

## A COMPUTER-ASSISTED APPROACH IN CLASSIFYING IMAGE ORIENTATIONS IN PHOTOMECHANICS

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### Abstract

The use of computers to facilitate instruction in higher education has been reported in many disciplines. In this paper, the role of the computer as a tool to help with complex learning is examined. The question as to whether computer-assisted instruction (CAI) can be appropriately developed by instructors who are not programming experts is raised. The author describes his efforts in putting the concepts of image orientation as used in graphic arts operations into a computer based lesson. Typical examples of how this CAI unit works and the instructional strategies in implementing it are given.

### Introduction

Because of the continued development of more powerful computer hardware at less cost in recent years, the use of computers to facilitate instruction at all levels of learning has been evidenced at home, in school, and at work. At the college level, developments of computer-assisted instructions (CAI) are quite active. For example, computer based lessons in biology and chemistry have been supported by the National Science Foundation and developed by community college instructors in Illinois (Suppes, 1979). Other disciplines like English, mathematics, and physics have been developed at various campuses in the United States.

As a graphic arts instructor, the author wishes to examine the state of the art of CAI. Is it just a little more than a set of expensive flash cards? Or is it an instructional technique which may be favored over the traditional classroom approach? More importantly, if graphic arts concepts are to be taught in CAI form, what are the considerations and skills that are demanded from graphic

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arts instructors who are not programming experts? By reviewing current literature on CAI and by developing a CAI unit on image orientations in photomechanics, this paper sets out to answer or form opinions about the above questions.

### Computer-assisted Instruction (CAI)

From an educational viewpoint, computer-assisted instruction is considered an instructional technique. While it is not intended to be used as a replacement for any existing teaching methods such as lectures, books, laboratories, etc., CAI can be appropriately used if factors like content, student, instructor, and environment are carefully considered and optimized (Kozma et al., 1978). For example, computers have remarkable data processing capabilities which can be programmed to interact with the student for complex learning. When using CAI, the student takes an active role in learning at his (her) pace; CAI drastically departs from the passive role of the student in the large lecture situation. In addition, computers have amazing graphic capabilities which help make CAI attractive and which have the potential, therefore, to make learning effective.

Briefly, a typical CAI unit may use any of the following three instructional modes: 1) the tutorial mode, which provides direct instruction; 2) the simulation mode, which uses the computer's graphic capabilities as an aid to building physical intuition (Suppes, 1979); 3) the drill-and-practice mode, which reviews contents of computer-based lessons for mastery or comprehension. Because the computer is the heart of CAI, it can also be used as a communication tool between students and the instructor and a test administering device (Bork et al., 1977).

### Image Orientation as the CAI Content

It was reported that CAI is particularly effective in presenting content which requires practice for mastery (Kozma et al., 1978). To gain direct experience in producing a CAI unit to teach graphic arts principles, the author chose the subject of image orientations in photomechanics as the CAI content for this paper.

The use of light sensitive materials in the form of films and plates has made the photomechanical reproduction method the most widely accepted practice in graphic arts.

Regardless of the type of printing processes used, one of the similarities in photomechanical reproduction processes is that they are generally composed of four image stages, i.e., from original stage, to film stage, to plate stage, and to reproduction stage. The four image stages are generally linked by the following graphic arts operations as shown in Figure 1.

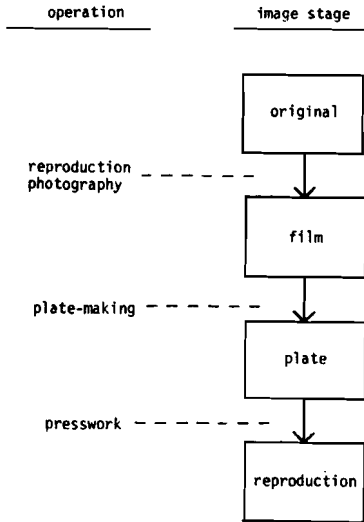


Figure 1. A block diagram showing the photomechanical process in general.

