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ABSTRACT

The teaching of science demands the regular use of diagrams and sketches which may be formal or informal. This document outlines some basic guidelines, principles, and suggestions for preparing these diagrams. Topics covered include: basic drawing, shapes, lines and angles, contrast and shading, and lettering. (JRH)

SKETCHING SKILLS

FOR

SCIENCE TEACHERS

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BASIC PRINCIPLES

The teaching of Science demands the regular use of diagrams and sketches. These may be:

- Formal *or*
- Informal

Formal Diagrams are those used to give an accurate representation of some object or principle requiring accuracy of ***scale, content*** and ***colour.*** Examples of these would include cross-sections of plants, anatomical diagrams, chemical flow charts, graphs, physics apparatus and the like. Such sketches are usually drawn so that students may copy them into their books. Other formal sketches may be simply for elaboration and illustration and may be permanently drawn on paper or a spare chalkboard. Whilst many teachers prefer to use 35 mm slides or overhead transparencies, some still wish to do their own unique versions and lead by example when stressing the need for care and artistry in written work.

Informal Sketches often occur more frequently in the midst of normal classroom teaching. If used with flair, they can break up the boredom of "Chalk-and-talk" sessions. Moreover, they can be used to:

- Motivate the student.
- Illustrate abstract ideas.
- Aid student memory *and*
- Put a little joy into learning.

Indeed, some students will remember, with happiness ***and*** scientific accuracy a teacher's "weird" sketches used in the classroom.

To give Science some impact, sketches may be:

- Exaggerated e.g. Don't draw a "stick-figure" - draw an elephant;
- Slightly gross (but *not* offensive) e.g. don't just draw plants - draw man-eating plants.
- Humourous e.g. don't just draw a flow diagram of the Water Cycle, draw a diver on a bicycle (then erase and do the real thing!)
- Colourful e.g. use many colours to draw biological or mineral specimen and encourage students to do the same. (Whiteboard sketches require "past-on" sketches prepared in advance.)
- Topical (without being offensive) e.g. don't draw a picture of a human figure - draw a cartoon character.
- Consistently "eccentric" - (a little madness helps!) develop a set of characters (e.g. my Professor Oz) to help you teach science; obtain some professional "science" cartoons (e.g. The Far Side); try a few good demonstrations (e.g. Science "magic") to make up a story with your characters; and have fun.

BUT REMEMBER - practice makes perfect.

Do not try any "weird" methods unless they have been practiced, your Science is correct; your discipline is reasonable (keep control at all times) and you have a very good rapport with your class. Students do not respect fools who talk down to them.

BASIC DRAWING

Once that the need for a drawing has been established, the teacher should clearly define what is to be incorporated into the drawing and what are the objectives to be reached using the drawing.

Part of the careful planning that would go into the successful drawing would include:-

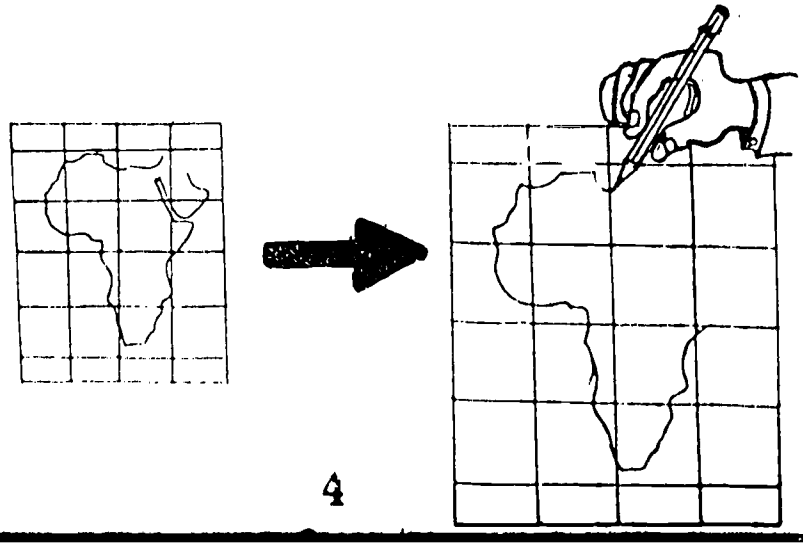
- **clear knowledge of what is to illustrated**
- **maturity/ability level of the class**
- **medium and art material to be used**
- **intent (humour; technical description; etc) and**
- **time and space considerations for the drawing**.

Naturally, with experience and long-term knowledge of the class and subject matter, the teacher would be able to make these consideration s in a minimum amount of time. Often these considerations are evaluated within the classroom itself.

