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ABSTRACT

A sequel to the booklet "A Review of the Different Types of Instructional Materials Available to Teachers and Lecturers," this booklet begins by discussing the main educational uses of the overhead projector and its various strengths and weaknesses. Basic guidelines for using the overhead projector effectively are then offered, which include ways to avoid some common problems. Finally, detailed guidelines for designing and producing overhead projector software are provided which cover the following topics: (1) the two basic forms of overhead projector software--the continuous roll and the single transparency--and their respective uses; (2) basic principles for designing overhead projector transparencies; (3) producing the transparencies by hand, with a typewriter, from opaque originals, or using a computer-based system; and (4) display techniques such as use of progressive disclosure, overlays, and animation. An annotated list of two items recommended for further reading is included. (MES)

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A Guide To The Use Of The Overhead Projector

Introduction

In "A review of the different types of instructional materials available to teachers and lecturers", we saw how the *overhead projector* (OHP) is probably the most useful and versatile visual aid that is available to the modern teacher. Indeed, it has now replaced the traditional chalkboard as the main teaching aid provided in many classrooms and lecture theatres. It is therefore important that all teachers and lecturers should know how to make effective use of the OHP, so that they can exploit its potential to the full. This booklet has been written to help new, inexperienced lecturers to acquire this basic knowledge and expertise, although it is hoped that experienced staff will also be able to pick up some useful hints from it.

The booklet begins by discussing the main educational uses of the OHP, and highlighting its various strengths and weaknesses. It then offers some basic guidelines on how to use the OHP effectively, showing (for example) how to avoid common faults such as keystoning. Finally, it provides detailed guidance on how to design and produce OHP software.

How the OHP can be used in different instructional situations

It is now generally acknowledged that the overhead projector is probably the most useful visual aid available to anyone who wishes to carry out expository teaching of virtually any type. It is also extremely useful in many group learning situations, both for presenting information to a group (e.g. in a seminar or the briefing for an exercise of the game/simulation/case study type) and in enabling members of a group to display material that they themselves have produced (e.g. in a group project or case study).

Some strengths of the OHP

The OHP has a number of definite advantages over other methods of presenting visual information. A lecturer can, for example, use it in exactly the same way as a chalkboard or markerboard (for writing out notes, working through calculations and proofs, drawing graphic material, and so on) but with the great advantage of always facing the class, and thus being able to maintain eye contact with the learners. Such eye contact, which is, of course, impossible when a lecturer is writing on a chalkboard or markerboard, can play an extremely useful role in expository teaching, serving both as an

outward non-verbal communication channel for the teacher and as a means of obtaining feedback from a class on how a lesson is going.

Another important advantage over the chalkboard or markerboard is that the OHP can also be used to show pre-prepared material, thus enabling teachers and lecturers to build up banks of notes, diagrams, tables etc. that can be used over and over again. When well planned and designed, such sets of overhead transparencies can often also provide all the cues and 'aides memoire' that are needed during a lesson, so that no conventional teaching notes are required. As we will see later, such material can be prepared using a variety of production methods (free-hand writing or drawing, transfer lettering, thermal or electrostatic copying, and so on) and can incorporate a wide range of presentation techniques (progressive disclosure, use of overlays, use of animation, etc.). Overhead transparencies are also relatively compact compared with some other types of visual aids (e.g. charts), and are therefore easy to store in suitable boxes, large envelopes, folders or files.

Compared with other projected aids, the OHP also has the great advantage that it does not require the room to be blacked out, thus allowing students to take notes; indeed it can be used in all but the very brightest light (e.g. direct sunlight). The OHP is also clean, quiet, and 'user friendly', requiring no technical skill or knowledge on the part of the operator apart from the ability to change the occasional lamp.

Some weaknesses of the OHP

Disadvantages of the OHP include the fact that it requires a power supply, and needs a suitable flat (preferably white) surface on which to project its image. Also, unless this surface is inclined forward at the correct angle, the image will probably suffer from 'keystoning' (see figure 1). Unlike chalkboards, OHP's do also require a certain amount of routine maintenance. They are also liable to break down occasionally (generally at extremely inconvenient times), so it is always advisable to have a spare bulb close at hand (some modern machines do in fact have a built-in spare bulb that can be brought into use at the turn of a knob). A further disadvantage is that some lecturers find the glare from the OHP troublesome, although this can generally be overcome by attaching a suitably-positioned shade to the machine.