In order to reproduce texts or pictorial images in their correct orientations, e.g., right-reading positive as intended for direct viewing, images at film stage and plate stage are required to have different orientations for various printing processes. For example, a \*wrong-reading negative is generally used to expose a negative-working plate for indirect printing. While plate images are generally prepared in positive mode (unless the reversal effect is intended), they should be prepared in wrong-reading mode if it is intended for direct printing. Diagrammatically, typical image orientations for offset lithographic printing processes are presented in Table 1. Similar diagrams for letterpress, flexographic, and gravure printing processes are included in the Appendix A.

\*By convention, reading orientation of film images are judged by viewing from its emulsion side.

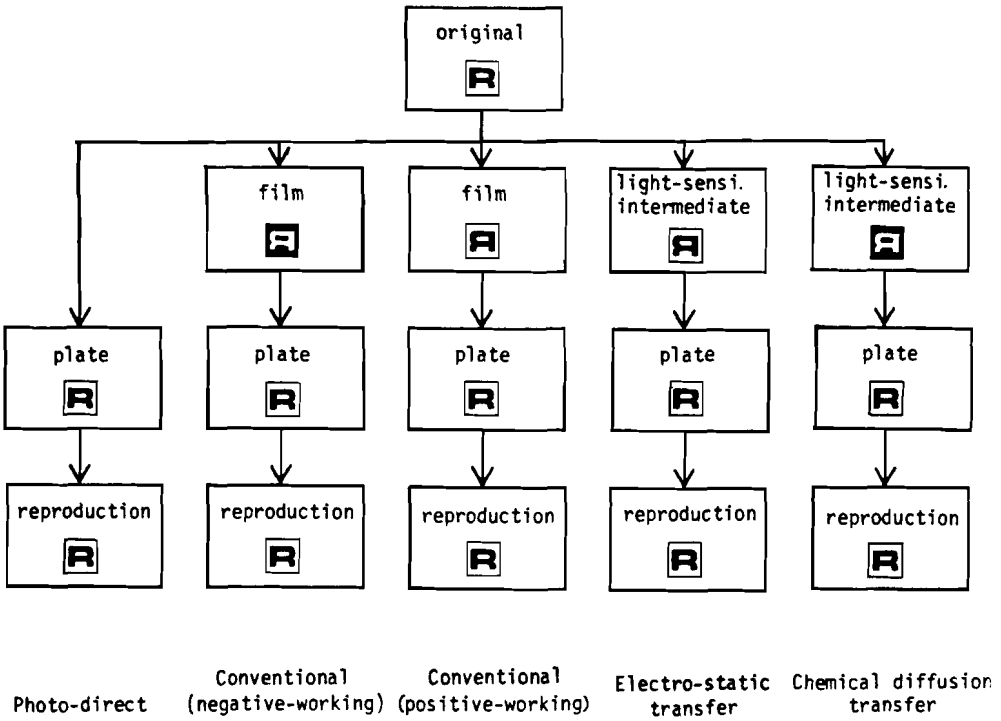


Table 1. Image orientations of typical offset lithographic printing processes.

Computer-assisted Approach in  
Classifying Image Orientations

From literature review, it became apparent that a CAI unit should be 1) highly interactive, 2) user-friendly, and 3) graphics-oriented. With these in mind, the subject of image orientations in photomechanics was developed into a CAI unit with the use of a micro-computer at RIT. This computer-based lesson contains four parts and is summarized in Table 2.

<u>Part</u>	<u>Contents</u>
I	Terminology-defining the vocabulary
II	Tutorial-presenting typical image orientations in photomechanics
III	Quiz-reviewing contents of parts I and II
IV	Drill and practice-learning to become effective through practice

Table 2. The make-up of the CAI on image orientations.

To explain, Part I defines the terminology with texts and graphics. The student (user) is given the choice of viewing one of four image orientations on the monitor. To present the definition of image orientation graphically, the asymmetrical letter 'R' is programmed in four different manners as shown in Figure 2.





