

Mobile Technologies at the Boundary of Work and Life

Cheryl Geisler

Language, Literature & Communication
Rensselaer Polytechnic Institute
Troy, New York 12180
+1 518 271-7718
geislcr@rpi.edu

Annis Golden

Department of Communication
State University of New York at Albany
1400 Washington Avenue
Albany, NY 12222
+1 518 442 4870
agolden@albany.edu

ABSTRACT

We report the results of structured interviews conducted with 42 PDA users to document patterns of mobile use in relationship to work-life arrangements. Results suggest that, though originally designed as a technology of the workplace, PDAs are regularly crossing the boundary between the workplace and personal life. We describe three patterns of mobile use that emerge from the data (work-intensive, life-intensive, and integrated) and identify differences in actual work-life arrangements and adoption history for each use group. We conclude by discussing the ways these patterns of mobile use are related to the social and historical context of work-life arrangements and consider implications for the design of mobile devices.

Keywords

Hand held devices and mobile computing, computer mediated communication, home, office and workplace, user studies and fieldwork, empirical methods, qualitative

INTRODUCTION

Handheld computers, or personal digital assistants (PDAs), represent a species of mobile technology with roots in the form of systematic time management widely practiced by professional and managerial workers [16]. According to the Consumer Electronics Association [9], there are upwards of 5 million PDAs now in use in the United States. With built-in applications for appointments, addresses, notes, and tasks, PDAs have computerized and miniaturized the functions of paper-based personal organizers from the world of work, such as the Filofax, Franklin Planner, Daytimer and Rolodex, which facilitate the coordination of activities and communication with others.

While not as pervasive a technology as mobile telephony, the convergence of wireless technologies promises to propel PDAs into more widespread adoption and to heighten their use as collaborative devices for communication and information sharing [9]. However, there are already strong signs in media representations that PDAs have moved beyond the world of work. Churchill and Wakeford [7],

following Du Gay's "circuit of culture" model [13] in their analysis of mobile technologies, recommend looking to media representations for insights into how users may view devices, what motivates acquisition, and what expectations for use adopters may bring to the experience of incorporating a new technology into everyday life.

To summarize our analysis of media representations of PDAs, we have found that advertisements (similar to Churchill and Wakeford's [7] analysis) associate PDAs with images of masculinity, individualism, and competition. When the PDA is associated with images of life outside work, it is often with extreme sport rather than family. However, a detailed analysis of technology reviews and other articles on PDAs from 1995 to 2000 yields a much different set of representations.

As early as 1996, technology reviews called attention to the border crossing potential of the PDA, with various reviewers representing the devices on kitchen tables [1] and at the bedside [22, 39]. By 2000, these representations were even more diverse and appearing in a wider variety of publications. PDAs were being represented as used by wives to play solitaire [2], as the subject of envy for neighbors in the apartment down the hall [5], and as guides to bar hopping with friends [21]. The trend may be accelerating: In 2001, reviews have shown PDAs in the hands of mothers [36, 30], Gen Y women [15], tech-savvy kids [32], and teachers and students in public schools [31]. The May 2001 issue of *Consumer Reports* featured PDAs on its cover, a powerful portent of the technology's diffusion into the mass market and life outside of the workplace.

While discussion of PDAs abounds in the popular press, descriptions of use are anecdotal rather than systematic and analytical. From a technical standpoint, analysis of the PDA has been largely limited to discussion of its role in initiating a paradigm shift in the design of human-computer interactions: the successful technological implementation of handheld computers challenged the assumption that more was necessarily better in computational devices. The fact that PDAs, while originally designed as a workplace technology, appear to be crossing the boundary between work and life, suggests that documenting and understanding the meaning of patterns of PDA use should be done within the context of culturally defined work-life relationships.

The goal of this study was therefore twofold: 1) to undertake a systematic approach to collecting data on PDA use in order to document the extent and manner in which PDA use crosses the boundary between work and life outside work, or is used to manage that boundary; 2) to bring a more broadly contextual approach to analyzing that data, which has been recently called for in human-computer interaction research. Theoretically, our approach to analyzing and interpreting our data is informed by activity theory, which provides an analytic framework for examining the evolution of technology in cultural and historical context [16, 17, 25, 26, 27].