Apart from these possible 'hardware' difficulties, the main problems associated with the overhead projector stem from the fact that many users do not give sufficient thought to the production of their display material. In many cases, writing is too small or too untidy to be read easily (both in some cases), quite apart from the fact that it

frequently extends beyond the visible area of the transparency (teachers often forget that the illuminated projection area in most overhead projectors is slightly smaller than the standard square acetate sheet, and is also often cut away at the corners). As in the case of slides, there is also a tendency to include too much information on a single frame.

Finally, teachers and lecturers tend, if anything, to *overuse* the overhead projector just because it *is* so convenient, employing it in situations where other forms of visual aid might, on occasions, be more effective.

Some basic guidelines on how to use the OHP effectively

Despite its near universal use, many teachers and lecturers fail to get the best out of the overhead projector for various reasons. Many of these reasons relate to the use of the machine itself, since even experienced teachers and lecturers sometimes fail to observe all the following basic rules:

(1) Position the projector and screen so that the latter can be seen *clearly* by *all* the members of the class or group with whom you will be using the machine. In many cases, it is best to place the screen in one of the front corners of the room, especially if locating it in a central postion would deprive you of access to a fixed chalkboard or markerboard, which you might well find that you want to use in the course of the lesson.

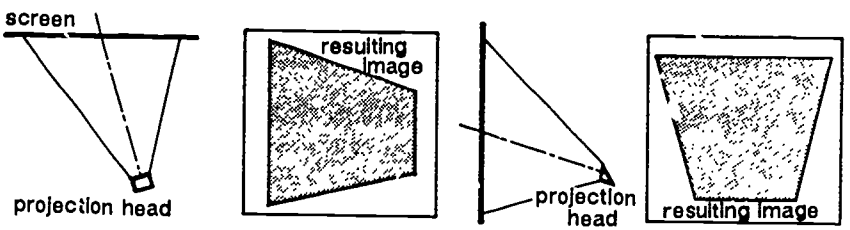

Figure 1: the two causes of keystoning in an OHP display

(2) Arrange the projector and screen in such a way as to eliminate or minimise the two forms of *keystoning* shown in figure 1. The first type arises when the axis of projection is not at right angles to the screen in the *horizontal* plane, and can be elimi-

nated by placing the projector opposite the centre of the screen. The second (and most common) type arises in cases where the axis of the projection is not at right angles to the screen in the *vertical* plane, usually because the projection head is too low. It can usually be eliminated or made acceptable by tilting the screen forward, it this is possible. In the case of a fixed vertical screen, however, the only way to solve the problem may well be to raise the level of the overhead projector itself, provided that this can be done without blocking the learners' view of the screen, of course!

(3) Adjust the distance from the projector to the screen so that the image fills the *full area* of the latter when properly in focus; failure to use the entire area of the screen can make it difficult for people at the back of the room to make out details.

(4) Make sure that the *platen* (the glass plate on which the display material is placed) and head lens surfaces are clear and free from dust; dirty or dusty surfaces can reduce image brightness and detract from the clarity and quality of the display.

How to design and produce OHP software

Even if they succeed in getting everything right from a 'hardware' point of view, many overhead projector users do not give sufficient thought to the design of the *software* that they use or take sufficient care in its preparation to make sure that it achieves the desired objectives. Let us therefore take a systematic look at how the design and production of OHP software should be tackled.

The two basic forms of OHP software

First of all, let us take a brief look at the two basic forms that OHP software can take – the *continuous roll* and the *single transparency* – and examine their respective uses.

The continuous roll

Most overhead projectors are fitted with a system whereby a long roll of acetate film can be wound across the platen from one spool to another. This enables a virtually endless supply of blank film to be used in the course of a lesson, either for writing out a continuous set of notes or for providing a succession of blank surfaces for the display of specific items of material.

Continuous rolls of this type are best suited to the requirements of those who prefer to create their supportive display material during the actual course of a lesson rather than produce it beforehand.

They constitute, for example the standard display method that is now used by many mathematics lecturers. In the bad old days, these used to have to write all their material on a chalkboard, which not only entailed their having to rub old material out at regular intervals in order to make room for new material, but also covered their hands and clothes with chalk dust. Now, however, thanks to the advent of the overhead projector with its virtually endless roll of acetate film, they can work their way through an entire lecture without having to rub anything out, and, furthermore, can do so sitting down and without any messy dust!.