<u>graphical symbol</u>	<u>image orientation tonal</u>	<u>reading</u>
	positive	right-reading
	positive	wrong-reading
	negative	right-reading
	negative	wrong-reading

Figure 2. Four modes of image orientations represented graphically by the letter 'R'.

Part II of the CAI unit provides direct instructions on typical image orientations for letterpress, flexographic, lithographic, and gravure printing processes. Because the amount of information the monitor can display at any moment is limited, some esthetical considerations in text display and hierarchical branching in programming are necessary. Again, using lithographic printing processes as an example, its hierarchical structure is shown in Figure 3. The user needs to specify the printing process up to the tip of the 'tree' and can then begin receiving the image orientation information for that particular printing

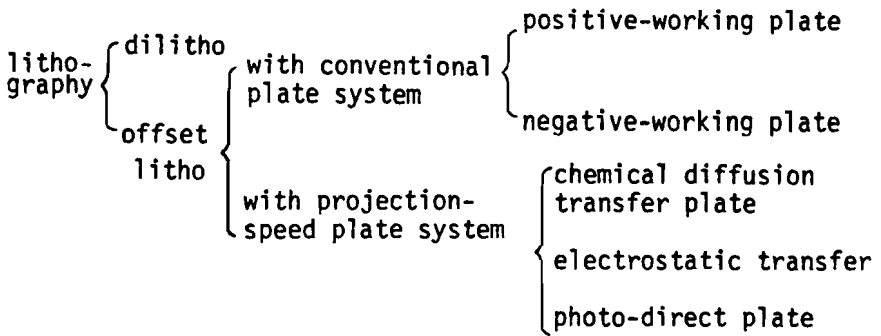


Figure 3. A hierarchical structure for lithographic printing processes.

process. Detailed flow charting of typical image orientations for lithographic options is included in Appendix B. Figure 4 shows a typical image orientation display for the offset lithographic process using a negative-working plate.

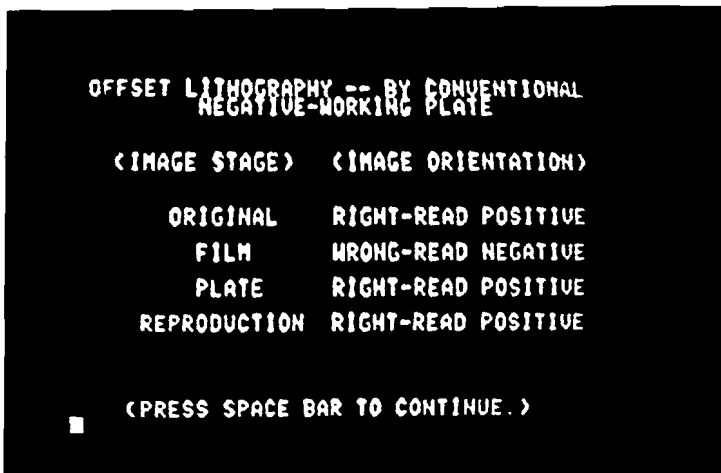


Figure 4. A typical display of image orientations in the tutorial part of the CAI unit.

Part III of the CAI unit is a quiz for reviewing concepts of image orientations which have been presented previously. The computer is programmed to respond to the user with appropriate comments as each test item being answered. At the end of the quiz, a score summary is shown, and the

option to try out the next part of the CAI is given.

Part IV of the CAI unit provides the user with a drill and practice opportunity for mastery of image orientation concepts in lithographic printing processes. Initially, the computer asks for the starting image stage and its reading and tonal orientation. Then the computer asks for the subsequent image stage and the type of light sensitive material the user wishes to use. As soon as the user has fed the above information into the computer, it responds with image orientation information for that subsequent image stage. The process can be repeated for a number of times at the film stage only and is terminated when the reproduction stage has been reached. Figure 5 illustrates a typical display of image orientations in the drill and practice part of the CAI unit.