WORK-LIFE RELATIONSHIPS AND PDA USE

We suggest that understanding PDA use requires not only documenting individuals' patterns of practices but interpreting those practices within two contexts. The first context is how the individual has arranged the relationship between work and life outside of work. The second, larger context, is the combination of sociohistorical conditions and culturally specific work-life ideologies that inform the individual's arrangements. Individuals' work-life arrangements are presented in the analysis of the data that follows. The larger sociohistorical and cultural context is presented first.

The widespread separation of workplaces from homespaces that took place following the Industrial Revolution gave rise to an ideology of "separate spheres." Within this framework, work and family, or personal life, were distinct not only in terms of location. They had different values and psychological orientations. The workplace was public, masculine, and competitive, while the homespace was private, feminine, and nurturing [24, 34, 40]. The ideology of separate spheres, though more of a reality for middle class workers than the working class, nevertheless exerted a powerful moral imperative as an ideal work-life arrangement.

Several factors converged to undermine this ideology of work-life segregation in fact, if not wholly in cultural value. The first was the major influx of women into the workforce in the United States beginning in the early 1970s, propelled by social changes such as the women's movement, and economic changes that compromised the ability of single earner families to maintain the standard of living they enjoyed in the post-war era [3, 10]. Women's employment outside of the home eroded the role specialization that characterized the world of separate spheres, and led to greater involvement by men in domestic labor. Though there is disagreement among work and family researchers about the extent of this trend, with some arguing that women continue to shoulder disproportionate responsibility for managing the domestic arena, there is also compelling evidence of role convergence between men and women, as compared with the patterns of the first half of the 20th century [29].

At the same time as these social changes and economic changes were taking place, advances in information and communication technology changed not only the nature of the work that many Americans performed but made it

possible to accomplish work at times and places outside of the traditional workday and place. Cairncross [6] predicts the blurring of lines between work and home life as more and more people work from home. According to the International Telework Association and Council, 19.6 million workers telecommute at least once a month [28]. Not only does work cross over into the homespace; communication technologies like cellular phones, e-mail, and instant messaging [33] facilitate the integration of personal life into the workplace.

These combined circumstances bring a new construct into focus: work-life boundaries. What was taken for granted as fixed and unchanging in a world of separate spheres becomes problematic in this new set of social and technological conditions. A sophisticated theoretical framework has arisen to examine this construct. Clark [8] identifies characteristics of work-life borders to explain alternative arrangements: permeability, flexibility, strength, and blending. Jorgenson [23] looks at work-life management as an ongoing process of "boundary work," with boundary as a symbolic construct that individuals actively monitor.

Yet though the whole of idea of work-life borders has become more complex and problematic, the moral imperative implicit in the ideology of separate spheres has remained remarkably persistent: private life must be protected from public life; segregation of work and home is preferable to integration. This in turns leads to questions about appropriateness of applying the same techniques of organization and management that are used in the world of work to life outside of work.

It is within this cultural context that patterns of PDA use must be understood. Faced with the necessity of managing the boundary between work and life-related activities, users may choose to use their devices for boundary maintenance or boundary crossing, for segregation or integration. As the results of this study will suggest, patterns of PDA do not necessarily reflect users' work-life arrangements directly, but are filtered through the work-life ideologies of boundary work.

METHOD

The design for this study was structured by three considerations. First, although the popular literature on PDAs is replete with discussions and anecdotes, we found little systematically collected data concerning the extent to which PDAs or other mobile technologies cross the boundary from work to life outside of work. To answer the need for quantitative data on this topic, we included close-ended questions in our interview protocol. At the same time, however, earlier exploratory interviews with users suggested that adequate constructs did not exist for describing their interactions with PDAs. Thus, to answer the need for theory development, we followed up in our interviews with more open-ended questions probing for participants' understandings in their own terms. And finally, although we expected PDA users to have poor recall about the content of their PDAs, we also knew that many considered their PDAs extremely private. Thus, to

answer the need for assessing PDA content in detail but at a distance, we developed a content classification task described more fully below.

PDA Content Classification Task

To ascertain patterns of PDA use, participants were given a content classification task in which they looked at their PDAs during the interview and reported the number of items they considered work-related, life-related, or related to both work and life. Since it was impractical to expect them to review the entire contents of their PDAs in the time allotted, we asked about a stratified sample from the four main PDA applications.

