This paper is concerned with pictorial means of communicating instructions for the use of equipment. The problems differ from those involved in development of discrete symbols, in that instructions require representations of states, actions, and conditional relations comparable to those represented in natural language. Accordingly, our approach concentrates on analogues of linguistic factors and pictorial aspects of sequence and context.

Two tasks were used involving interpretation of sequences of pictorial instructions for an apparatus. In one task subjects gave a verbal interpretation of pictorial instructions; in the other task they used the same instructions to operate the device, which simulated the operation of an English pay-phone. Comprehension was affected by how much of the apparatus was depicted in each picture, segmentations of the picture sequence, and the use of insets. The effects of graphic variables and the error patterns implicate cognitive structures underlying comprehension of pictorial instructions (especially relations between actions and states). Amongst other comparisons with natural language, the inferential nature of interpretation is emphasised. Differences between the two tasks indicate people's strategies in using instructions to operate equipment. Indeed, the effect of graphic variables can only be understood in the context of users' strategies and their preconceptions about particular equipment.
There has been surprisingly little research on pictorial instructions for the operation of equipment. Obvious applications include international usage and user populations of limited literacy or with impaired language. Even literate native speakers of a language often find written instructions difficult to follow. Not only might pictorial instructions serve as an alternative to verbal texts, but they might also aid comprehension when the two are presented together.

Discrete graphic symbols are in widespread use and have received some attention in human factors research (Easterby, 1970; Cahill, 1975). However, their function is restricted to denotational reference or single unconditional commands. For most equipment whose operation requires a paragraph of instructional text, actions and their preconditional or resultant states must be represented. If these are to be structured into an unambiguous message, it would be desirable to parallel the use of logical connectives as well as various linguistic devices that influence interpretation (e.g., sentence structure and punctuation). If direct functional analogues for these variables are not to be found, then one needs either to teach a new, international visual language or to find other means to guide the user's interpretations.

The approach to visual language taken by Premack (1971) with primates is to attempt to replace virtually all lexical items or morphemes with logograms or discrete symbols. To a large extent, the representation of relationships and most function words is arbitrary. Indeed, this approach has not proved a clear success with aphasic patients (Gardner, 1977). Bearing this in mind, we decided to use "comic strips," where representational pictures, corresponding to phrases or clauses, individually have fairly unambiguous semantics (conceptual reference), but whose sequential relationships provide a problem of inference. Recent ventures by designers into the use of such structured pictorial sequences have been restricted to meeting specific equipment needs, such as the telephone (Ericsson, 1972; Hadler, 1972; Design, 1975), and the research has a characteristically ad hoc approach. Almost a decade ago Kolers (1969) pointed out that "we need to study the kinds of instructions that can be represented pictorially, the characteristics of such pictures, and the rules useful in their successful concatenation - the syntax of picture writing." While information on a wide range of topics is available to the designer of verbal instructions and information (Broadbent, 1977; Wright, 1977; Wright & Barnard, 1975), there appears to be little published work examining more general issues associated with the comprehension and use of pictorial instructions.

Even individual pictures are not necessarily understood "directly." Conventions underlie the reading not only of deliberately symbolic art (e.g., Egyptian wall paintings or Botticelli's "Primavera"), as delineated by art historians (Gombrich, 1950, 1972; Goodman, 1968), but also of simple line drawings or any representational depiction (Arneheim, 1974; Deregowski, 1977). However, sequences of pictures present the additional problems of the logical and semantic links between pictures. Although we have some speculative notions about spontaneous interpretations of smoothly changing visual sequences (Michotte, 1963), little is known about juxtapositions of static or noncontinuous images. Cinematic montage is an example of such juxtapositions for which people have a visual sophistication. Mascelli (1965) has articulated some of the cinematic rules, but the only investigation relating