency in rereading the separated list, as it allows readers to easily grasp the internal structure by its appearance.

Clearly, the appearance of text itself communicates as much information as its words (Schriver, 1997; Waller, 1982; Winn, 1993). The ease of reading and understanding text seems to depend on how well the appearance or layout reflects its internal structure. Moreover, it could be that the text layout induces readers to read in a specific manner, to some extent. This notion seems to offer an interesting view, yet it needs further research.

Finally, more studies are needed on the effectiveness of lists in text. For example, the number of points presented in a bulleted list could be an important element. Carliner (1987) suggests that when a bulleted list grows beyond about five points, they should be further chunked into main points and subordinate points, and then subordinate points into sublists. Similarly, the length of each item in a list might be an influential factor. Its effects on reading and understanding should be examined. In addition, while the studies presented here used a list with a parallel structure, other types of lists including sequential ones explaining step-by-step procedures should also be studied. These lists are often found in technical instructions such as software manuals. Further empirical research on the effectiveness of lists in such a context would be useful. ■

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Resource A

Bullet version text (translated from the original Japanese text)

Today, millions of people are studying a foreign language in the world. What is the purpose of their study, and what is the role of language teaching and language learning?

The following are considered as the answers to the questions:

- Language is the means of communication in travel and business, including speaking, listening, reading, and writing. Even though the language is not currently useful, it may be helpful in the future.
- Language learning helps us to understand a foreign culture, because we can experience other cultures as well as languages through it.
- Learning a foreign language can be a pleasure. In doing so, people make good use of their leisure time or sometimes get their mind off their loneliness.
- Studying a foreign language becomes a symbol of some sort. For example, French is associated with something artistic, and Russian reminds us of communistic ideology.
- Language education plays a role in skill building. Even the acquisition of useless knowledge helps us to grow skills by systematic and patient study.
- Language education contributes to the maintenance of the school system. Since foreign languages have traditionally been required courses, students cannot graduate without credits in them. A number of language teachers will lose their job if those courses are abolished. For these reasons, language education has been maintained.

They are considered as the roles of language teaching and language learning.

Resource B

Transition version text (translated from the original Japanese text)

Today, millions of people are studying a foreign language in the world. What is the purpose of their study, and what is the role of language teaching and language learning?

The following are considered as the answers to the questions. To begin with, language is the means of communication in travel and business, including speaking, listening, reading, and writing. Even though the language is not currently useful, it may be helpful in the future. Next, language learning helps us to understand a foreign culture, because we can experience other cultures as well as languages through it. In addition, learning a foreign language can be a pleasure. In doing so, people make good use of their leisure time or sometimes get their mind off their loneliness. Moreover, studying a foreign language becomes a symbol of some sort. For example, French is associated with something artistic, and Russian reminds us of communistic ideology. Then, language education plays a role in skill building. Even the acquisition of useless knowledge helps us to grow skills by systematic and patient study. Finally, language education contributes to the maintenance of the school system. Since foreign languages have traditionally been required courses, students cannot graduate without credits in them. A number of language teachers will lose their job if those courses are abolished. For these reasons, language education has been maintained.

They are considered as the roles of language teaching and language learning.