

## Creating Effective Visual Metaphors

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### Abstract

This paper examines the background, selection, and integration of visual metaphors into learning environments. As the design of the human-computer interface evolves, this important visual component should play an increasingly greater role in the enhancement of effectiveness of World Wide Web-based learning.

### Introduction

Learners tend to interpret new, previously unencountered information based on their past experiences and knowledge. Gagné (Gagné, Briggs, & Wager, 1988) identifies in his events of instruction that, early in the instructional experience, the learner must be stimulated to recall prior knowledge and experiences that will be related to some new information to be introduced. Ellen Gagné (Gagné, Yekovich, & Yekovich, 1993) advocates a few words or questions that help the learner relate what will be learned to what is already known increases learning and recall.

Research investigating metaphors and analogies (Anderson & Sunstein, 1987; Hayes, 1980; Hayes & Tierney, 1982; Kogan, Connor, Gross, & Fava, 1980; MacCormack, 1985; Smith & Ragan, 1989) have been shown them to be effective instructional strategies, but most research has centered on the use of verbal metaphors and analogies rather than those of visual content.

### Metaphors and Analogies

A first encounter with metaphors and analogies usually comes in high school literature classes and the study of literary figures of speech, such as similes and metaphors in prose and poetry. Examples used are from Johnson, Burns, and Shakespeare among others. Some examples found around us include:

- Time is money.
- Life is a journey.
- Computers are like human brains.
- World Wide Web
- Family tree
- Forecasting weather / foretelling the future

Metaphors were defined in Webster's Ninth New Collegiate as "a figure of speech in which a word or phrase literally denoting one kind of idea is used in place of another to suggest a likeness or analogy between them (Mish, 1984, p. 746). That definition clearly deals with textual or verbal metaphors. The use of "a word or phrase" excludes visual content, but makes the point of metaphors referring to one thing in terms of another.

Lakoff (1983), however, gets a little closer when he remarks that metaphors are "...understanding and experiencing one kind of thing in terms of another" (p.

5). Consider then, that the metaphor extends beyond the "figure of speech" definition to include the visual sense. Therefore, a visual metaphor is one image or set of images used in place of another to suggest an analogy between the two images or sets of images.

If one were to represent the previous examples of verbal metaphors in visual terms, we have the images in Figure 1.

Figure 1  
Visual Metaphors

Time is money.



The family tree



Life is a journey.



Foretelling the weather



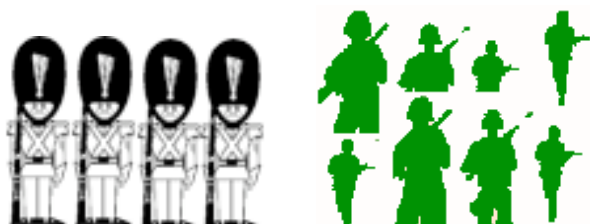
### Using Visual Metaphors in Learning

Using this perspective, one image or set of images might be used to represent another image or set of images, and serve to assist the learner in recalling prior knowledge of familiar concepts before encountering new, unfamiliar concepts. One such unfamiliar realm is science. In describing the response of the immune system, one might use images of little soldiers for antibodies or use symbols for atoms and the solar system interchangeably when introducing either as a new topic.

Research by this author (Williams, 1997) showed no significance in using visual metaphors over verbal metaphors and attributed the results to poor visual construction. In using the metaphor of a diaphragm

pump to introduce the concept of cardiac circulation, too little attention was paid to the familiarity of the pump metaphor to the target audience. As a result, the metaphor, although introduced and discussed, was not inherently familiar and carried no mental transfer to the heart instruction. In addition, the graphic contained too much detail to be quickly interpreted. With this in mind, in Figure 3, which soldiers would best represent the antibodies fighting the infection? Which is more familiar, the toy soldier or the combat silhouettes?

Figure 3  
Immune Response Visual Metaphor



Another unfamiliar area of knowledge for many is the computer. Apple Computer, Inc. recognized the significance of the visual processing of information and pioneered much of the study of the human-computer interface. Their use of the Graphic User Interface (GUI) in their Macintosh allowed people who had never used computers before to sit down and relate to images taken from everyday life. There were images of trash cans, filing folders, and documents that simplified the concept of computer disk directories and file pathnames. Users were freed from the "C prompt" and typing word commands, clicking instead on icons.

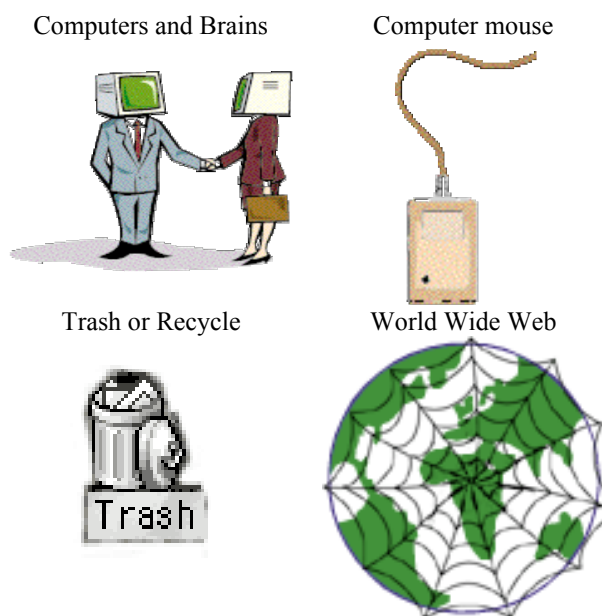
Early on, Apple published its HyperCard® Stack Design Guidelines (1989) and under "Guideline 3: Decide how to present the subject matter to your users" asks the reader to "Consider using a metaphor. A metaphor is an identification between a realworld object and parts of your stack that share the object's characteristics" (p.7). The company still maintains a page on their website devoted to Human Interface Guidelines at: <http://developer.apple.com/techpubs/mac/HIGuidelines/HIGuidelines-2/html>.