With a little skill and a lot of practice, the teacher may be able to draw simple cartoons and sketches without much difficulty. However, if technical subjects or exact reproductions are to be made then more effort and some innovation is required. These illustrations are best ***copied*** from either original illustrations or from well-drawn illustrations made by the teacher when time permitted. Drawings, cartoons and even photographs can be reproduced (as drawings) by means of :-

- ***Grid-square enlargement*** in which the original is covered with a transparent grid and the outlines are carefully copied onto a finely-drawn grid of enlarged (or reduced) dimensions.

- ***Direct tracing of the original*** using semi-transparent paper. This is only possible if the original is large enough for use in front of the class (so why not use the original?):

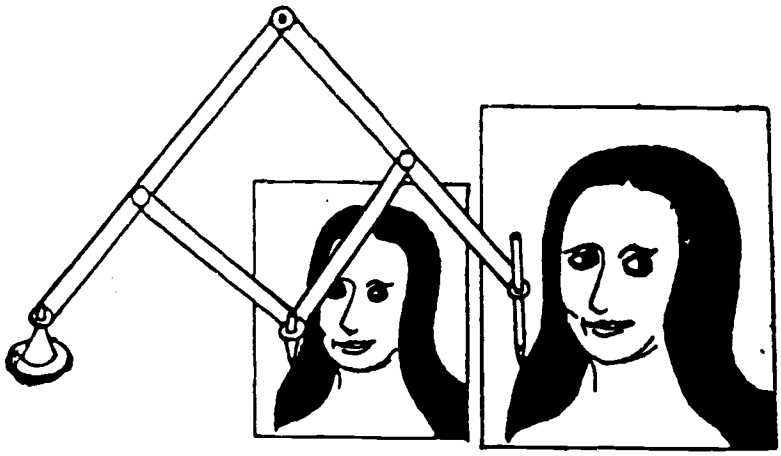


- ***Tracing the original onto a transparency*** or sheet of clear plastic using a felt pen. This transparency, no matter how small can then be projected (using a slide projector or an ove ead projector) onto a chalkboard or chart-paper for any dimension.

- ***Small originals can be cut out and projected*** if the original is on white paper, very small e.g. (3½ mm x 2½ mm) and is able to be cut out. The small cutting is then mounted into a cardboard slide mount and made "transparent" by the coating it with a layer of vegetable oil;

- ***Large originals can be photographed*** and the negative projected to any dimension;

- ***Use an optical or mechanical drawing aid*** such as the draughtsman's ***Pantograph***.



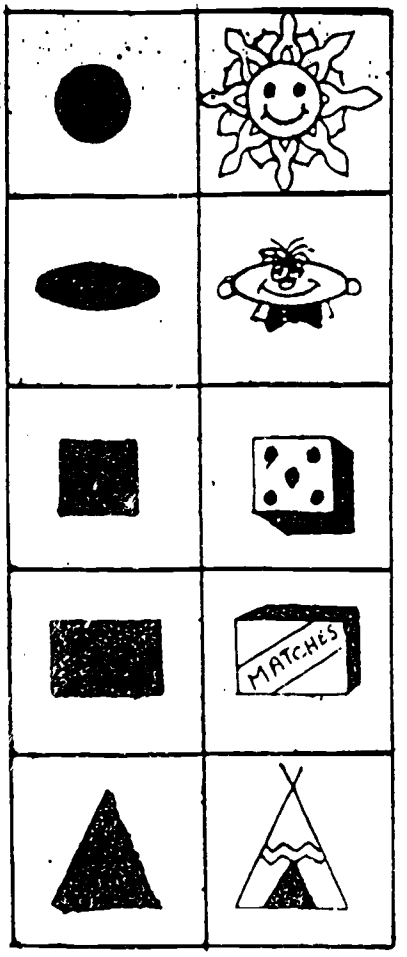
and ***using prepared templates*** of countries, apparatus and other shapes and letters.

By the use of any of the above methods, a teacher without much artistic skill can reproduce almost any drawing or photograph provided that there are no major difficulties with copyright.

SHAPES

Many of the drawings used in education, particularly those drawings constructed in front of the class, are the ***sketch*** or ***cartoon*** variety. In order to produce a reasonable drawing other than the "stick figure" type (these can be useful too), the teacher must have some basic ides of freehand drawing skills. These include the use of shape.

