

# Users and Customizable Software: A Co-Adaptive Phenomenon

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May, 1990

## Abstract

Co-adaptive phenomena are defined as those in which the environment affects human behavior and at the same time, human behavior affects the environment. Such phenomena pose theoretical and methodological challenges and are difficult to study in traditional ways. However, some aspects of the interaction between people and technology only make sense when such phenomena are taken into account.

In this dissertation, I postulate that the use of information technology is a co-adaptive phenomenon. I also argue that customizable software provides a particularly good testbed for studying co-adaptation because individual patterns of use are encoded and continue to influence user behavior over time. The possible customizations are constrained by the design of the software but may also be modified by users in unanticipated ways, as they appropriate the software for their own purposes. Because customization patterns are recorded in files that can be shared among users, these customizations may act to informally establish and perpetuate group norms of behavior. They also provide a mechanism by which individual behavior can influence global institutional properties and future implementations of the technology. The presence of these sharable artifacts makes it easier to study customization than related co-adaptive phenomena such as learning and user innovation. Because some mechanisms may be the same for all co-adaptive phenomena, findings about use of customizable software may also shed light on user's choices about when to learn new software and when to innovate.

Current research models do not provide useful ways of exploring co-adaptive phenomena, thus requiring new research models and methods. Research on technology and organizations commonly follows one of two theoretical models, each of which is inadequate to account for how users customize software. One treats technology as a static, independent variable, which influences the behavior of the people in the organization. The other treats the organization as the independent variable, in which decision-makers in an organization make strategic choices about technology and appropriate it for their own purposes. The structurational model proposed by Orlikowski (1989) takes both perspectives into account and incorporates an active role by individuals in the organization. This dissertation extends her analysis by examining the *co-adaptive* relationship between users and user-customizable software: users both adapt to the available technology and appropriate the technology, adapting it over time. These appropriations may take the form of user innovations which may change both the technology itself and the characteristics of the organization, such as who communicates with whom and how coordination of work processes is handled.

The theoretical model and evidence for co-adaptation is first illustrated with data from a two-year study of the Information Lens, a software application that allows users to customize the process of managing their electronic mail. I describe the development of the Information Lens and identify the interactions between the technology and individual users in the context of the organization. I also examine the individual patterns of use of Lens rules and trace patterns of sharing of rules among members of the organization. I then examine user customization of software in greater detail, in a study of Unix users at MIT's Project Athena. The data consist of interviews and records of customization files of 51 members of the Project Athena staff. The data is presented from the perspective of the structurational model, with a micro-level analysis of the customization decisions by individual users. The key findings include:

1. The specific identification of the interaction between users and customizable software as a co-adaptive phenomenon, supported by field data.
2. The theoretical linking of co-adaptive phenomena and the structurational model and evidence for a mechanism by which individual interactions with technology affect the organization.
3. The discovery of common patterns of customization:
  - a. Users are most likely to customize when they first join an organization, which is when they know the least about the technology and their eventual use of it.
  - b. Customization activities are often conducted as a way to explore a new software environment.
  - c. Users attempt to incorporate their current work context into their customizations.
  - d. Over time, most users make fewer and fewer customizations, regardless of level of technical expertise.
  - e. Some external events, especially those that cause users to reflect upon their use of the software, increase the probability that users will customize.
  - f. Users who customize like to maintain the same environment, even when the software changes. They will either retrofit the new software to be like the old or refuse to use it at all.
  - g. The most common on-going customization occurs when the user becomes aware of a commonly-repeated pattern of behavior and encodes it as a customization.
4. Customization cannot be considered a primarily individual activity. The following patterns of sharing occurred:
  - a. Users are most likely to borrow customization files when they first join the organization. These files are rarely evaluated for effectiveness and may have been created many years ago.
  - b. A small group of highly technical individuals act as lead users of new technology. They are the first to explore new software and create a set of customization files that other people then borrow. However, the authors of these files receive little or no feedback as to the effectiveness or use of these files.
  - c. Less technical individuals take on the role of *translators* for other members in their groups. They interpret individual user's needs and create sets of customizations organized to meet those needs.