The Microsoft™ Windows operating system GUI followed on Apple's heels, employing the Recycle Bin, folders, and other similar icons to support its desktop office metaphor. Its "Office" name for the popular software package is a reflection of that virtual office metaphor.

In addition to the office and desktop metaphors, other computer programs have chosen hiking or sailing themes for programs through which one must navigate. Images of maps, charts, and directional compasses are designed to assist in that navigation and successful hiking or sailing through the program. Multimedia

applications such as Quicktime™ and MediaPlayer provide a visual metaphor representing the videotape player in "playing" the media file. It has forward and rewind buttons as well as volume controls. All the buttons are intended to be so familiar to the user that they use them intuitively.

Figure 2  
Visual Metaphors about Computer



### Creating the Visual Metaphor

Learners do not come to the learning environment, however carefully it may be constructed, with the same life experiences, prior knowledge, observations, and cultural backgrounds. The construction of the visuals is then of great importance in assuring that the metaphor represents familiar concepts and is easily interpreted. For example, if using the "time is money" metaphor, an number of images may be used. For example, American audiences would recognize the dollar sign (\$) appearing on a clock, while they might miss the significance of seeing a British pound sign (£) on a timepiece.

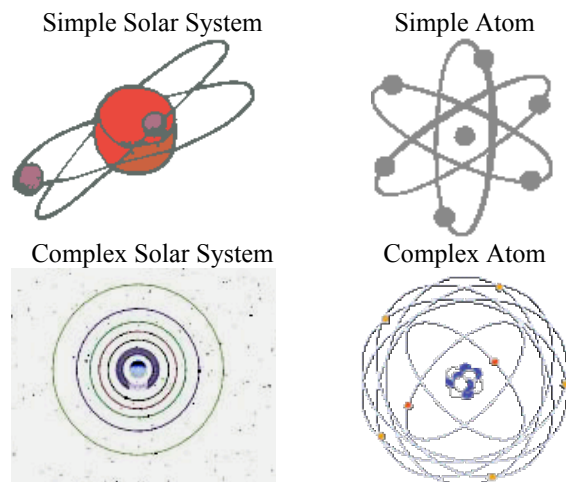
A computer - or web-based unit on chemistry might focus on a virtual chemistry laboratory in which the visuals support the metaphor. Beakers, flasks, and other laboratory equipment might be manipulated in activities. Macromedia Director utilizes the metaphor of the theatre using a "stage" and "cast." As the program author, you direct the cast of characters to create your animation. Unfortunately, the visual metaphor is not as well developed as the nonvisual metaphor.

### Requirements of the Visual Metaphor

In addition to familiarity, an effective metaphor must not be overly simple or complex. It is important to identify learner characteristics that play a role in the ability to observe, interpret, and utilize a particular visual metaphor. The metaphor designer must find that narrow corridor where the analogies presented by the metaphor support successfully the transfer of identity from metaphor to new information without making so many analogies that the learner is overwhelmed by the number or the level of complexity. An image or set of images should be appropriately simple enough to be easily interpreted, but include enough detail so that the learner can process the metaphor quickly. If the learner's ability level is not taken into consideration and too much or too little detail is included, the metaphor will fail.

Often, the metaphor designer seeks to be so accurate that too much visual detail is included. This is another decision point in creating visual metaphors for instruction. If comparing the structure of the atom to that of the solar system, which visual metaphor conveys the structure accurately, but effectively? In Figure 4, which image would be more effective and why?

Figure 4  
Atoms and Solar Systems



It is likely that an elementary teacher would find it more effective to point out the analogies between the solar system and the atom using the simple visual metaphor than the complex. However, a high school or college student might be able use the additional detail to build a stronger set of analogies, while also understanding the differences between the two concepts.

### Combing the Visual and the Verbal

Besides creating an effective visual metaphor, adding supporting text can offer the learner a guide to interpreting the metaphor. Dwyer (1978) encourages the use of multiple channels of communication in instruction. Paivio's (1971) dual-coding hypothesis proposes that people convert concrete verbal information into images in order to process and encode them. Therefore, adding text to an image supports differences in learning styles and increases the effectiveness of the visual metaphor. A word or phrase integrated into the visual image or accompanying text references can facilitate the learner's interpretation. In this author's study, while still not providing significant differences, the combining of visual and verbal components did increase mean scores and reduce the standard deviation over the verbal or visual alone.

### Summary

Visual metaphors must be constructed carefully in order to be effective instructional strategies. The metaphor must be familiar to the target learner. It must come from everyday experiences and be appropriate for the developmental / educational level of the learner. The metaphor designer must create visuals with an appropriate degree of accuracy and detail.

Too much detail and the learner may not be able to interpret the metaphor; too little detail and the learner may not be able to find enough analogies to use the metaphor. A very accurate metaphor may contain so much detail that the learner is overwhelmed and abandons the attempt to interpret it at all. Finally, the judicious use of text along with the visual metaphor may assist in the interpretation.

As the design of the human-computer interface evolves, effective visual metaphors will play an increasingly greater role in the enhancement of learning in the newly emerging environments.

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