Most drawings consist of simple geometric shapes:-



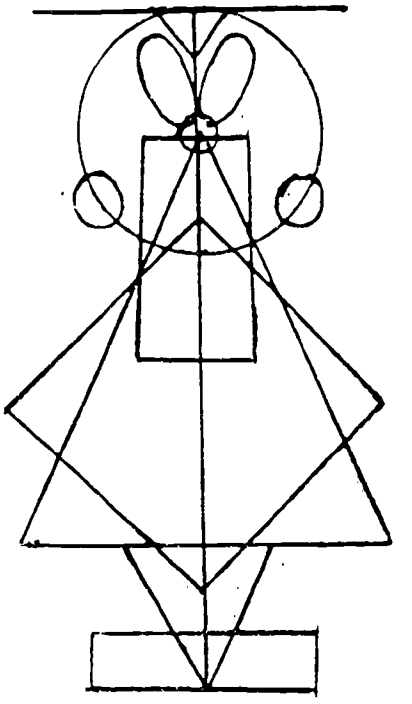
CIRCLES

OVALS

SQUARES

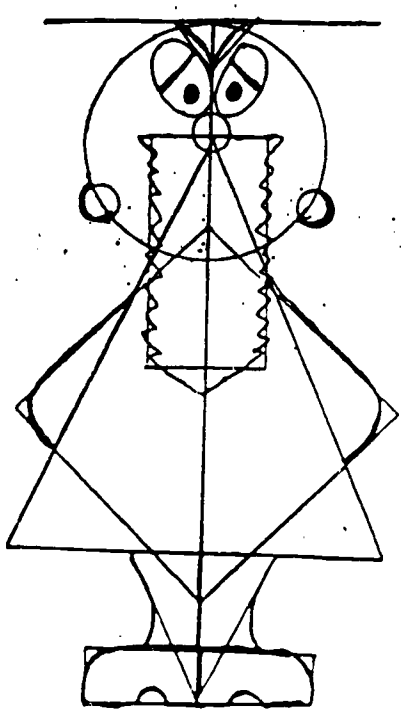
RECTANGLES

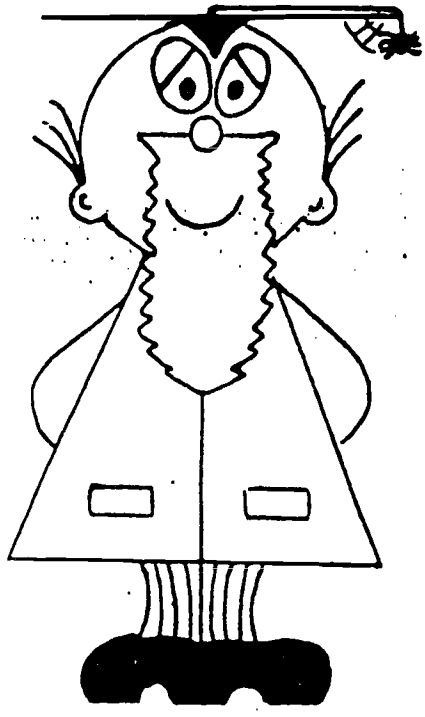
TRIANGLES



OR COMBINATIONS OF THESE SHAPES

Naturally most sketches and drawings are not simple geometric constructions but these are used as the ***framework*** around which the drawer can build the subject of the illustration using curves, straight lines and shadings:





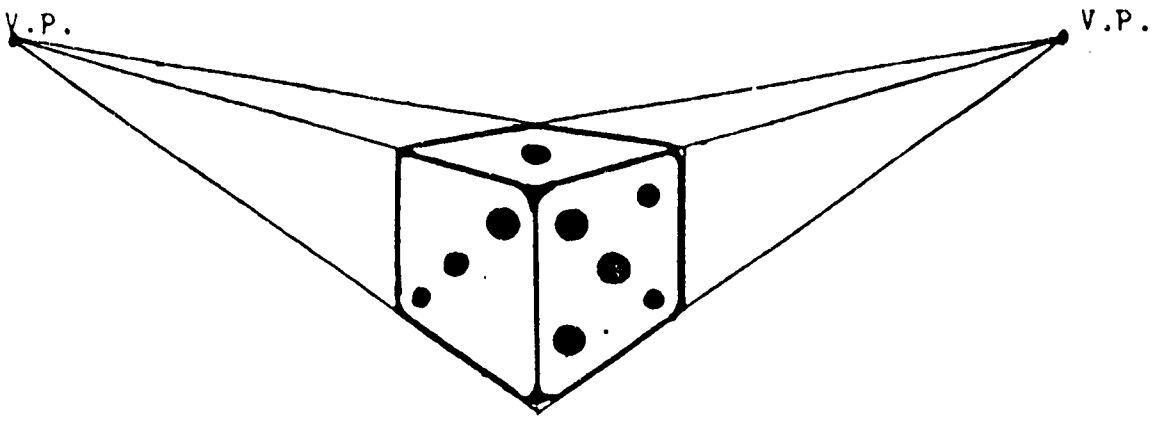
As for inspiration, the best place for this is ***real life***; with some exaggeration and distortion to give the drawing some character and humour.

