

## IMPLICATIONS OF SCREEN DESIGN UPON LEARNING\*

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### ABSTRACT

Research pertaining to the effects of Screen Design upon learning is scarce. Many recommendations point out the need for "using blank space," "being consistent" in the presentation, "preventing clutter," and "avoiding scroll," which are subject to interpretation. This article deals with practical recommendations applicable to all CAI lessons. They are the use of external structure of knowledge, capital versus lower case, screen page as a unit, and margins. Figures are provided for each recommendation.

### EXTERNAL STRUCTURE OF CONTENT

Learning is the result of associating new input to existing knowledge [1-5]. Smith, Glenberg and Bjork define context in terms of students' inner structure in conjunction with external conditions and experiences related to stimuli [6]. By the same token, content cannot be seen as composed solely of the text of graphics on the screen, but also of the background and location in which the information is presented [7, 8]. This background is made available to the reader by its size and spatial distribution within the screen monitor as well as by the cues it provides for future recall.

External structure of content sets a pattern for internal organization, facilitating perception, memory and future retrieval [1, 9-13]. Several elements to be discussed here contribute to the depiction and enhancement of spatial attributes which affect the design of legible and meaningful screens.

\*This article is based on presentation given at the 1991 AECT conference.

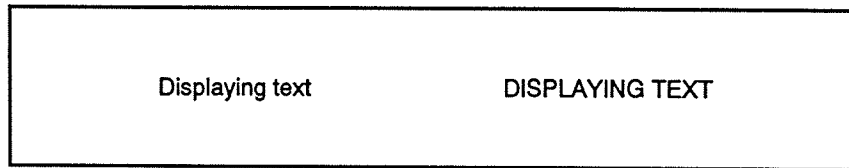


Figure 1. An example of a "word shape" and its effect in capital letters.

### CAPITAL VS. LOWER CASE

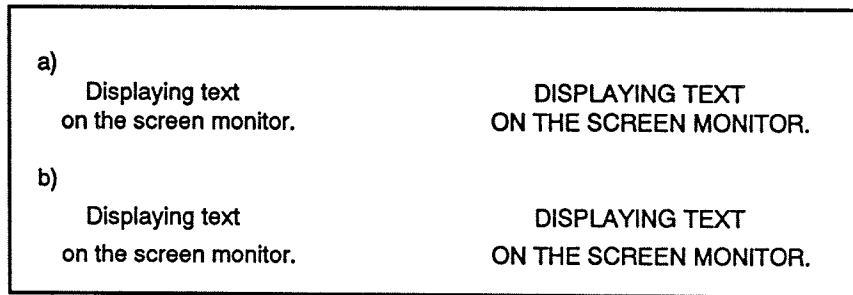
One such element is the use of capital versus lower case letters. Researchers have found that capital letters do not provide as many visual cues as do lower case. In lower case each word depicts a specific shape created by the combination of ascenders, as in the letter **h** and descenders as in the letter **p**. In capital letters ascenders and descenders are not present, and the words become a solid block decreasing readability [14], as shown in Figure 1. This could be easily solved by the use of a larger point of lower case, which is available in the computer.

Contrary to lower case, capital letters provide most of their information in their right hand extension, such as **P** and **R** [15]. Some of them, such as **X** and **S**, are made by symmetrical lines or shapes. Consequently, when grouped into a word they lose their uniqueness, becoming a solid block. Nevertheless, capital letters are preferred when used in isolation, for their shape becomes more salient, as does their size.

### INTERLINEAR SPACE

A second consideration should be the amount of interlinear space or lead. When designing screens, one goal should be readability. Extra space between lines contributes to legibility by making ascenders and descenders more prominent. This results in a more perceptive "word shape." Text written in a solid manner loses legibility [16, 17], as demonstrated in Figure 2. However, if space between lines is too wide, the concept of continuation may be lost. Therefore, the amount of interlinear space should be consistent throughout the presentation.

Interlinear space may also be used to demonstrate hierarchical order. Information should be grouped in relation to its content and divided according to ideas, discriminating major points from subordinate ones. This calls for a hierarchy of content [14, 18, 19]. The amount of space can be increased between the heading and the paragraph, providing saliency to the title which becomes a mnemonic device [14, 20].



**Figure 2.** An example of information written in a solid manner, by  
a) the use of capital versus lower case without interlinear space, and  
b) the use of capital versus lower case with interlinear space.

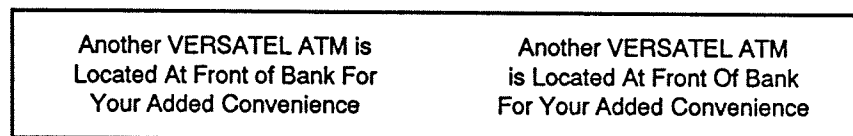
### SCREEN PAGE AS A UNIT

A third element affecting readability is line length. Research has found lines that are too short do not provide readers the advantage of peripheral vision which helps in overall perception. Peripheral vision provides adjacent information [21]. However, in designing a screen page, each line should have a brief, self-contained, message as seen in Figure 3, and paragraphs need to reflect meaningful information. This design eases and speeds information processing [18, 22].

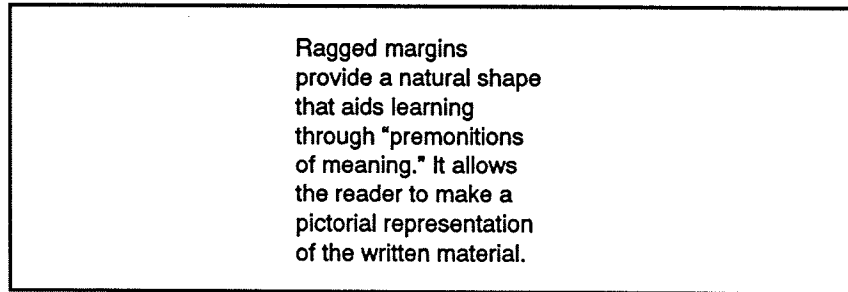
Providing the learner with adequate prompts and retrieval cues is crucial, since further use of stored information relies on these strategies [9]. Research has found that people encode written information differently from pictorial. In fact, studies show two separate memory systems: one for each modality. Hence, when information activates more than one memory system at a time, the one complements the other, providing an alternative storage mode [23-26].

### STRATEGIES FOR RECALL

Other strategies that aid recall are the use of chunks, margins, and the location of information in relation to graphics. In relation to margins, research indicates



**Figure 3.** A non-example and its correct way of displaying lines with self-contained messages.



**Figure 4.** An example of a “paragraph shape” provided by the silhouette of a ragged margin.

that ragged margins are preferred over right justified margins, for the latter does not allow the reader to benefit from the “premonitions of meaning” provided by additional information found in the subsequent line [27]. In addition, the natural shape that ragged margins provide becomes a spatial attribute, allowing the student to recall from either the content or the location of information [14, 15, 28, 29]. The silhouette allows the formation of a “paragraph shape” as seen in Figure 4. Standard justified margins break endings and hyphenate sentences. This interrupts normal eye movements, forcing readers to do additional work and causing distraction from the main focus [18, 19, 21, 27, 30, 31].

### LOCATION OF INFORMATION

A final consideration when designing screen layouts is the location of information. Location has been identified as a mediator between content and visual material [2, 32], that provides a visual organization from which to link new material as well as an alternate storage mode. Consistency of location has proven to facilitate the transfer of information and to enhance learning [8, 9].

Today’s software allows the implementation of these principles and strategies based on human perception. To achieve better instruction, designers should take advantage of this new technology, apply what has been discovered and continue to research Screen Design.

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