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Human agency in a wireless world: Patterns of technology use in nomadic computing environments

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Abstract

The problems of nomadic computing users have been described as challenges presented by the interplay of time, space and context. However, theoretical accounts to date have not addressed all three aspects of nomadic computing in a single effort. We investigated how the practices of individual nomadic computing users in a large mortgage finance company changed after implementation of a nomadic computing environment. Although users experienced contradictory outcomes as they sought resolutions to the dilemmas posed by work and nonwork demands, all users reported effectiveness in their computing practices. We attribute their effectiveness to skilled use of technologies to control the boundaries between their personal and business social contexts. The variety of patterns of boundary control across nomadic workers in the study is explained using a theory of human agency that focuses on the temporal, spatial and contextual conditions facing actors as they engage with their nomadic computing environments.

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1. Introduction

Accompanied by the unprecedented growth of the mobile workforce, organizations have begun to deploy nomadic computing environments (Drake et al., 2002). Based on such technologies as mobile devices, networks and applications, nomadic computing environments provide transparent, integrated, convenient and adaptive communication and computing services to nomadic workers as they move from place to place (Kleinrock, 2001). Nomadic computing environments facilitate access to enterprise resource planning systems, such as inventory and customer relationship management, and to productivity tools such as email and scheduling. Their deployment is aimed at increasing employee productivity by providing access anytime, anyplace to organizational resources.

Although information systems scholars have speculated on the intended benefits and unintended social consequences of nomadic computing environments, empirical studies of social implications are rare (Davis, 2002; Jessup & Robey, 2002; Lyttinen & Yoo, 2002a, 2002b). Anecdotal evidence suggests that mobile technologies and the environments they facilitate manifest a Janus-faced quality, characterized by flux and contradiction (Arnold, 2003). Mobile technologies can facilitate access yet restrict access (Sherry & Salvador, 2001). Personal activities can be carried out along with business activities (Gant & Kiesler, 2002). Mobile technologies can be disruptive yet provide continuity (Davis, 2002). They can facilitate synchronous or asynchronous communication (Kakihara & Sorensen, 2001). Planned activities can be carried out alongside unplanned activities (Kakihara & Sorensen, 2001). They can also control as well as empower (Sherry & Salvador, 2001).

The literature also suggests that achieving access anytime, anyplace may be problematic. With regard to access, organizational resources are not always accessible in a form suitable for use, and nomadic workers may intentionally limit access to themselves (Perry et al., 2001; Sherry & Salvador, 2001). Anytime access may actually reduce performance because of unnecessary interruptions to work (Davis, 2002). The notion of anyplace is also problematic because not all spaces and places are functionally equivalent (Gant & Kiesler, 2002). Anyplace access may also blur the boundaries between personal and work life. Despite the problematic and contradictory consequences reported, other research suggests that nomadic computing users enjoy increased productivity, are highly effective and that organizational benefits have accrued (Gartner, 2001).

This paper focuses on how effective nomadic computing workers manage the boundaries between business and personal activities through technology use. Three related dimensions of nomadic computing are empirically examined. First, a *temporal* dimension is relevant because nomadic workers need to adapt to dynamic technological, individual and institutional environments over time. Second, a *spatial* dimension is relevant because nomadic workers are required to use nomadic computing environments across diverse spaces such as in airplanes, motor vehicles, clients' offices and hotel rooms. Third, a *contextual* dimension is relevant because nomadic workers play multiple social roles in addition to their business-related responsibilities. Because mobile and distributed technologies may be used in different places

and at different times, an individual's work roles may encroach upon other social roles. These three dimensions are closely interconnected, suggesting that their effects be examined together empirically.

An illustration of the interplay among these dimensions is the story of a software sales representative relaxing in a Silicon Valley hot tub (Newsweek, 2004). After learning that his fellow soaker was an IT executive, the sales representative used a mobile device to demonstrate the business software that his company made. In this example, the temporal dimension involves the spontaneous and inventive use of the nomadic computing environment in response to an emerging opportunity. The spatial dimension relates to the ability to use the nomadic computing environment in an unconventional location to carry out business. The contextual element comes into effect as the nomadic computing environment allows the software sales representative to switch his role from personal to business. Daily, similar business deals enhance productivity by capitalizing on the opportunities presented to nomadic computing users in diverse temporal, contextual and spatial settings. Such scenarios are expected to become more common, as the U.S. nomadic workforce grows from 91.8 million in 2002 to 104.5 million in 2006 (Drake et al., 2002).