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      (IMAGE STAGE)  (IMAGE ORIENTATION)
1 ORIGINAL          RIGHT-READ POSITIVE
2 FILM(CM)          WRONG-READ NEGATIVE
3 FILM(CT)          RIGHT-READ POSITIVE
4 FILM(CT)          WRONG-READ NEGATIVE
5 PLATE(NW)         RIGHT-READ POSITIVE
6 REPRODUCTION(OF) RIGHT-READ POSITIVE

      * END OF PRINTING *
      (PRESS SPACE BAR TO CONTINUE.)
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Figure 5. A typical display of image orientations in the drill and practice part of the CAI unit.

In programming the drill and practice part of the CAI, the following assumptions are used. First, the image conversion process is assumed to be done in an emulsion-to-emulsion condition. Second, the reading orientation of an image is assumed to be judged from its emulsion side. Given these assumptions, the alteration of image orientation can be predicted accurately with the following rules:

1. Between any two adjacent image conversion steps, e.g., from film-to-film or film-to-plate,
  - a) When a negative-working material is imaged, both tonal and reading orientation of an image are alternated.
  - b) When a positive-working material is imaged, only the reading orientation of an image is alternated.
2. Between any two adjacent image transfer steps, e.g., from plate-to-blanket or plate-to-substrate, only the reading orientation of an image is alternated.

It is interesting to note that content of the drill and practice exercises is generated by the user rather than being stored. In addition, the computer does not check for the correctness of the user-assembled reproduction process against any norm. It only acts as a loyal servant who keeps track of the image orientations accurately for the user. This way, the user has the maximum freedom to practice for comprehension.

#### Discussion and Conclusion

As "computer literacy" prevails, (Anderson et al., 1981), to have a graphic arts person learn programming for instructional usage is far easier than to have a programmer learn graphic arts. Therefore, programming for CAI should be encouraged and done by graphic arts instructors.

Computer-assisted instruction is not intended to replace the functions of books or lectures. Thus, its special features such as self-paced learning, user-and-computer interaction, and graphic capabilities should be effectively used. Because most graphic arts instructors do not have extensive experience in instructional computing, reviewing some existing CAI units and attending computing workshops are useful. Once an idea for CAI is formulated, it should be discussed and supported by other faculty. Doing this tends to make the idea better focused.

In the course of developing the subject of image orientations into a CAI unit, the pacing factor was experienced in the area of adopting programming skills and debugging programs. Therefore, sufficient time should be allotted in long stretches. A good understanding of the capability as well as the limitations of the computer hardware can save many hours of frustration. The esthetics of



CRT display for legibility and for avoiding eye fatigue were also essential.

As to the content of the CAI unit on image orientation, with further tryout and refinement, it should provide students with an enhanced opportunity to learn important concepts in graphic arts operations. It also serves as an extension of a one-on-one contact basis between the faculty and the students.

#### Acknowledgement

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## Appendix A

The following diagrams (figure 6, 7, 8) show typical image orientations in letterpress, flexographic, and gravure printing processes.