LINES AND ANGLES

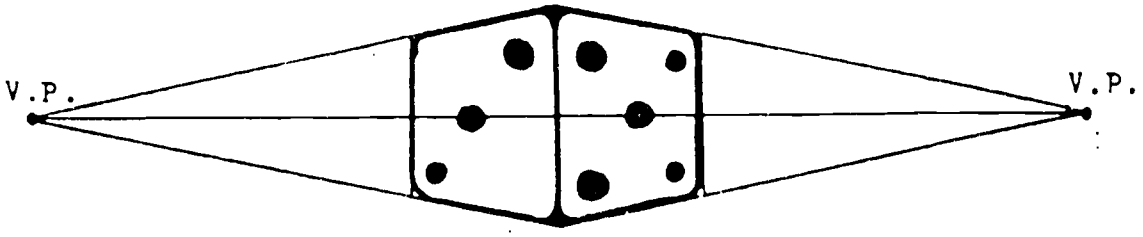
Lines may be used for purposes other than connecting and rounding-off geometric patterns to give them a more natural appearance. The type of line can also be used to convey a message about the object or cartoon character.

Thin lines infer a delicate, weak object and broad lines suggest strength, smooth lines infer neatness but rough, wrinkled lines suggest untidiness.

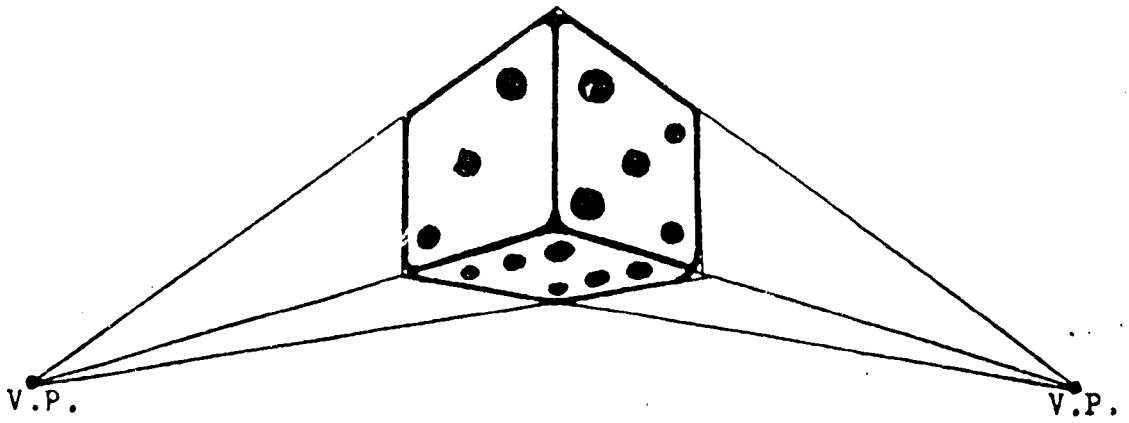
Lines can also be used to create an illusion of depth, giving the character some ***perspective*** with the background. This can be done by drawing more distinct objects much ***smaller*** and ***closer together*** than objects which are in the foreground:



(a) HIGH ANGLE VIEW



(b) EYE LEVEL VIEW



(c) LOW ANGLE VIEW

CONTRAST AND SHADING

Drawings and diagrams are usually constructed so that a class can have their attention focussed onto a particular item or educational interest. Often it will be the method used to ***contrast*** the object or ***shade*** its background that will have the greatest effect in attracting the attention of the class.