The single transparency

The other basic form that OHP software can take is the single transparency, whether mounted or unmounted. Until comparatively recently, most OHP acetate sheets were rather thin, and were usually mounted in large cardboard or plastic frames in order to make them easier to handle and prevent them from curling up during use. Now, however, sheets are somewhat thicker and less prone to curling up during projection, so that there is no longer the same need to mount them in this way, although some users still prefer to do so. Others simply use them as they are – unmounted – since this makes them easier to store and carry round, the boxes in which blank sheets are supplied being ideally suited for both purposes. Although single OHP transparencies can again be used for the creation of display material during the actual course of a lesson, their principal use is in the production of pre-prepared materials. It is with the design and production of such single OHP transparencies that the remainder of this booklet will be concerned.

Designing OHP transparencies – basic principles

Although OHP transparencies can be produced in an extremely wide range of forms, there are two basic principles that should underlie the design of all such materials.

First, *do not try to put too much information on a single transparency*. This is one of the most common mistakes that are made when preparing both photographic slides and overhead projector materials. Ideally you should restrict the content of each transparency to the presentation of a single concept or limited subject area, using a series of such simple transparencies to cover a complicated topic rather than trying to include everything in a single frame. Remember that including too much detail will not only make the material difficult for the viewers (especially those at the back of the room) to see, but will probably also cause conceptual confusion.

Second, *use a clear, systematic layout*. As with all still visual display materials, the way in which the information is presented is often just as important as the intrinsic content in determining whether the material is effective from an instructional point of view. Thus the material should be laid out clearly and systematically, with any key words or items highlighted in some way (e.g. by making use of contrasting colours).

Producing the transparencies

Overhead projector transparencies can be produced by a variety of methods, but, whichever method is used, there is one basic rule that over-rides all others:

Make sure that **all** *the material will be seen when the transparency is projected.*

Because most of the blank acetate sheets that are supplied for use with the overhead projector are larger than the effective size of the platen, there is a danger of 'running off the edges' – either vertically or horizontally – unless due care is taken. Also, most overhead projectors 'cut the corners' off the image, so any material in the extreme corners of the transparency may well also fail to be seen.

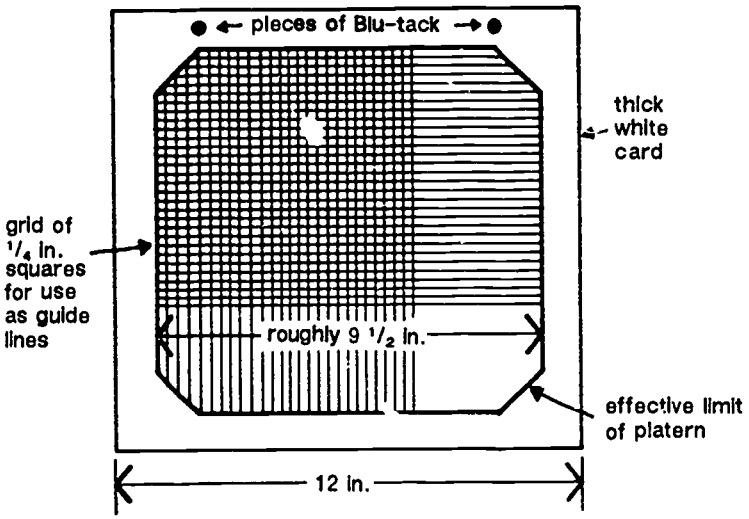

Figure 2: A home-made work surface for the preparation of OHP transparencies

Fortunately, there is an extremely simple and foolproof way of avoiding all such problems. This involves cutting out a square of thick

white card of suitable size (roughly 12" square is usually ideal) and marking on the effective limits of the OHP platen using a black marker pen with a reasonably wide point. This should then be used as a work surface and guide during the preparation of all OHP transparencies to be used with the machine in question or machines with the same platen size and shape.

The usefulness of such a guide can be further increased by ruling a system of guidelines on its surface using a fine-tipped marker pen. The most useful system is probably a grid of $^1/_4$ in squares, produced by ruling horizontal and vertical lines $^1/_4$ in apart. It is also helpful to stick two small pieces of *Blu-tack* or similar 'rubber adhesive' to the top edge of the card, as shown in figure 2; this enables the acetate sheet to be held firmly in place while you are working on it.