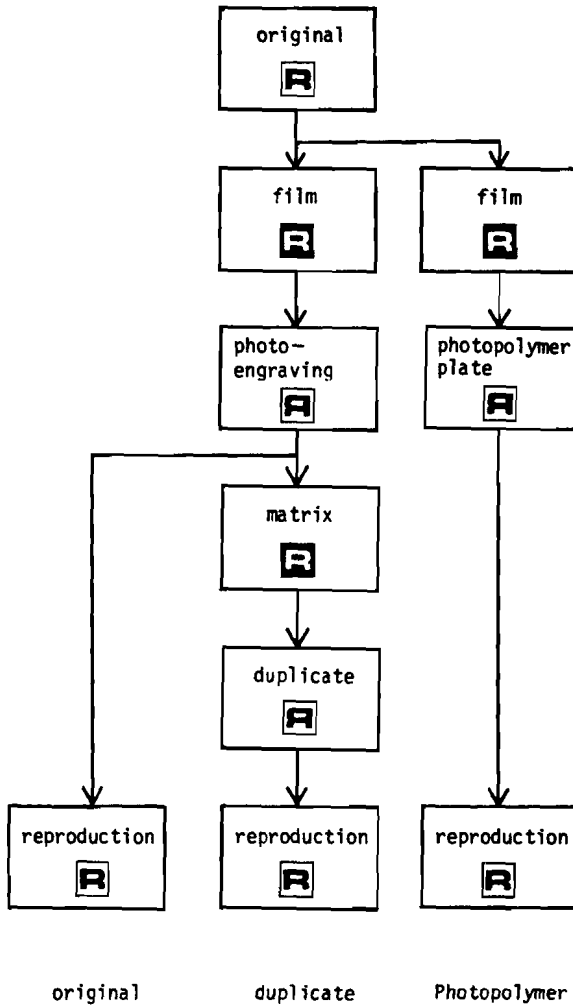


Figure 6. Image orientations of typical letterpress printing processes.

(Appendix A, continued)

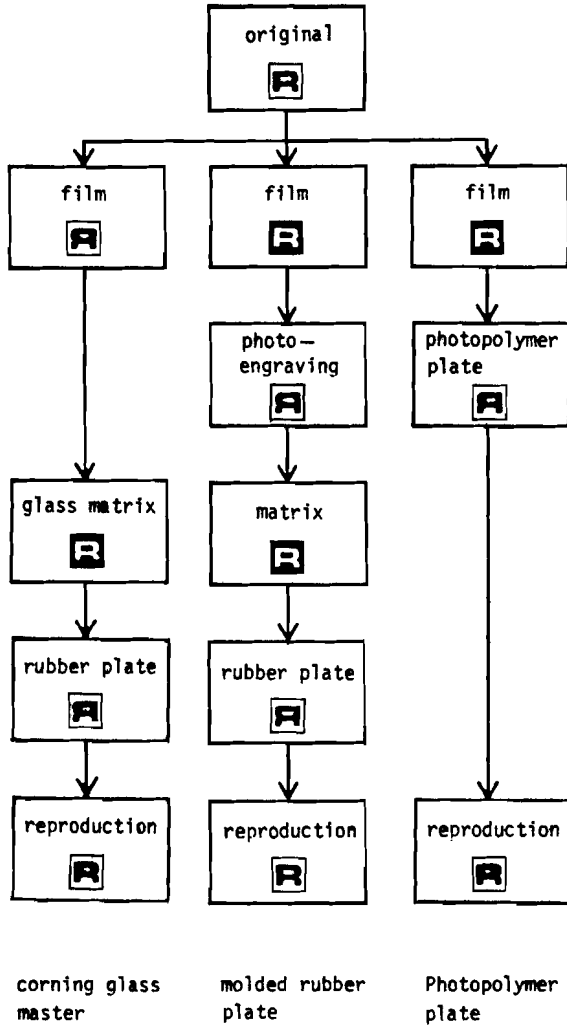


Figure 7. Image orientations of typical flexographic printing processes

(Appendix A, continued)