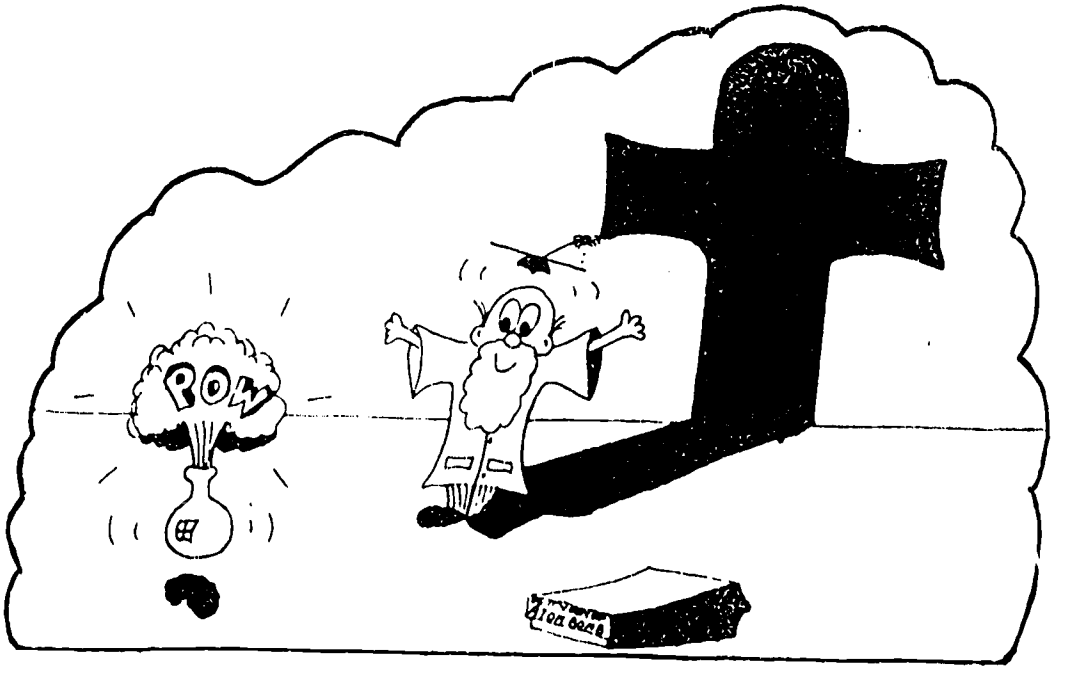
Usually in teaching, the best contrast is gained by drawing with a dark pen etc. onto a light background - white is useful but light yellows and pale pinks, greens and even blues also provide the added interest of colour.

If a chalkboard is used, the colour of the board itself will have an effect on the contrast achieved with different chalks: (*colours in order of best contrast*)

BLACK CHALKBOARD	GREEN CHALKBOARD	BLUE CHALKBOARD
1. Yellow	1. Yellow	1. Yellow
2. White	2. White	2. White
3. Pink	3. Blue	3. Pink
4. Green	4. Pink	4. Green
5. Red	5. Green	5. Red
6. Blue	6. Red	6. Blue
7. Purple	7. Purple	7. Purple

In addition, it should be remembered that, at a distance outlines are difficult to see so they must be drawn in heavier shades.

Subtile shading of the central object or character will also add to the depth of the drawing. Shadows drawn next to the object can be used to denote time of day or position in relation to a light:



