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Resisting Technological Overkill: 35-mm Slides as an Alternative to Videotape/Videodisk

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An enticing array of advances in instructional media has appeared in recent years. Unfortunately, those of us who are interested in instructional technology are often accused of suffering from the 'young-child-at-Christmas" syndrome. We ask the powers that be for $1,000 or $10,000 or $100,000 to buy a new "toy," assuring them that (1) this new equipment will allow us to solve all of our instructional problems and (2) we will never ask for anything else again. This behavior is easily excused, of course, because our sister institution, the University of the Awesome Endowment, has already bought 50 of these toys, and we obviously must do the same.

Unfortunately, we often forget to ask an important question: What happened to all of the great instructional innovations of prior years? At least one of my colleagues has admitted to having a closet where toys from previous generations are buried [5]. What goes wrong? Why do some of the most fascinating technological breakthroughs of the past fall into disuse?

There are a number of explanations. Often, the individual who originally developed the program has retired or moved to another institution, and there is no one left who is interested in using the program or who knows how to use it effectively. Another common problem is transferability; instructional materials developed by one person may not be suited for classes taught by others, even at the same institution. A more subtle source of failure is the tendency to pay more attention to choosing the medium than to asking what kinds of tasks the medium is best suited to handle.

There is no doubt, for example, that computer-assisted instruction (CAI) can be beneficial for students [7]. And yet many of us have seen CAI programs that do no more with a $2,000 microcomputer than could be done with a few pieces of paper. Similarly, there is no doubt that videotape, and more recently videodisk, technology can improve instruction in the classroom. And yet it is a fact that many of the people who get involved with videotape stop after making only three or four tapes [3]. Microcomputers and videotape are powerful instructional techniques, but we must pay a price to obtain this power — a price in the cost of equipment, the flexibility of the programs produced, and, finally, the amount of time and effort required to produce satisfactory programs.

In recent years, we at Purdue have developed a series of audio-tutorial lessons and multi-image or lap-dissolve [1,2,4,6] lecture programs based on 35-mm slides as an alternative to more expensive visual techniques such as film or videotape. We have found several advantages to using slides for these purposes:

- It is cheaper to put together the equipment needed to make slides than that needed to make either videotape or film.
- Slide programs are flexible; they are very easy to edit.
- Slide programs are used to *enhance* a lecture; videotapes and films are more often used to *rep/ace* the lecture.
- The instructor retains control. Slides can be advanced as fast or as slow as needed. The order in which the slides are used is also under the instructor's control. Furthermore, since there is no prerecorded audio track with slide programs used in a lecture, the instructor retains control over the points that are made. These factors tend to make slide programs easier to transfer from one course to another. The medium conforms to our needs, rather than vice versa.

In the course of our work, we investigated a number of ways of making slides, and we feel that it might be useful to share some of the knowledge we accumulated with others who might be interested in using slides in their classrooms.

Negative (White-on-Black) Slides

Most black-and-white films are *negative* films. They give a white-on-black or negative copy of a black-on-white original. Most black-and-white films, however, are also continuous-tone films. They give a wider range of tones from light to dark, and they are not suited for making negative slides. We have found three films that are best suited for making negative slides: Kodak Technical Pan, Kodak Kodalith Ortho Type 3, and Kodak Reproduction Film.[1]

The principal advantage of Kodak Technical Pan film is that it is available in individual 36-exposure rolls, so it is often the best choice if you only want to make a few slides. Technical Pan is also the "fastest" of these films. On our copy stand it requires an exposure of 1 sec. at f32 or 1/30 sec. at f 5.6. It is, therefore, also the film of choice if you do not have access to a copy stand with bright enough lights to allow you to use the "slower" films described below. Unfortunately, Technical Pan is not a high-contrast film. The blacks are not as dark and the whites are not as clear as negative slides shot with either of the other films.

Kodalith, or 6556, is a very high-contrast film that gives much darker blacks and clearer whites than Technical Pan. Unfortunately, it is only available in 100-foot[2] rolls. In order to use Kodalith you will, therefore, have to learn how to bulk-load film into individual 36-exposure cassettes. Since Kodalith can be handled under a safelight without fear of fogging, this is not a very difficult task to master.

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[1]Kodak Technical Pan, Kodalith (6556), Reproduction Film (2566), Precision Line Film (LPD4), Ektachrome, Panatomic-X, Wratten, and Vericolor are all registered trademarks of the Eastman Kodak Company.

Kodalith is a slower film than Technical Pan. On our copy stand it requires an exposure of 1 sec. at f5.6. Kodalith also requires very careful control over exposure. Too much exposure leads to a blackening or filling-in of the clear white core of the image. Too little exposure gives a background that is not quite dark enough. We therefore bracket Kodalith by ±1/2 f-stop every time we shoot.

The principal disadvantage of Kodalith is its tendency to form pinholes, small dots or points of white that appear in the black background. Although these pinholes can be painted out with an opaquing solution, this process is tedious at best. We have found some correlation between the number of pinholes and the developer used to process this film. We get the best results using the liquid Kodalith A + B developer.

Kodak Reproduction Film, or 2566, is the standard against which negative slide films are compared. It is better than Kodalith because it gives fewer pinholes. It also has a more stable polymer base than Kodalith, which makes it a better film for use with multi-image or lap-dissolve programs that require dose registration. Unfortunately, it is only available in very large (500-foot) rolls!

