

How much are pictures worth?

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Introduction

There are convincing arguments for using visually-oriented instructional design as a means of making content easier to understand and more memorable. However, it is too simplistic to base instructional actions on the folk-wisdom that ‘a picture is worth a thousand words’. One problem with this statement is that it implies all pictures are the same (and equally accessible). Another problem is the implication that pictures in general have some *intrinsic* value that makes them more effective than other ways of presenting information (such as words).

In order to use pictorial materials effectively as instructional resources, we need to do some careful thinking about how learners interact with pictures. There are a number of questions we need to ask such as:

- Which pictures are valuable?
- What characteristics give pictures their value?
- Is a given picture equally valuable to all viewers?

Students can encounter many different types of pictures during instruction. They range from highly realistic depictions such as coloured photographs to extremely abstract representations such as flow diagrams.

Are these pictorial genres equally accessible to the learner? Is one type of picture better at representing information than another, and if so, why? Which of the types of pictures mentioned above would be most readily understood by humanities students versus science students?

Some types of pictures, such as photographs, are relatively ‘faithful’ representations of their subject matter in that they involve little manipulation of the material. Others, like diagrams, bear very little superficial resemblance to their subject matter because of the extensive manipulations that have been done in order to produce the depiction.

It can be argued that the more realistic a picture is (that is, the more faithfully it represents its referents), the more valuable it will be as a learning resource. However, a counter argument is that, compared with diagrams, realistic depictions are cluttered with irrelevant detail and show only the superficial natural organisation of their contents rather than any deeper levels of content organisation.

These examples show that using pictures effectively as an instructional resource is rather more complex than it first appears. We need to consider carefully not only the type of picture to be used, but also the way in which we use it. Until recently, there was little questioning of the utility of pictures in learning. However, there is now a growing body of very interesting research showing how teachers can help to ensure that pictures realise their potential as learning resources.

Visuals or text?

Our goal in this section is to compare the task of ‘reading’ a picture document with that of reading a text document. Understanding some of the key differences between these two types of document can help us to design pictorial teaching materials that are more likely to be instructionally effective.

This idea of designing instructionally effective pictorial materials definitely does *not* require you to be an artist. The focus is upon the instructional aspects, not on the aesthetics. In fact, most of what we will consider deals with *existing* pictures and how they can be modified to increase their instructional value. Many of the pictures that we will encounter in learning materials ranging from textbooks to multimedia are of very questionable instructional value because of the limited attention paid to instructional design issues.

Knowing where to look

Competent readers of text have expectations and habits that almost unconsciously guide them through a text document. These expectations and habits come about as a result of being taught to read in a certain pattern (left-to-right, top-to-bottom with English) and from years of practice in using these reading patterns across a variety of document types. Even the scanning of text (as opposed to careful reading) involves well rehearsed and relatively standardised actions. The careful sequencing of written text and its highly conventionalised linear structure allows us to invoke the same general reading strategy no matter what type of text document we encounter and be reasonably confident that this strategy will be effective.

However, there are no corresponding general guidelines for reading a picture. The arrangement of information within a picture is not standardised (as it is for text) and so we have no automatic reading routines that we can call on to help us follow a productive path through its contents. With some types of picture, this may not be a problem because the content is very familiar to us and is arranged in a way that matches the organisation of our everyday surroundings. Our strategy can then be based upon how we would normally read those surroundings.

A more challenging situation occurs when the content is unfamiliar or when familiar content is presented in unusual ways. For example, a photograph of the inside of a computer would present material that is unfamiliar to many people and hence they would have little idea of which parts of the photograph contained important information. In contrast, a highly abstract diagram of a very familiar object or situation can be quite unrecognisable to the non-specialist viewer who will therefore not know which areas need to be inspected.