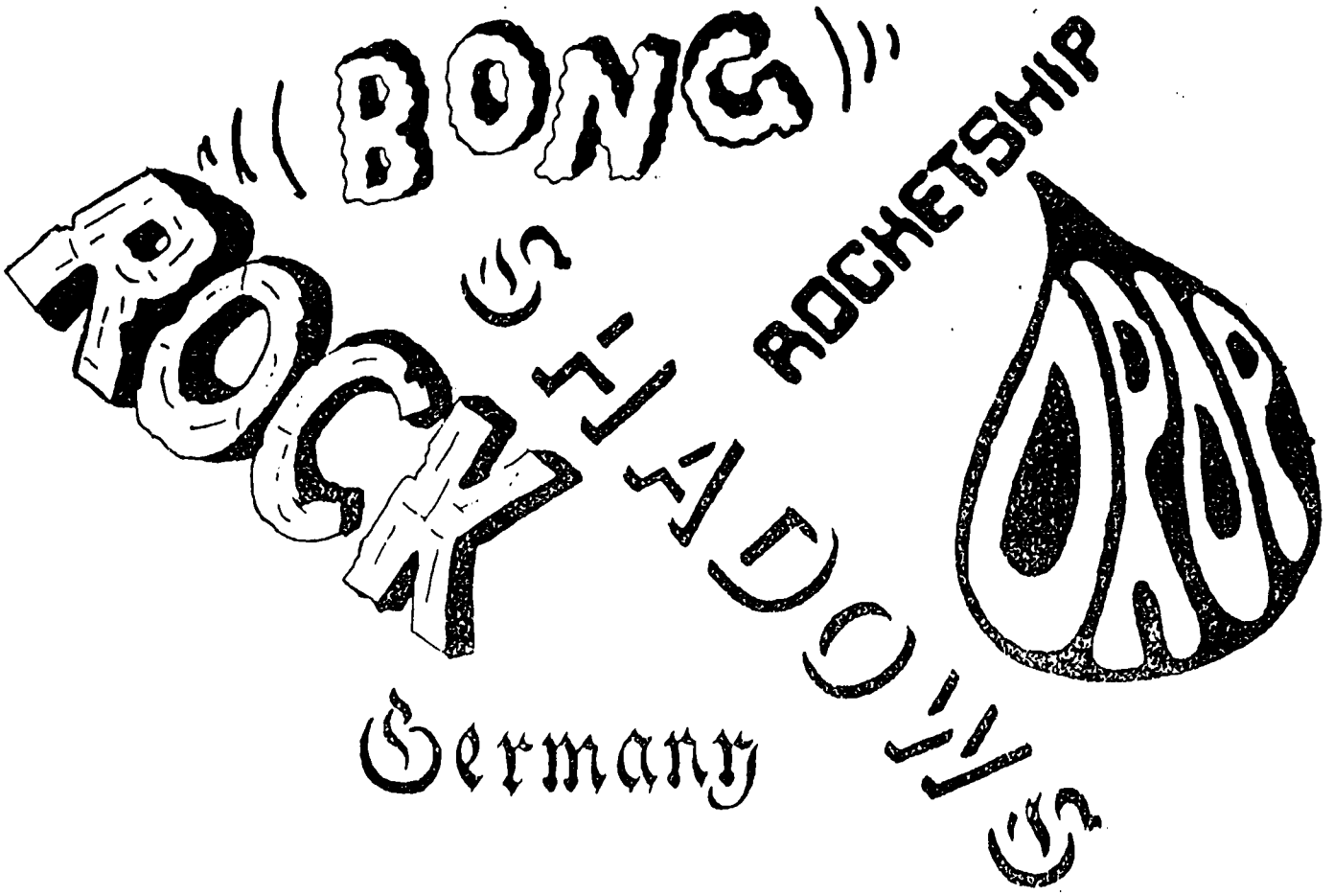
SOME IDEAS ON LETTERING

Lettering, other than the normal test of a message, can be used to:

- Give the title or heading of information
- Complement a diagram or sketch - captions, action, sounds etc.
- Label parts of a diagram
- Assist with difficult words in spelling training *and*
- Generally attract attention.

The incorrect use of lettering can easily spoil an otherwise well-produced drawing or text. The lettering should be appropriate and complement the other visual information. What is to be considered as "appropriate" is largely up to the author of the visual material as long as the combination of the lettering and the rest of the visual image is pleasing to the eye and conveys the intended message.

- Some thoughts on the use of lettering may help the reader to develop a sense of ***visual harmony***:



- Select a suitable ***size*** of lettering that neither distracts from the text or drawing not is too small to read. In most cases, where the titles and labels support the main work, the lettering could probably be kept to about 1 to 5 times the normal size of the lettering in the text (or of equivalent for drawings).

- ***Upper Case*** titles and labels generally look more pleasing, unless the use of lower case letters is desired for a special effect, such as teaching writing.

- If the lettering is meant to refer to some special event, culture or purpose, then the use of illustrative lettering may be more effective.

- The random mixing of lettering styles, cases and size often distracts from the purpose and is not pleasing to view. Lettering should be consistent.

- Different styles of lettering must be used correctly. For example, the ceriphs (thin lines at the end of letters) of Roman, Italic and similar styles should not be omitted.

- If the letters are to be read from distances other than normal reading distance (e.g. if on a chalkboard), then they should be drawn thickly and may be bordered with a contrasting shade or colour.

