user level and extended support for scripting.

One of our long-term goals is to be able to automatically animate programs. For the near-term, we are developing tools to simplify the animation process. For example, it seems possible to eliminate the animator from the loop, and allow the animations to be done by an algorithm designer (by just specifying interesting events and names of library views), or even by a user (by pointing to a data structure declaration in a program and then picking a view from a list of available views for that type of data structure).

Many of our images suffer from a lack of resolution or become unacceptably slow on large cases, so we are interested in investigating the use of more advanced hardware and software systems for Balsa-like activities. In particular, preliminary studies indicate that color will play an important role in the future, especially in dynamic displays.

On the other hand, we can apply many of the techniques that we have learned to much less powerful systems, so we are also interested in investigating the use of less powerful personal computer systems for Balsa-like activities. While this will mean giving up many of the advanced features to which we have become accustomed, we feel that our experience will enable us to utilize personal computers, such as the IBM PC or the Apple Macintosh, for algorithm animation. Furthermore, we have the capabilities of Balsa available as a test-bed for alternative animation techniques that might be appropriate in less rich environments.

Finally, we believe that the wide range of dynamic images that we have created and the ways we provide users to interact with them suggest a number of intriguing possibilities on using personal computer systems as a supplement, or even as an alternative, to traditional printed media. We expect to explore this area much more deeply in building upon the material described here, and in developing more advanced versions of our system.

Acknowledgments

Many people have participated in the implementation of Balsa and the underlying software. Without trying to mention all of the participants, we do want to acknowledge the efforts of Steve Reiss, Joe Pato, and Mike Strickman. Special thanks to Janet Incerti and Steve Feiner for their usual meticulous readings and insightful comments on drafts of this article.

Partial support for this research was provided by the Exxon Education Foundation, and by the ONR and DARPA under Contract N00014-83-K-0146 and ARPA Order No. 4786. Partial equipment support was provided by NSF Grant SER80-04974 and by Apollo Computer, Inc. Partial support for the second author was provided by NSF Grant MCS-83-08806.

References

15. Ronald Baecker, Sorting out Sorting, 16mm color sound film, 25 minutes, 1981.