Knowing what the elements are

One of the things that we are taught to do very early when learning to read is to recognise letters, the groups of letters that form words and the arrangement of words into continuous text. Different spacings mark the distinction between these smaller units of meaning (letters, words and lines of text) while capital letters, full stops and inter-sentence spacing signal larger units of meaning. Because these arrangements embody quite strict conventions, they are applicable to virtually any text document we read. During normal reading, we perform the process of breaking up a text document into its components with little awareness of what we are doing because this fundamental activity has become so automatic.

Conventionalised marking off of elements at different levels in this way allows a capable reader readily to identify the various units of information that comprise the text. However, there are no similar ‘universal’ rules for identifying the boundaries of elements that make up a picture. Each picture must be divided into individual information units according to a limited number of graphic cues (such as a sudden change in colour, intensity or line) and the viewer’s background knowledge of the objects depicted.

In contrast with text documents, the basis upon which any given picture document is divided up into its components is not necessarily applicable to some other picture document. In this respect, pictures can be more challenging than text.

Following an appropriate sequence

Well-written instructional text obeys grammatical rules and typically sequences ideas carefully so that they form a clearly connected linear chain. There are only a few possible ways of legitimately arranging word elements that function as nouns, verbs, adjectives, adverbs and the like. This means that if readers follow the left-to-right, top-to-bottom sequence through the text, they will be working through the elements and ideas in the order the author intended.

However, there are no similar sequencing constraints that apply to the exploration of pictures. Because the structure of a picture reflects the structure of the content it represents (rather than some arbitrary conventional structure), there can be no universally applicable reading sequence as there essentially is for text. In principle, the reader of a picture can start at any point in the display, follow any sequence through its elements and distribute attention amongst those elements quite unevenly during the reading process. Contrast this with typical text reading behaviour.

Unfortunately, this freedom to explore a picture in a highly individualistic manner is not necessarily beneficial for learning. Whether a learner takes a productive or an unproductive path through a picture depends on the design of the picture itself and on the learner's existing background knowledge and interpretative skills. If the learners are new to the subject matter being depicted (which is often the case) and so lack relevant knowledge and skills, they can be forced to rely heavily on the picture's instructional design to guide them in productive reading paths. However, all too often no such guidance is given because pictures are assumed by authors to be self-explanatory.

Knowing how to connect the elements

Like text documents, picture documents typically represent information at a number of levels. At the broadest level, the whole of a text document has an overall theme. Individual sections that make up the document contribute to the theme in various ways. Within these sections, sub-sections made up of a number of paragraphs develop these contributions in some detail.

In a formatted text document, this hierarchical structure is signalled by different levels of headings and subheadings. Variations in spatial layout (vertical and horizontal) are further used to indicate the pattern of interconnections between ideas in the document. In a well-designed document, these visual and spatial cues allow the content structure of a text passage to be appreciated at a glance. However, with pictures there is no strictly comparable set of conventions. The overarching ideas or aspects of a picture are presented simultaneously with the minutest details and it can be very difficult for a novice in the subject area to appreciate the different levels (a problem of not being able to see the forest for the trees).

Even at the level of details, it can be challenging for a learner to interpret appropriately the relationships amongst the various elements comprising a picture. A key challenge for the learner is to determine what aspects of a picture indicate how its different elements are related to each other. For example, the fact that some elements are physically close in the picture while others are far apart does not necessarily indicate anything about the extent of their functional or conceptual relatedness. Further, even when there seems to be compelling evidence from the graphic treatment that a number of elements are closely related, this does not mean that the learner necessarily knows the nature of the relation involved.

Pictures that instruct

There is a big difference between a picture that merely presents information and a picture that has been specially designed to make it instructionally effective. The 'take it or leave it' presentational picture that makes no attempt to help the learner understand the information it offers is too often of limited educational value. In order to re-design a picture so that it is more instructionally effective, it

is important to address the sorts of differences between text and pictures discussed above.

This re-design task involves providing the learner with explicit support for picture processing. The guidance that conventions and structure provide to support effective reading of a *text* document need to be paralleled by graphic and other helpers that do much the same job for a *picture* document. These can either be added to the picture itself or accompany the picture as external reading aids. In some cases, extensive manipulation of the original picture or complete re-design will be necessary.