Producing transparencies by hand

By far the quickest means of producing your own OHP transparencies is to prepare them by hand, using suitable marker pens. Either water-soluble or permanent pens can be used for this purpose, but it is strongly recommended that you use the latter, since water-soluble material tends to smudge when touched. Medium-tipped pens are best for most OHP work, and four basic colours – black, red, blue and green – are usually sufficient for most purposes. Avoid using yellow or orange pens, since material produced in these colours is usually difficult to make out, especially from the back of a room. If large areas of colour are required, these can be added using transfer film, which should be cut to the exact shape required using a scalpel *after* it has been applied to the transparency.

When putting alphanumerical information on OHP transparencies by hand, it is important to use a writing or printing style that *all* members of the viewing group will be able to read without difficulty. It is strongly recommended that you try to develop a clear lower-case printing style for this purpose, since this is generally far easier to make out than either upper-case printing or ordinary handwriting. Also, it is absolutely essential to make the letters big enough to be seen by those furthest from the screen. The recommended sizes for different forms of printing and writing are as follows:

lower case printing: just over $^1/_8$ in
(excluding ascenders and descenders)

upper case printing: roughly $^1/_4$ in

handwriting: as for lower case printing.

It is also advisable to leave a gap of roughly $^1/_4$ in between lines and to leave generous spaces between words, since this greatly

increases legibility. Thus, use of guidelines 1/4 in apart (as recommended in the previous section) can be of considerably help in getting both the size of the lettering and the spacing of the lines right, as illustrated in figure 3.

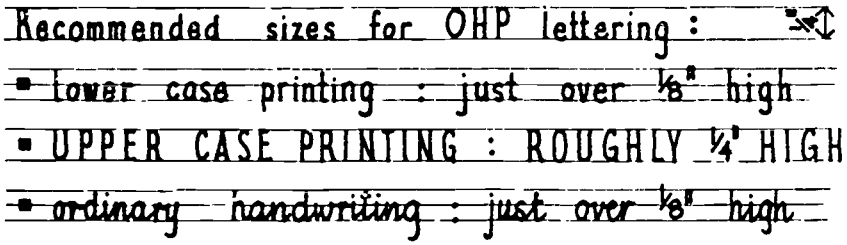

Figure 3: recommended sizes and spacing for hand-produced OHP transparencies.

It is, of course, also possible to use some form of stencil or template system to add verbal information to OHP transparencies, or even to use instant lettering or machine-generated lettering of some sort if a particularly high-quality finished product is required. For most purposes, however, hand-produced lettering is perfectly adequate, as well as being much quicker to produce.

Typing OHP material

Another popular – albeit much abused – method of producing OHP transparencies is to type the material. This can be done either by typing directly onto the acetate sheet using a special ribbon or carbon sheet, or by first typing the material onto paper and then making a transparency from this (e.g. using a suitable electrostatic photocopier or thermal copier). It must, however, be stressed that a standard office typewriter should NEVER be used for such work, since the letters that it produces will always be far too small to be seen clearly when displayed using an overhead projector. A special typewriter (known as a *bulletin typewriter* or *primary typewriter*) which produces letters roughly twice as large as an ordinary machine should be used for all OHP work. Electronic lettering machines (e.g. Kroy or Merlin) are also ideal for producing originals which can be made into OHP transparencies.

Producing OHP transparencies from opaque originals

Another standard method of producing OHP transparencies is to use a photocopier or thermal copier to prepare a transparency from an opaque original – e.g. a page of text. This can produce perfectly acceptable results *provided that the original material is suitable for OHP projection*. As we have seen, ordinary typed material is useless

for this purpose, and the same is true of most printed materials, since these are normally intended for individual study at close quarters rather than long-range viewing by a group. Thus, producing an OHP transparecy from (say) a diagram in a book or journal is nearly always worse than useless, since the resulting material will almost invariably be far too small and/or highly detailed to be seen clearly when projected, especially by the people at the back of the room.

If you are in any doubt about the legibility of the material you have produced, go to the back of the room in which you are to use it and check for yourself; you should be able to make out *all* the information without difficulty if your material is to be of any use.