This study addresses two research questions:

1. How can patterns of technology use within nomadic computing environments be explained by time, space and context?
2. How are patterns of technology use within nomadic computing environments associated with user's own interpretations of their effectiveness?

We address these questions in a qualitative and interpretive investigation of the practices of four individual nomadic computing users in a large mortgage finance institution. Consistent with recent theoretical arguments concerning human agency (Emirbayer & Mische, 1998), we show how use of nomadic computing environments is related to the "practical-evaluative" dilemmas faced by nomadic workers as they seek to balance past practices, future goals, and present contingencies (Emirbayer & Mische, 1998). Our empirical results show how each worker resolved his or her dilemma by managing temporal, spatial and contextual boundaries, thus maintaining or enhancing their effectiveness.

2. Theoretical background

Emirbayer and Mische's (1998) recent theory of human agency explains actors' behaviors based on the simultaneous influences of three temporal elements: past practices, future possibilities, and present contingencies. Because the population of nomadic computing users is likely to experience a wide range of temporal influences, the theory is positioned to explain diversity of practice in nomadic computing environments, even where the same technologies and company policies apply.

Emirbayer and Mische's (1998) temporal theory differs from more familiar explanations of technology use based on Giddens's (1984) structuration theory (e.g.,

DeSanctis & Poole, 1994; Orlikowski, 1992). Specifically, Emirbayer and Mische place less emphasis on the structural properties of technologies or organizations. In effect, structure is subsumed as an element of agency that reflects past practices (Boudreau & Robey, 2005; Orlikowski, 1992). The de-emphasis of structural properties is appropriate for studies of nomadic computing environments, which consist of portable technologies designed to be configured in different ways to support mobile workers. Thus, structural properties embodied in the technologies themselves appear to be less relevant than human agency in explaining patterns of technology use (Orlikowski, 1992). Moreover, although mobile workers are members of social systems, they are relatively less constrained than most workers in organizations. With mobility comes independence from narrowly prescribed roles and direct supervision. The temporal aspects of human agency are especially relevant in the context of nomadic computing environments because those environments change frequently as new technologies are developed and adopted. Thus, Emirbayer and Mische's temporal theory seems especially well suited to the study of nomadic workers.

Among the proposed variations on structuration theory, DeSanctis and Poole's (1994) adaptive structuration theory offers the most specific guidance on theorizing human agency. They theorized technology design in terms of "spirit," recognizing that structural properties could be embedded in technology applications. However, they emphasized the exercise of human agency in arguing that users could appropriate technologies in ways that were "unfaithful" to the spirit of the design. As embedded structures and human agency interact in practice, a variety of appropriations become possible, suggesting that actual patterns of technology use vary over time and across individuals.

An implicit assumption of adaptive structuration theory is that decision processes are likely to be more effective when appropriations remain faithful to the technology's spirit. However, this assumption is relaxed in Emirbayer and Mische's (1998) temporal theory, which focuses upon idiosyncratic resolutions of individual dilemmas among alternative courses of action. Thus, a user may reach an effective resolution to an agency dilemma by working around or reinventing an application's intended features (Boudreau & Robey, 2005). For example, nomadic computing users may save time in transit by calling their own voicemail systems to record important ideas. Although such practice is clearly not in accord with the spirit embedded in cellular telephone technology, it may contribute to user effectiveness by saving time. Such practices are more readily explained through the temporal theory of human agency (Emirbayer & Mische, 1998).

Our focus on human agency more closely matches Orlikowski's (Orlikowski, 1992) practice oriented lens for understanding technology use. From a practice perspective, users enjoy greater freedom to "enact" technology's features in ways that satisfy their particular needs and interests. Users may enact technological applications as designers intended, or they may improvise with technology to produce unintended patterns of use. Orlikowski's practice lens directs attention away from structures embedded or embodied in technology while drawing attention toward structured patterns of human action. This perspective has received support in recent

empirical studies involving a range of technology applications (Boudreau & Robey, 2005; Schultze & Orlikowski, 2004).