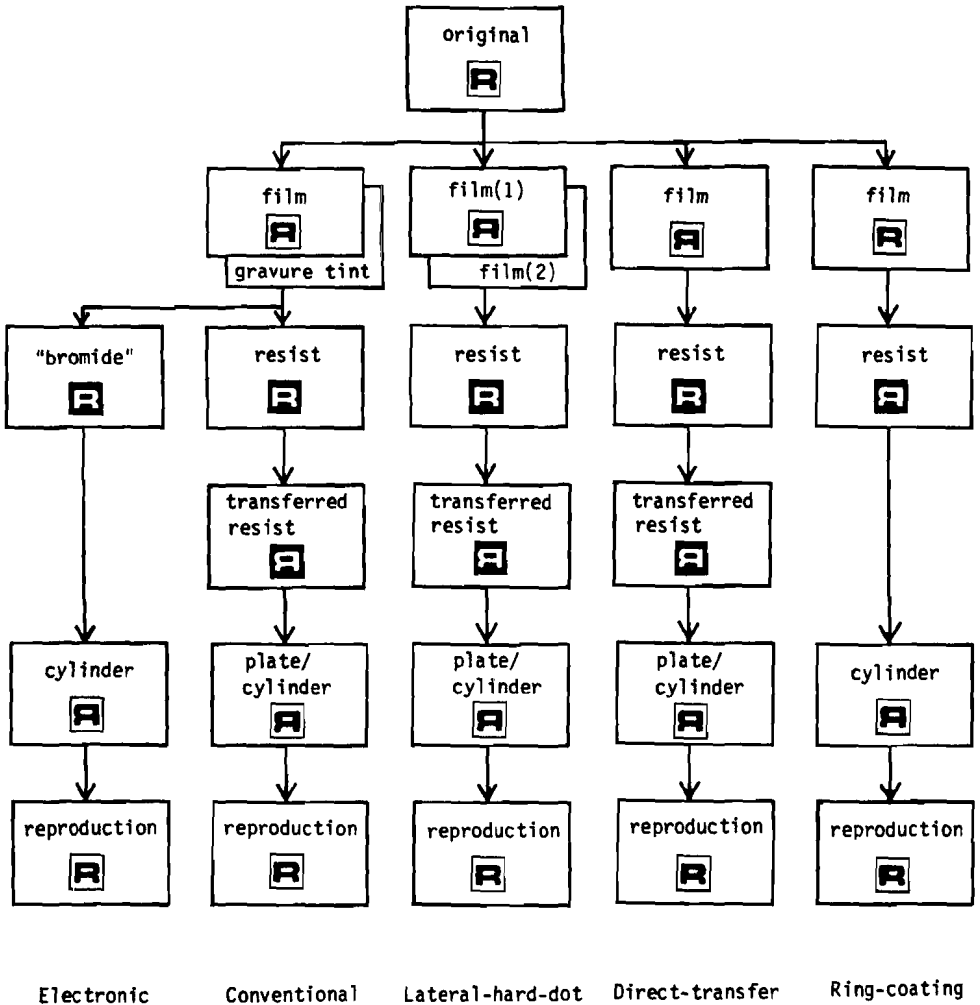
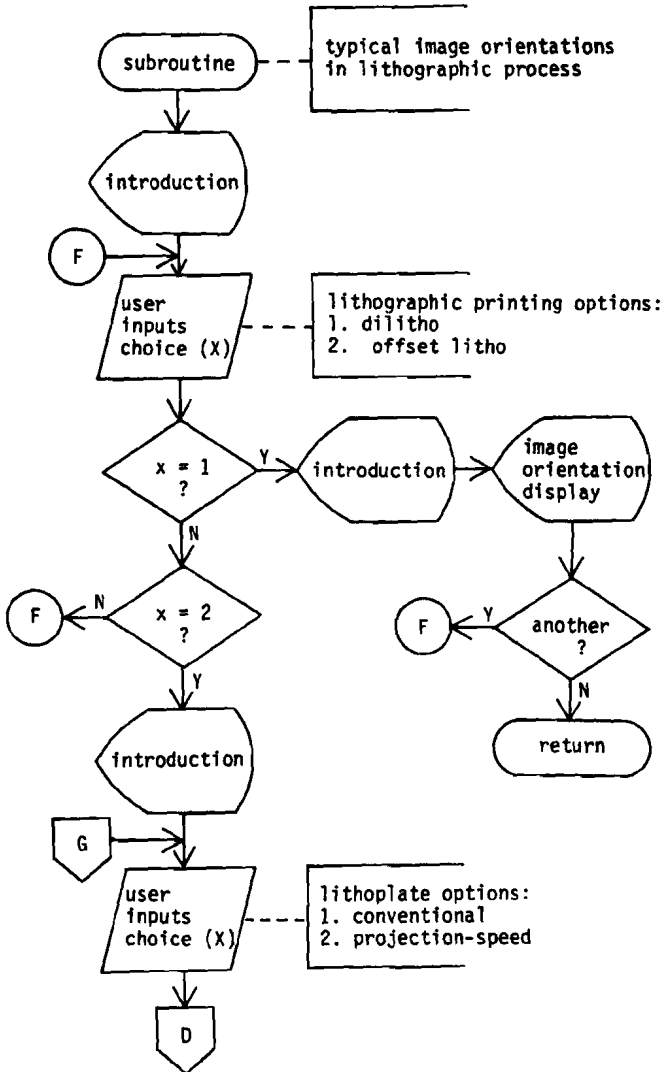