Producing computer-generated OHP materials

In the same way as it is possible to use a word processor or similar computer-based system to create and produce opaque originals for duplication or printing (see booklet on "How to produce printed and duplicated materials", it is now possible to use the computer to design and produce OHP transparencies. Although it will probably be a long time before machines of this type start to appear in schools, they will probably become standard fixtures in most tertiary education and specialised training establishments in the not-too-distant future, and will undoubtedly prove to be of enormous help to staff in preparing OHP materials. Most systems of this type can be used to create both alphanumeric and graphic materials and print them out in OHP transparency form – in full colour, and with whatever size of lettering is wanted.

Some useful display techniques

Let us now look at some of the standard techniques that can be used to increase the effectiveness of OHP displays.

Progressive disclosure

This is one of the basic techniques that can be used in overhead projector displays, and one of the most useful from an instructional point of view. It involves covering up all or part of the material on a given transparency, and progressively revealing the material as the presentation proceeds. This has the double advantage of concentrating the mind of the learner on whatever item or section is being discussed at the time and maintaining interest by keeping him or her in suspense over what is going to be revealed next (always a good psychological ploy).

Progressive disclosure can be achieved in a number of ways, the easiest of which is simply to cover the material to be hidden with a

sheet of paper, card or other opaque material and then to move it out of the way as and when required. This can be quite effective when used with a simple list of headings of key points, which can be revealed and discussed one by one. There is, however, a tendency for the mask to fall off the projector before the material at the bottom of the transparency is reached, something that can be prevented by weighing it down with a suitable heavy object (e.g. a bunch of keys or a ruler).

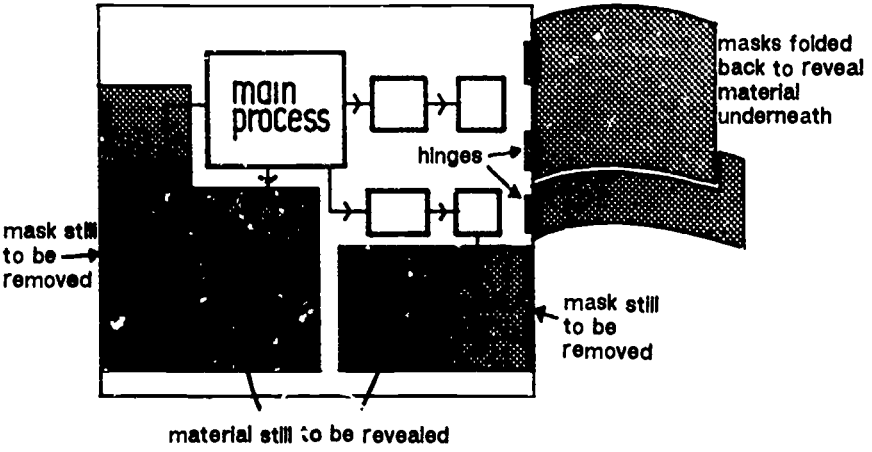

Figure 4: use of a system of hinged masks to allow progressive disclosure of the various sections of a block diagram

A more sophisticated and more versatile way of achieving progressive disclosure is to cover the various items or sections with individual masks of the required shape and attach these to one or more of the edges of the transparency by means of suitable hinges (e.g. pieces of Sellotape). The masks can then be pulled back one by one in order to reveal the different items or sections. This technique is particularly useful with graphic displays such as block and flow diagrams, since it enables the various sections of such a diagram to be revealed one by one, thus showing how the complete system is built up. The use of such hinged masks is illustrated in figure 4.

Use of overlays

Another standard technique that can be used to build up the information content of an overhead projector display is the use of overlays. This differs from progressive disclosure in that the whole of the area of the transparency is revealed from the start, with additional information being added to the original display by superimposing further transparencies on the original. Again, this can

be used to guide learners through the development of a complicated display stage by stage, thus avoiding the confusion and/or distraction that might well arise if the entire display were shown right from the start.

There are two basic ways in which material can be overlaid on an OHP display. The first is simply to lay separate transparencies, carrying the new information, on top of the first. This may give rise to problems of registration, however, particularly if the display is a complicated one or if exact positioning of the new information is crucial. The second method is to make use of hinged overlays attached to some or all of the edges of the original transparency, overlays that can then be flipped into position as and when required. Use of this system clearly enables the registration problems mentioned above to be avoided, the secret of achieving perfect registration being to add the information to each successive overlay *after* it has been attached to the original transparency and moved into its display position. The way in which a progressively more detailed display can be built up by adding a series of hinged overlays is illustrated in figure 5. Clearly, appropriate use of colours can add greatly to the effectiveness of such a display.