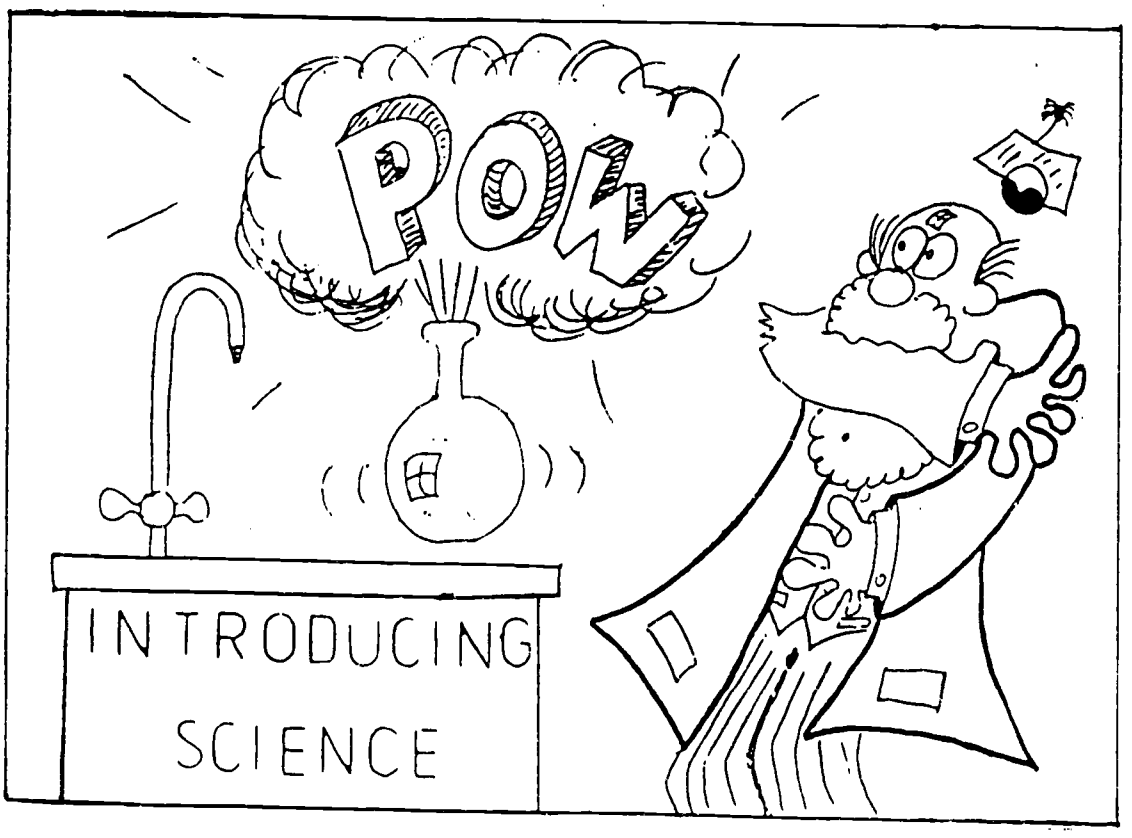
- Correct spacing is also a lettering technique. Allow a pleasing space between each letter and around the entire lettering. Usually the mid-lines of each letter (in a vertical plane) are spaced at equal distances.

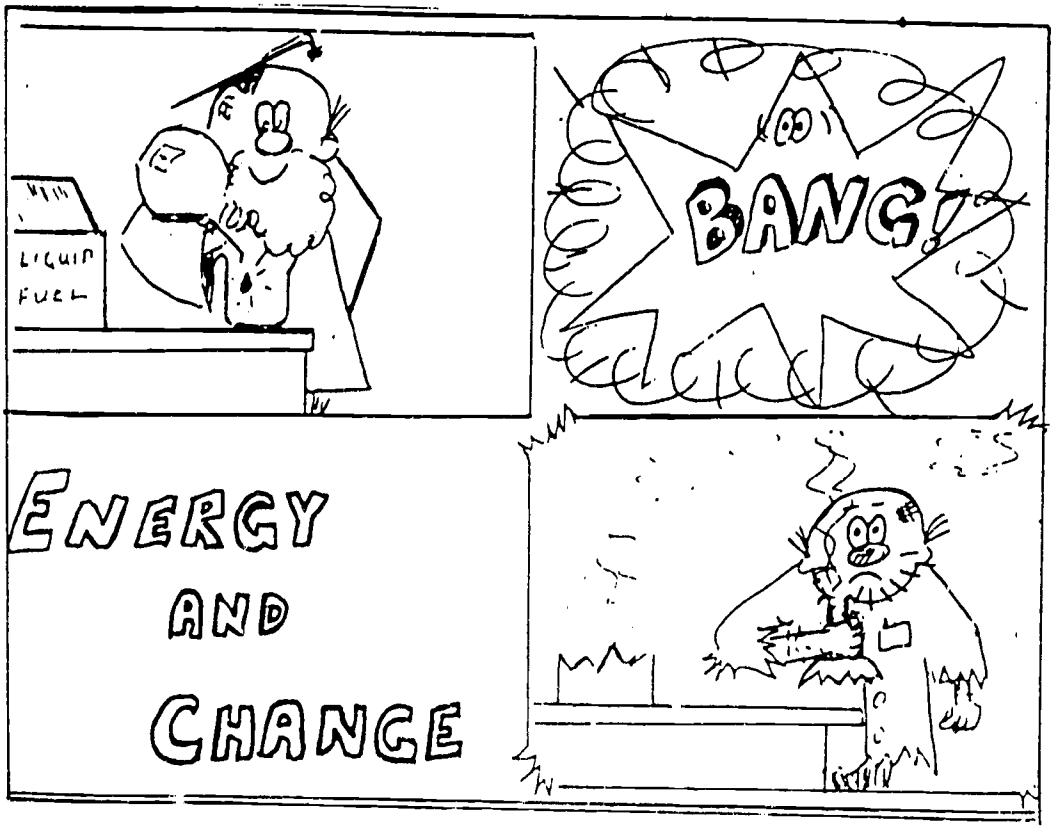
- If the letters are sloped or are given depth, such features should be retained throughout the same section of letters.