Kodak 2566 is also less sensitive to light than Kodalith (we expose for 1 sec. at f4), and it is somewhat more sensitive to accurate exposure. This film is processed in a special developer known as Kodak 55 developer, which is available in 5-gallon containers. If you only shoot a couple of rolls of slides a year, it may not be economical to use 2566. However, if you intend to make a number of negative slides, it is undoubtedly the best film for that purpose.

Highlighting and Opaquing

There are two principal advantages to negative slides: (1) It is possible to paint out or *opaque* images that you do not want the students to see and (2) it is possible to *highlight* parts of a negative slide by adding color, thereby drawing students' attention to the most important information.

The ability to paint out, or opaque, a portion of a slide allows us to correct any imperfections in either the slide or the original artwork. More important, it allows us to take advantage of a technique known as *progressive disclosure.* As anyone who has ever attended research seminars knows full well, it is very easy to put so much information on a single slide that the eye cannot search out and focus on the most important facts or features.

Progressive disclosure uses a series of carefully matched slides to develop a complex set of ideas or a complex figure, one step at a time. We start with a number of identical copies of the original artwork. All but the most important features of the original are painted out in the first slide in the sequence. Each subsequent slide in the sequence then adds a little more detail until we finally reach a slide that has the complete original. Figure 1 shows a trivial example of the progressive disclosure technique.

The opaquing solution is applied to the slide with a very fine paint brush. Figure 2 shows the opaquing solution being applied to the “top,” or nonemulsion, side of a negative slide. The opaquing solution can also be applied to the “bottom,” or emulsion, side of the slide. If you are going to use one of the watercolors described below to highlight certain portions of the slide, apply the opaquing solution to the emulsion side of the slide. With patience, and some coordination, it is possible to paint our very fine details on a slide. We have no difficulty, for example, painting out individual pairs of dots representing the electrons in a Lewis dot formula of a covalent compound. We have used several opaquing solutions. Kodak sells a water-based opaque, but we have had a bit more success with an isopropyl alcohol-based opaque made by the Direct Image Corporation (1350) 5. Monterey Pass Rd., Monterey Park, CA 91754).

With patience and coordination, it is also possible to add color to a negative slide and thereby highlight certain portions. This technique inevitably draws the eye to the most relevant information on a slide. We have had the most success with Dr. Ph. Martin’s Synchromatic Transparent Water Colors, marketed by Salis International (Hollywood, FL 33020), particularly their cadmium (#2) and chrome (#3) yellows. These watercolors can be applied with a very fine paint brush, a cotton swab, or one of the applicators sold by Salis for this purpose. If the opaquing solution has been applied to the bottom side of the slide, the watercolor should be applied to the top.

Positive (Black-on-White) Slides

We have used three approaches to making black-on-white, or positive slides. It is possible to take a normal black-and-white film such as Kodak Panatomic-X, which usually gives a negative image, and use the Kodak Direct Positive Film developing outfit in a two-step process to bleach the slide to give a positive image.

It is also possible to use color films to copy black-and-white originals and thereby obtain a positive slide. Kodak Ektachrome 50 Tungsten film (EPY 50), for example, gives very good results. It strikes us as ludicrous, however, to use relatively expensive color films to make black-and-white slides.
If you are going to make more than just a handful of positive slides, the method of choice might be to use Kodak Precision Line Film (LPD4). LPD4 is the positive equivalent of Reproduction Film, or 2566. It is exposed under the same lighting conditions as 2566, and both films are processed in Kodak 55 developer. LPD4 gives a very high-contrast black-on-white slide on the same stable polymer base as 2566, and it is therefore ideally suited for use with multi-image slide shows.

White-on-Colored-Background

Negative slide films are so high in contrast that they can be tiring to the eye. It is possible, however, to make these slides appear softer by turning them into slides with white letters or lines on a colored background. The technique used to make these slides is called a *burn-in* or *burn-through,* and it requires a slide copier.

Burn-throughs are produced by a double exposure. The camera in the slide copier is loaded with a color film, such as Ektachrome 50 Tungsten (EPY 50) or Ektachrome Slide Duplicating Film (5071). A Kodalith or 2566 negative slide is then mounted in the slide copier and this white-on-black slide is copied onto the color film without advancing the film in the camera. The negative slide is then removed from the slide copier, a colored filter is placed in front of the camera, and the film is double exposed.

We use Kodak Wratten filters for this purpose. Filter #25 gives white on a red background, #35 gives white on purple, #47 gives white on blue, #56 or #61 gives white on green. We feel that the #47 filter gives us the best results.

The light that passes through the clear or white portion of the negative slide during the first exposure "burns into' and saturates the color film. The portion of the color film that corresponds to the black background in the negative slide is not exposed in the first exposure and therefore picks up the color of the filter in the second exposure. The result of this double exposure is a slide with white letters or lines on a colored background.

Alternatively, the color film can be exposed to light passing through the filter in the first exposure and then double exposed to light passing through the negative slide. In this case, the white light that passes through the negative slide "burns through" the colored background.

White-on-colored-background slides can also be made by contact-printing negative slides onto diazo films. Unfortunately, diazo slides are light sensitive, and they fade with continued use. A more attractive alternative to the two-step burn-through process involves the use of Kodak Vericolor Film (50—279). We do not believe, however, that the slides obtained using this film are quite as sharp as those made by the burn-through process.

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