I conclude with a discussion of the theoretical implications, including support for and elaboration of the structurational model and the beginning of a theory of the use of customizable software. I propose changes in the software development process (to include observation of use in the field as an important input to future development), in software design (to include mechanisms that support reflection about use of the software and mechanisms for sharing of customizations), and for managers (to support periodic "maintenance" of skills and to support translators and help them provide more effective customizations for others in the organization).

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### **Acknowledgements**

I am deeply indebted to two people, who were instrumental in this dissertation. Professor Wanda Orlikowski gave generously of her time and I greatly enjoyed our many research discussions. She introduced me to a new body of literature and shared many insights. Professor Lotte Bailyn taught me new ways to look at data, took the time to read and carefully comment on my papers, and gave me encouragement and practical advice when I needed it most. Both provided a supportive intellectual environment and I cannot thank them enough.

I would also like to thank the members of my committee. Dr. Lucy Suchman was a source of inspiration and helped to change my ways of looking at the world. Professor Marcie Tyre gave challenging, insightful comments and helped me think more deeply about the theoretical issues in this research. Professor Tom Malone supported the work on the Lens study and encouraged me to think about the software implications of the research. Professor Tom Allen showed the importance of communication patterns in organizations and provided useful ideas about how to look at and present the data. Phyllis Reisner, Deborah Tatar and Randy Trigg gave me insightful comments on an early draft and I enjoyed interesting discussions about customization and the Lens study with Christina Allen, Danny Bobrow, Stu Card, Tom Finholt, Frank Halasz, Tom Moran, Jim Miller, Don Norman, Franklyn Turbak, Isaac Salzman, Hank Strub, and Ramana Rao.

I have learned a great deal from my fellow graduate students. I particularly want to thank Dietmar Harhoff, Abbie Griffin, Ben Whipple, Brad Hartfeld, Andy King, Jane Salk, Kevin Crowston, Dave Rosenblitt, Jin Tae Lee, Maya Bernstein, and especially Mark Ackerman, for challenging, on-going exchanges of ideas. Sharon Cayley deserves special mention for her practical advice, encouragement and occasional sanity checks.

I want to thank my first thesis advisor, Professor Murray Sidman, for teaching me the value of good writing and clear thinking. Professor Hal Abelson was responsible for my coming at MIT in the first place and provided a wonderful role model. Professors Andy Lippman, Glorianna Davenport and Chris Schmandt at the Media Lab kept me thinking about how all this relates to multi-media.

The staff at Project Athena patiently put up with all my questions and generously donated their time and I especially want to thank Beth Anderson, Paul Boutin, Don Davis, Eduard Guzovsky, Matt Hodges, and Brian Michon for many late night discussions. Professor Earll Murman and Ron Orcutt deserve special thanks for providing me with access to Athena.

I am grateful to Digital Equipment Corporation, for providing me with a scholarship and the opportunity to conduct this research. Many people at Digital were helpful over the years, in particular Jack McCredie, who first brought me to Athena and George Champine who continued to be supportive

throughout. I also wish to thank Jim Gettys, Jim Miller, Win Treese, Vik Vyssotsky and Jan Walker from the Digital Cambridge Research Lab for their insights and discussions, Carl Klempler, for being a wonderful person and Branko Gerovac for becoming my technical sponsor and giving me useful advice. I'd like to thank Shirley Stahl, of the Graduate Engineering Education Program, for her understanding and help and Bob Glorioso and John Manzo for efforts far above and beyond the call of duty.

Sometimes, the best help is from people who are in a completely different field. I want to thank Krzysztof Blusztajn, Barbara Slack, Ignacio Lopez, Mary Logue, Johann Sandmann, Ellen Garde, Misha Lakher, Marek Kloczewiak, Agnes Virga and the others, for Thursday night dinners with no mention of management. Also, my thanks to Bob McKie, Jill Bennett and the Border Cafe, and Michelle Fineblum, Debby Hindus, Ottavia Bassetti, Michael Granat, Bonnie Samet and Peter Brady for friendship and support. I also want to thank the members of the SIGCHI executive committee, especially my co-chair, Austin Henderson and Phyllis Reisner, Marilyn Mantei and Carrie Ehrlich, for helping me to stay in touch with the outside world and being so understanding during the final stages of the dissertation.

My thanks to George and Jean Brady, who encouraged me for many years. Finally, thanks to my family, Mum, Dad, Heather and Trevor, for their love and support.