- For APPOINTMENTS, we asked about the most recent complete week, starting with Monday and going through Sunday. If users judged this week not typical, we asked them to choose a more typical week.
- For ADDRESSES, we asked them to look at 5 screenfuls of contacts.
- For NOTES and TASKS, if users used categories, we asked them to classify the categories and tell us the number of items in each. If they had no categories, we asked about the first screenful.

This procedure did not result in a complete inventory of PDA contents, but rather a representative sample. In the rest of this discussion, therefore, when we discuss the numbers of items in the PDA, these should be understood as not as comprehensive totals, but as totals for the sample examined.

Interview Protocol

In addition to the content classification task, the interview protocol, available at <http://www.rpi.edu/~geislc/Mobile>, included:

- a set of multiple-choice questions on participants' BACKGROUND, including their work and home situations as well as their leisure activities;
- a set of likert-scales and open-ended questions assessing participants' perceptions of their own WORK-LIFE RELATIONSHIPS;
- a set of multiple-choice and open-ended questions on PDA ACQUISITION;
- a set of multiple-choice and open-ended questions on routines for PDA USE;
- a 24-item instrument exploring participants' decision-making strategies for USING PDAS; and
- a set of multiple-choice questions, open-ended questions, and likert scales assessing participants' SATISFACTION with the PDA as well as the perceived impact of the PDA on work and life.

Participants were interviewed, usually by phone, in an interview that lasted approximately 45 minutes. Each was sent a copy of the interview protocol ahead of time and most had it in front of them during the interview. The interviews were audiotaped. Participants' responses to multiple choice and scaled items were recorded on paper by the interviewer.

Participants

Participants were solicited through requests for referrals sent by email to over 70 people across the United States. To insure that the work-life relationship construct would be relevant to our participants, we specifically asked for referrals to PDA users with some kind of paid employment. Replies to these inquiries generated a list of over 90 PDA users, 48 of whom were contacted and 42 interviewed.

The PDA users in this study were, on average, highly experienced, with just over 30 months of PDA use. Their level of experience varied considerably, however, with a range of 2 to 74 months.

Participants' gender and age distribution generally mirrored the characteristics of typical PDA users reported in a recent profile by the Consumer Electronics Association [18, 41]. A slight majority of participants (62%) were men. In terms of age distribution, 36% were 50 or older, 33% were between 35 and 50, 24% were between 25 and 35, and only 7% were between 18 and 25.

The occupational distribution included many educators (42%), some managers (29%), and some IT professionals (19%). Most participants worked both at home and at a place of work: more specifically, 26% occasionally took work home, while fully 57% reported working in both places. Few worked exclusively at work (14%) or at home (2%).

Most participants had family or other relationship obligations of one sort or another. Only 19% did not. On the whole, they reported having an active life, with an average of 3.8 activities outside of work and family. These included engagements in athletics (43%), in an exercise program (67%), as a church member (38%), as a volunteer (52%), in a hobby (74%), through travel (62%), and in a miscellany of other activities (38%) including walking the dog and doing yard work.

ANALYSIS

Our goal for analysis was to examine users' interactions with their PDAs in the context of work-life relationships. We report on:

- patterns of ACTUAL USE as revealed through the contents of participants' PDAs,
- participants' WORK-LIFE RELATIONSHIPS as characterized by their descriptions of life outside of work and their perceptions of the relative place of work and personal life in their own lives and its relationship to patterns of PDA use,
- users' HISTORY in terms of length of use and influences on acquisition, and its relationship to patterns of PDA use.

In this section, we begin with a discussion of the key construct of a work-life balance index and then move on to describe its relationship to participants' interactions with their PDAs.

PDA Work-Life Balance Index

As we suggested in our literature review, we hypothesized that a variety of aspects of PDA use would be shaped by work-life balance, understood generally as the relative weight and degree of harmony between a person's commitments to work activities versus activities outside of work. In the context of PDA use, we defined the Work-Life Balance Index as a ratio:

$$\text{PDA Work-Life Balance Index} = \frac{\text{\# of work items in PDA}}{\text{\# of life items in PDA}}$$

To give an example of how this index related to patterns of PDA use we can contrast three participants, Suzanne, Bob, and Jeff (all participants' names are pseudonyms).