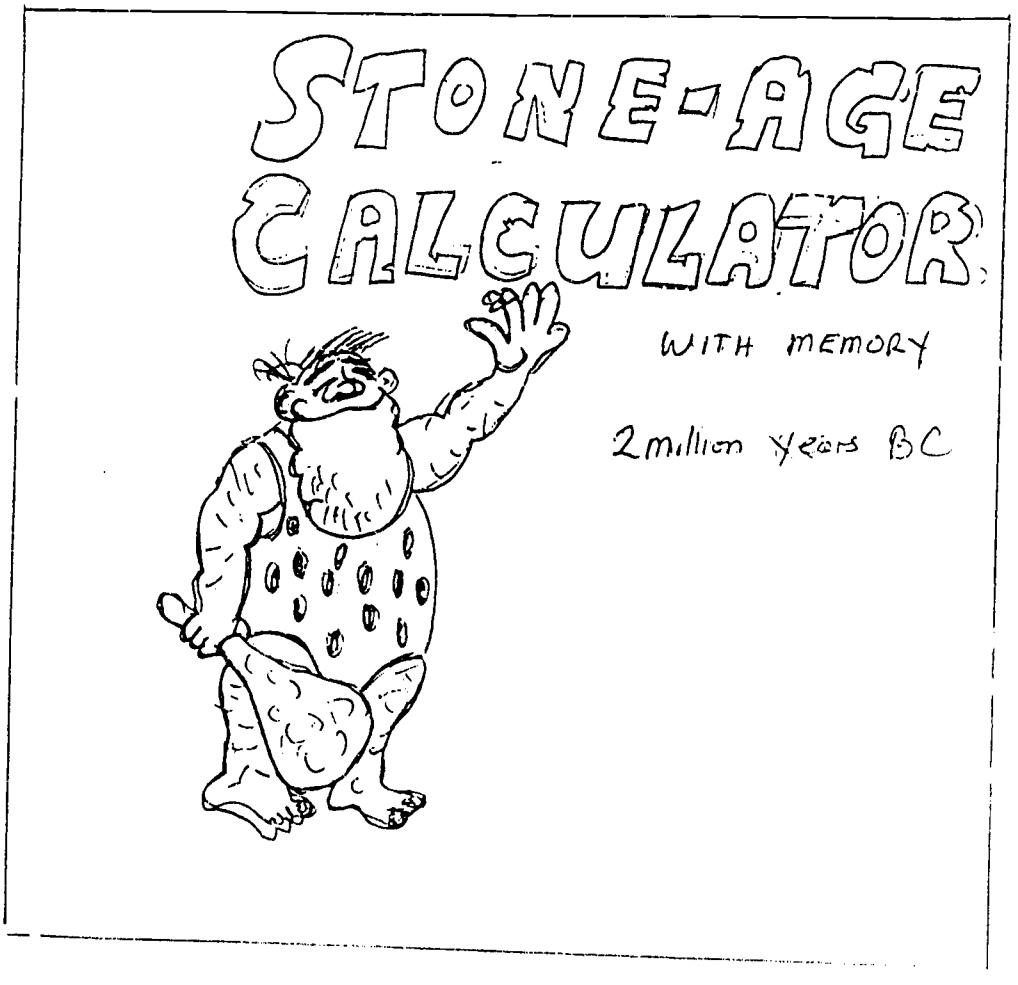
- Lettering should be clean and well organised. Use faint pencil guidelines (which are later erased) or a graphed backing sheet which can be seen through the paper.

EXAMPLES

The following examples show some of the motivational sketches given on the cover of each topic in a school program. As well as providing some humour to staff they are also used (as overhead transparencies) to introduce the topic and as an optional model for the students' title pages:




LIQUID
FUEL
BANG!
ENERGY
AND
CHANGE


STONE-AGE
CALCULATOR
WITH MEMORY
2million Years BC