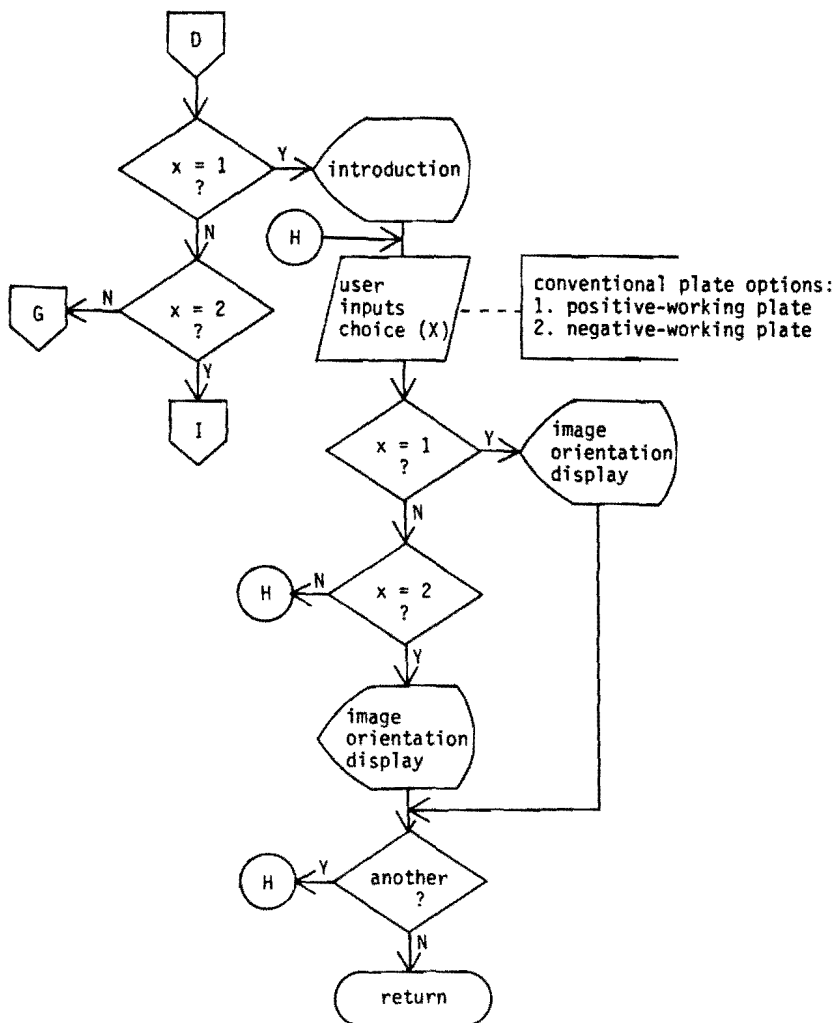
Figure 8. Image orientations of typical gravure printing processes.

## Appendix B

The following flow charts are part of the CAI documentations. They show, step by step, how image orientations in lithographic processes are programmed.



(Appendix B, continued)



(Appendix B, continued)