Suzanne's ratio of .21 work-related items to each life-related item does a good job of capturing the way her PDA use was configured by the boundary between work and life. Overall, she had 146 items in the sample we asked her to examine; 25 were work-related, 121 were related to life outside of work. In a more detailed breakdown, we see that she had 20 appointments in the week preceding the interview; 12 were related to work. She had 50 addresses in her address book, only 6 of which were work-related (She relied on her corporate web to give her contact information for colleagues at work). She had 11 tasks on her task list; only 2 were work-related. She had 65 notes, among which were 23 things she wanted to read, 7 poems, and 16 recipes; only 5 were work-related. Although we did not ask her to itemize items outside of these standard applications, the rest of her PDA use appears consistent with this pattern of focusing on life: among other things, she used her PDA to keep a shopping list, look up movie times, listen to books on tape while she walked her dog, check the phases of the moon, take pictures, and record movies. The only place where she reported she wouldn't take the PDA was to the shower. For Suzanne, then, the PDA had become a technology she turned to for activities outside of work.

For Bob, the PDA remained primarily a technology for work. Of the 73 items in his PDA sample, 63 were work-related and 10 were life-related. His ratio of 6.3 work-related items to each life-related item, though quite different from Suzanne's also does a good job of capturing the way his PDA use was configured by the boundary between work and life. Of the 13 appointments he had scheduled for the prior week, 11 were work-related. Forty of the 44 addresses in his address book were work-related (He kept a family paper-based address book at home). Twelve of his 16 tasks were work-related. He did not use the PDA to take notes. He only occasionally used it for games. Although he routinely carried his PDA from work to home in his briefcase, it often stayed there. He wouldn't take it with him on vacation, or anywhere he was not working.

If Suzanne exemplifies a "life-intensive" user and Bob a "work-intensive" user, Jeff lies somewhere in between. For him, the PDA was a technology through which he balanced work and life. His ratio of 1.02 work items to every item

related to life outside of work was consistent with his reported goal of keeping work and personal life in balance. Overall, he had 188 items in the sample of PDA content examined, 95 related to work and 93 related to life outside of work. Of the 28 appointments he listed for the preceding week, 19 were work-related. In his address book, only 13 of 51 contacts were work-related, perhaps reflecting his conscious decision not to call colleagues outside of work time. His list of tasks was extensive and mostly work related: 38 of 52 items related to work. But his notes showed greater balance, with 32 of 57 items related to life outside of work, including 15 on chess games. He also kept pictures in his PDA and used it to play games and check his biorhythms. He reported that while he would take his PDA on vacation and when he went shopping, he wouldn't take it to church or with him during outdoor activities.

These three examples suggest that work-life relationships provide a useful lens for examining PDA use. Overall, our analysis revealed that participants had an average of 109 items recorded in their PDA content samples, with an average work-life balance index of .94 work-related items for every life-related item. Thus, despite its origin in the world of work, the overall picture of PDA use in this data is of a technology that includes both work and life.

This picture varies considerably by participant, however. As the examples of Bob and Suzanne indicate, participants varied considerably in the ratio of work to life in their PDAs, with some, like Bob, strongly favoring work over life; others, like Suzanne, favoring life over work; and still others, like Jeff, showing a more balanced ratio shown in the middle third. To facilitate our examination of the relationship between users' PDA work-life balance index and aspects of users' interactions with their PDAs, we have divided the approaches taken by participants to their PDAs into the three categories indicated in Figure 1.

LIFE-INTENSIVE USE PATTERN: Like Suzanne, 24% of the participants in this study approached the PDA as a life technology. In Figure 1, the plot for these users is circumscribed by the work-life ratio of .42. That is, participants characterized as taking a Life-Intensive approach had less than half of one work-related item for each life-related item. In fact, as a group, they averaged 5 life items to every work item. These participants varied in how much they used the PDA to record work-items, ranging from 0 to 43 work-related items. But they consistently used the PDA for many life-related items, ranging in their content samples from 50 to 162. For this group, the PDA had become predominantly a technology for managing their life activities.