Use of animation

Although the overhead projector is classed as a 'still visual display' system, it is in fact possible to add an element of animation to certain types of OHP display. This can be used to show such things as the flow of fluids along pipes, and the direction of flow in flow diagrams. Two basic methods can be used to produce such apparent movement. The first is to incorporate special polarizing materials in the display, and to introduce a *polarizing spinner* into the optical system of the projector, between the platen and the projection head. The second is to make use of *Moiréé fringes* to create an illusion of movement in parts of the display. The materials and ancillary equipment needed to produce both types of animation can be obtained from specialist educational suppliers.

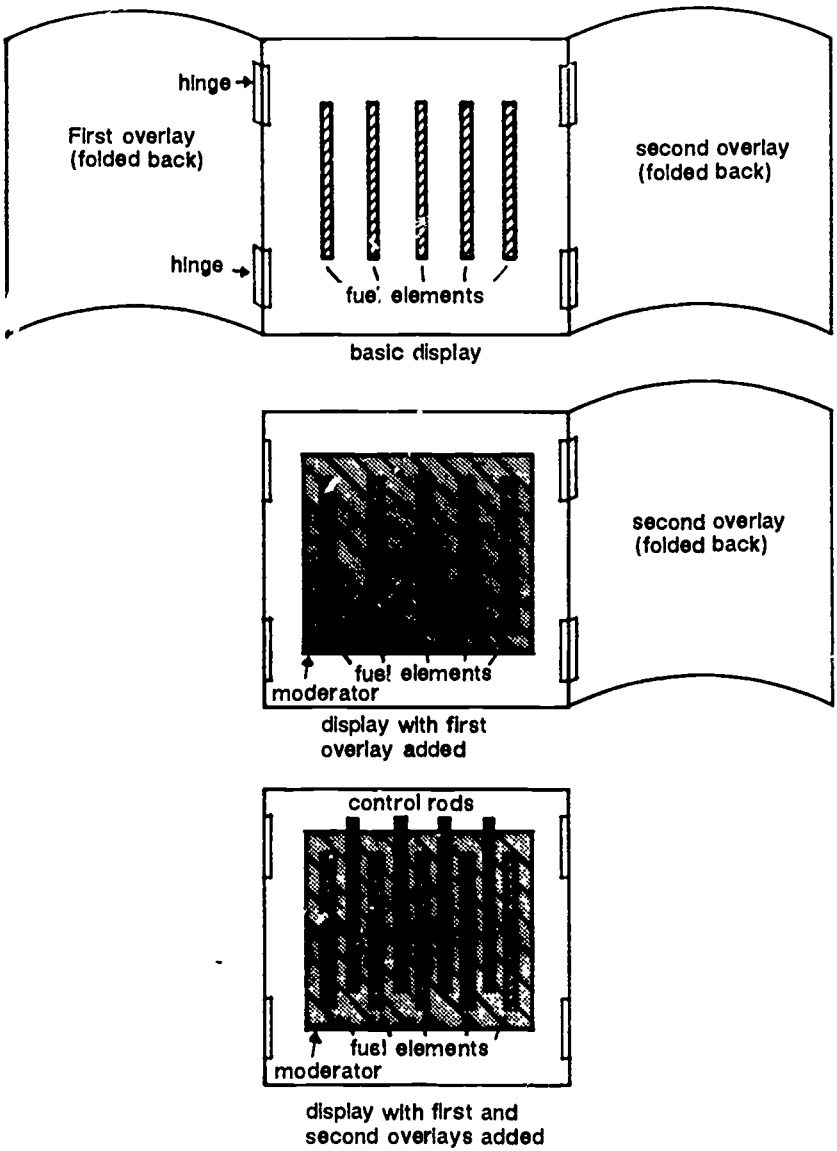

Figure 5: Use of a series of overlays to build up a progressively more detailed schematic diagram of the core of a nuclear reactor

Further Reading

1. *A Guide to the Use of the Overhead Projector*, by R W Rowatt; Scottish Council for Educational Technology, Glasgow; 1980 (An inexpensive booklet that contains many useful hints on how to make effective use of the OHP and how to produce OHP software).

2. *The Overhead Projector*, by A Vincent; Educational Foundation for Visual Aids, London; 1970 (A comprehensive guide to all aspects of the use of the OHP, including the design and preparation of software.)