The following instructional design suggestions address various limitations of pictorial representations that are often ignored in current instructional materials. They are given here in quite general form rather than as specific techniques because there are many ways of implementing the principles they embody. Different educational technologies provide different opportunities for dealing with these limitations and each design case should be considered on its merits.

Show macro structure

If a picture is rich with detail, it may be difficult for learners to appreciate its macro structure at a glance (compared with the way they would be able to pick up the macro structure from a well-designed and formatted text document). This is especially likely if all the information in the picture has the same visual status, as in a photograph. Learners need to know how to group the detail in a picture into the main informational chunks that make up the display.

Define key elements

The learner must be able to find all of the key elements that make up a picture easily and accurately. This means that each of these elements needs to be clearly defined in terms of its graphic characteristics (shape, size, surface treatment, outline, etc.) and have a set of characteristics that is readily distinguishable from those of the other elements. Relative positioning of the elements within the display area is another important consideration here. The instructional designer's aim should be to make the key pictorial elements as well-defined as are the individual components that make up a text document.

Indicate relative importance

Learners may need help in distinguishing between (a) information in the picture that is central to the ideas being presented and (b) the rest of the picture that constitutes its context. In addition, not all of the 'central information' will be of the same type so that the themes and sub-themes within that information may need to be clarified. Visual manipulation of the picture can make these different aspects more apparent to learners and so favour appropriate interpretation. For example, the contextual material can be suppressed and the main informational chunks highlighted. Further, different types of information can be explicitly indicated using different graphic treatments.

Direct attention

When learners are viewing an instructional picture, there are typically certain parts that they must attend to if they are to have any chance of developing an appropriate interpretation. Compared with text, pictures give learners much more freedom in where they direct their attention because there is no standardised reading procedure. This means there is a much greater danger that they will gloss over important information or even miss it completely. For this reason, a picture to be used for instructional purposes should incorporate design features that deliberately draw attention to its critical features by making them more conspicuous.

Guide the reading sequence

Although it is essential that a well-designed instructional picture directs learners to its critical features, it is also usually important that learners work through these features in a particular order. With some topics, this can be encouraged by arranging the pictorial elements in a conventional

sequence across the display (such as left to right to indicate the passage of time). However, with other topics this would distort aspects of the picture and so different approaches (such as arrows or numbers) must be used to indicate the suggested reading order. Such sequencing issues do not arise with conventional text documents because the order in which a particular idea is encountered during reading is determined by its position on the page.

Signal the relations

Items of information in a picture that are related in some way are often positioned near each other. However, this relation of 'physical proximity' can be misleading as an indicator of other types of relatedness (such as functional or conceptual relations). If items are widely separated within a picture and yet are closely related, learners need to be given help to make the appropriate connections. These perceptually counter-intuitive relations can be exposed by the use of various visual signals such as colour, texture or connecting lines.

Expose different levels

Because pictures are multi-layered representations, learners need to be aware of the different levels at which they can be read (from the global level right down to the details). Effective reading of a picture typically requires a learner to move flexibly between its various levels and to appreciate how they are interrelated. These levels can be explicitly indicated by providing several versions of the picture with each one emphasising a different level and how to connect these levels. Our purpose should be to help the learner take different perspectives on the picture's content and so develop a richer and more sophisticated interpretation.

Avoiding a mess

Although it is important to give adequate support to learners in how to read a picture, there are also some dangers in adding design features that are intended to make implicit information in a picture more explicit. Perhaps the most serious is that the picture becomes so overloaded with additions or so distorted by various manipulations that it becomes more difficult for the learner to deal with than the original. One way to circumvent such problems is to use multiple versions of the same picture, each with different instructional intentions. However, this approach must be treated with caution so that it does not produce an explosion in the total number of pictures.

Selected Readings

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