WORK-INTENSIVE USE PATTERN: Like Bob, 26% of the participants in our study approached the PDA primarily as a tool for work. In Figure 1, the plot for these users is circumscribed by the work-life ratio of 1.91. That is, participants characterized as taking a Work-Intensive approach had nearly two work-related items for each life-related item. Actually, because they did not use their PDAs for life-related items very often (15 items average in their content samples), their average work-life ratio was 5

work items for every item outside of work. These participants should not be considered infrequent PDA users, however; overall, they had the highest average number of work items (71) in their content samples.

INTEGRATED USE PATTERN: Like Jeff, 50% of the participants in this study used the PDA for both work and life. Falling in the mid-range of Figure 1, on average they balanced one life item for every work item. These people recorded many work-related items in their PDAs (69 items average) but they also recorded a great many items related to life outside of work (75 average). They thus became overall the heaviest PDA users (averaging 143 total items in their content samples).

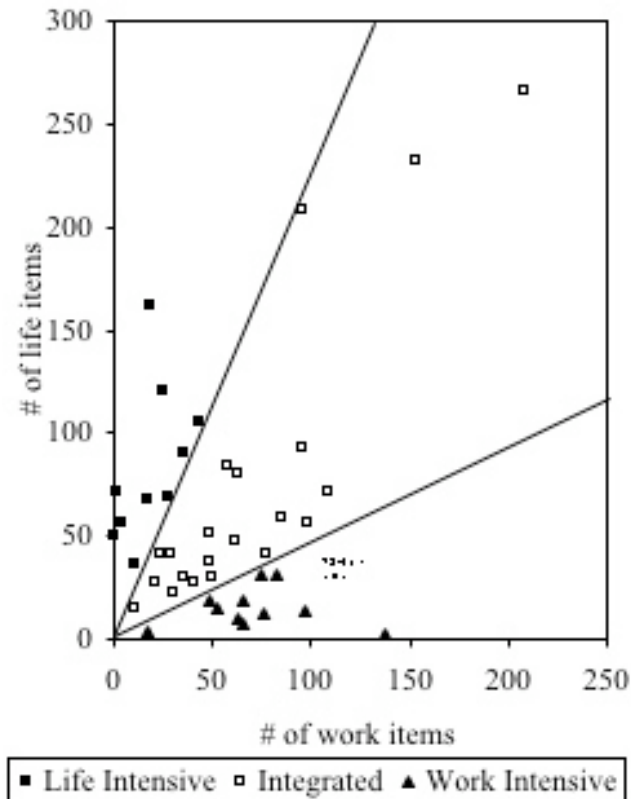


Figure 1: Scatterplot of work-life balance index for 42 participants.

Patterns of Use

For almost all of the users in this study, the PDA had become a technology that included not only work but at least some life outside of work, with the proportion of life-related items increasing as we move from the PDAs of those who took a Work-Intensive approach through the PDAs of those who took an Integrated approach to the PDAs of those who took a Life-Intensive approach. Moreover, those who took a Life-Intensive approach were generally more willing to use the PDA in leisure contexts than were other participants.

The PDA did not, however, exhibit a uniform affordance for use in life outside of work. It appears that the information management built into addresses, tasks, and notes was, in general, more consonant with life-related

activities than was the scheduling built into appointments. Scheduling, while the predominant purpose overall, was more work-oriented than other applications, with an overall work-life balance index of 2.55 compared to an average ratio of .78 for the other three applications (Address, Notes, and Tasks). In addition, participants taking a Life-Intensive approach saw information management as the most important purpose for their PDA use (70%) whereas information management was more nearly balanced with scheduling for those taking approaches that included a strong component of work-related activities. For instance, among those taking an Integrated approach, 29% rated scheduling most important compared with 38% rating information management most important; among those with the Work-Intensive use pattern, 36% rated scheduling most important compared with 27% rating information management most important. For the PDA users in this study, then, it appears that the extent to which they used the PDA for scheduling was directly related to the extent to which they used the PDA for work.

This relationship between work and scheduling may have multiple influences. Based on participants' comments, users seemed less inclined to schedule life-related events than work-related events for several reasons. First, scheduling implies some deficit in memory (as in, "If I had to write that down, I'd know I was really in trouble"). Second, many life tasks are not as time dependent or coordinated with others, which lessens the need to schedule them. Third, scheduling leisure-related life events (in contrast to events related to the "business" of life, such as doctor's appointments, automobile maintenance, or visits from the plumber) may confer a meaning of "obligation" rather than "invitation," draining them of enjoyment. Fourth, work events may be more visible and more valued than events in personal life, and thus more likely to be recorded. Finally, it may also be that characteristics of current PDA technology make it less amenable to casual recording of life events and obligations, such as stopping at the ATM on the way home to get cash or getting the car washed. Many users reported a preference for entering information into the PDA during desktop sessions rather than "on-the-fly" while users were on the move. For whatever reason, however, the PDA seems to have migrated into the arenas of life more as a personal information management tool, an extension of memory, than as a scheduling tool.

Work-Life Situations and Attitudes

Overall, participants were highly identified with their work, tended to see work and life as not very separate, tended to see work as slightly dominating, and thought work and life were in a fairly harmonious relationship. In a variety of ways, however, work-life arrangements were different for participants taking different approaches to PDA use.

To begin with, as a group those taking a Work-Intensive approach most closely followed the general profile just outlined. They tended to be highly identified with work, to see work and life as somewhat separate, to see work as slightly dominating, but to feel that the relationship

between work and personal life was relatively harmonious. They also tended to have the highest level of family obligations (91%) and the lowest average number of leisure activities (3.5); and they tended to be older compared with other user groups.

Next, as a group, those taking an Integrated approach to using their PDA generally had both family and leisure responsibilities. As a group, they tended to identify less with work than the other groups, to see work and life as less separate from one another, and to feel the greatest harmony.

Finally, as a group, those taking a Life-Intensive approach appeared to have a life outside of work less structured by obligation and more by leisure. They tended to be younger and to have fewer family responsibilities. 40% were without partner or children, for example, compared with 14% of those taking the Integrated approach and 9% of those taking the Work-Intensive approach. They also averaged a slightly higher number of leisure activities: 4.0 versus 3.8 for those taking an Integrated approach and 3.5 for those taking a Work-Intensive approach.

While the higher ratio of life-related items in the PDA may reflect these users' relatively high engagement in leisure (as opposed to family) activities, we should be careful not to conclude that their PDA use simply mirrored their work-life arrangements. In fact, although this group of users did feel that they achieved more balance between life and work than the groups taking other approaches, they also felt that life and work were more often in conflict. This suggests that the relatively high engagement in leisure and the relatively high ratio of life-related activities in their PDAs may be the result of strategic choices to favor life outside of work in the face of situations which, without family obligations, did not have built-in counterweights to working all of the time.

History

Responses to questions about participants' history with their PDAs suggest that the different approaches to PDA use arose as a combination of differences in the events that brought users to acquire their PDAs and differences in their level of experience with their PDAs. On the metric of experience, those taking an Integrated approach to using their PDAs averaged nearly a year's more experience with the technology: 35 months versus 26 months for those taking a Life-Intensive approach and 25 months for those taking a Work-Intensive approach. This suggests that, over time, users may tend to move toward a pattern of using their PDA for both work and life purposes.

Differences between the three groups were evident from the start, however. The work-life balance that users eventually showed in their PDAs use appears to have been shaped by the mixture of work-life events shaping participants' situations at the time of adoption. Such events ranged from a change in responsibilities at work to the birth of a child or an impending wedding. Those who eventually took an Integrated approach to their PDA use mentioned a mix of both work and life events driving their decision to adopt (1.2 work events and .7 life events), whereas those

taking a Work-Intensive approach described themselves as driven primarily by work events (1.2 work events and .2 life events), and those who took a Life-Intensive approach as driven primarily by life events (.5 work events and 1.0 life events).

In addition, those taking a Life-Intensive approach were less likely than the other groups to have been influenced by work-related factors, such as a colleague at work or an employer policy: 20% of Life-Intensive participants were influenced by work-related factors compared with 62% of Integrated and 55% of Work-Intensive participants. They were also more likely to have been influenced by family and friends: 50% versus 14% for Integrated and 9% for Work-Intensive.

That it would be most common for individuals to be introduced to PDAs in the workplace is not surprising, given the devices' origin as a technology of work. However, users' motivations for adoption may encompass more than simply the desire to avail themselves of a powerful new technology. As Palen, Salzman, and Youngs [35] observed in their study of mobile phone users, adoption of mobile technologies has significant implications for the presentation of self [20]. While only a tangential aspect of the data collected for this study, some participants explicitly commented that the image projected by other PDA users in work situations played a part in their decision to adopt the technology. The exception to the co-worker influence rule was in the participants' who took a Life-Intensive approach, but this result is not necessarily inconsistent with a relationship between adoption motivation and desired self-image.

CONCLUSIONS

The nature of the data presented here confirms the value of a contextualized approach to analysis. At the cultural level, the data for this group of participants suggest that PDA use both reflects and facilitates the kind of work-life "boundary work" [23] that contemporary social, economic, and technological conditions have made commonplace for today's workers. The data unequivocally confirm that the diffusion of PDA technology from the world of work to personal life has occurred for these participants, and suggest that the predominant pattern of PDA use integrates work and life. The secondary patterns of work-intensive and life-intensive use suggest that the PDA can also be used as an instrument to maintain the boundary between work and life outside of work and minimize boundary crossing.

At the level of the individual, we have seen that to render meaningful the work-life balance in a user's PDA, data must be contextualized within the user's perceptions of and goals for their particular work-life arrangements. For while the PDA is an extension of the self (in terms of capacity for activity and information management), it is by no means a mirror reflection of the self. Bob, for example with his Work-Intensive PDA use might appear to be a workaholic based on his PDA contents alone. Suzanne, with her Life-Intensive PDA use might appear to be more evenly balanced. When contextualized within their reported work-life arrangements, however, the opposite appears to be the

case. Bob makes a point of limiting the migration of his work into other areas of his life; his PDA contained predominantly work-related items not because he had nothing else to do, but because, when he left work behind, he also closed down his PDA. Suzanne, by contrast, characterized her life as being strongly dominated by work. Despite her attempts to use the PDA for a wide variety of life purposes, she routinely found work and life at odds with one another as work threatened to swamp her personal life.

Interestingly, this data does not support the claim that the use of PDA technology will automatically entail the adoption of the time management philosophy out of which the PDA developed [16]. Although other work [16, 11, 12, 14] has suggested that mobile technologies may move the multitasking and time fragmentation typical of mobile professionals into personal life, the data here suggests that, overall, users are reluctant to move the PDA's scheduling function into life outside of work. By contrast, they do appear willing to move information management functions into their lives (through lists of books to be read, places to be visited, etc.), providing some support for the belief that this form of mobile technology use is part of a general social trend to view life as a project to be worked on and managed [4, 38].

The confirmation, for this group of participants, that PDAs are being used not just for work (as originally intended) but for also life, has implications for design. The improved data entry functionality that is being implemented or planned for new generations of PDAs may better accommodate life-related uses such as casual, on-the-fly note-taking or list-making. As new users adopt these devices and existing users upgrade, usage of PDA for life-related tasks may become more widespread. Moreover, as noted earlier, the convergence of wireless communication technologies with the data management functions of PDAs are projected to position the PDA even more firmly at the boundary of work and personal life.

The results of this study, while strongly suggestive, are limited in their generalizability. To refine and extend the findings presented here, future research on this potentially powerful work-life technology needs to go both broader and deeper. Such research might take the form of surveys of larger samples (including more detailed information on use, especially with respect to mode and place of data entry), collection of longitudinal data to determine the extent to which patterns of use with respect to work-life integration evolve over time, collecting more actual items from PDAs rather than simply numbers and categories (from users who are willing to share actual content), field observations of "live" use recorded with screen capture technology; in-depth interviews to gather more contextual information about how PDA use fits within participants' work and home life and their attitudes toward technology, and even interviews with active resisters to adoption to uncover information with implications for design. Future research might also consider the technology's potential for gender-related empowerment and disempowerment, in response to the suggestion that by expanding women's capacity for

caretaking, mobile technologies reinforce gender-based inequities in this area [37]. Finally, consistent with our contextual approach to use analysis, we also advocate cross-cultural use comparisons to identify different orientations to the construct of work-life boundary management and their association with alternative scenarios of PDA use.

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