In the following section, we propose a framework for studying human agency in nomadic computing environments. The framework incorporates a temporal dimension as its central feature and acknowledges the influence of social context, as reflected in a person's social roles. In addition, our inclusion of space adds a dimension that is obviously relevant to studies of nomadic computing yet mostly neglected in information systems studies based on structuration theory.¹

3. A framework for studying nomadic computing environments

Emirbayer and Mische (1998) framed human agency as a capacity that is simultaneously oriented towards the past, future and present in any given moment. The past is reflected in agency's "iterational" or habitual element. The iterational element is oriented to past practice and defines the way in which actors engage with prior patterns of action in order to sustain identities, meanings and institutions over time. The iterational element acts as a point of reference for habitual behavior as well as for the transformation of past routines. The future is viewed as a "projective" capacity to imagine alternative possibilities. The projective element looks to the future, reconstructing past habits and traditions by generating alternative possible responses to problems. The present is conceptualized as a "practical-evaluative" capacity to contextualize past habits and future projects in the present. The practical-evaluative element entails the capacity of actors to make practical and normative judgments among alternative trajectories of action, in the context of emerging problems in their present. Practical-evaluative choices are made in the face of considerable ambiguity, uncertainty and conflict as means and ends sometimes contradict each other. Thus, neither routine nor newly imagined projects can usually be enacted without adjusting to present contingencies and practicalities.

The appeal of the theory lies in its capability to explain the sporadic, unpredictable nature of human interaction in addition to more stable patterns of action. Emirbayer and Mische (1998) acknowledge the difficulty that multiple influences on agency pose for predicting human action, but they also argue that disaggregating agency into its temporal elements allows us to understand actors' responses to their diverse and shifting environments. In particular, the theory portrays agency as a response to an ongoing stream of dilemmas that they may never be fully resolved. In the context of technology use, the theory potentially explains why planned uses of technology are adjusted to balance conflicting demands emerging from practical contingencies.

Temporality is one of three dimensions portrayed in the conceptual framework shown in Fig. 1. Combined with the two dimensions of context and space, described

¹ We acknowledge Giddens' discussion of time-space distanciation as an aspect of modern society, both in his 1984 book and in later books on modernity. These insights have not been exploited in IS research for the most part. One notable exception is Schultze and Richard (2000).

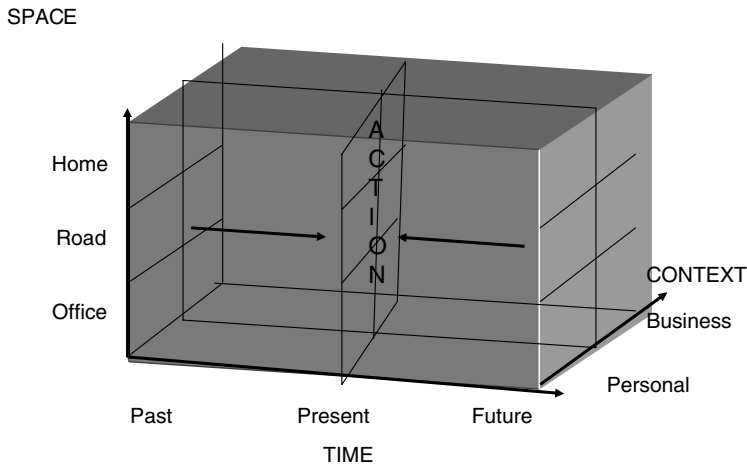


Fig. 1. Nomadic computing environment framework.

next, we portray agency in a three-dimensional space. At any point in time, represented by the plane in the middle of the figure, actors look to the past, future, and present in making judgments about their actions. As time progresses, the plane in Fig. 1 would slide to the right, toward the future and away from the past. Thus, today's present becomes tomorrow's past, and tomorrow's actions would be affected by a different set of temporal elements. The agency of the nomadic computer user is therefore situated in the flow of time.

Past research on nomadic work suggests that mobile computing also comprises the contextual and spatial dimensions shown in Fig. 1 (Kakihara & Sorensen, 2001). The contextual dimension recognizes that nomadic users simultaneously play multiple roles in their professional and personal lives, e.g., CEO, mother, wife and club president. In traditional work settings, roles might be confined to specific times and places, thus reducing role conflict. However, nomadic workers are likely to experience conflicts between professional and personal roles because their work is not confined in time and space. The resolution of the conflicts and dilemmas involve complex decisions that comprise human agency.

The spatial dimension recognizes the geographical mobility of the user to be "anywhere" – at home, at an office location or moving between locations. Our framework suggests that agency is affected by spatial location, although not in a deterministic sense. Location simply adds complexity to the agent's dilemma of choosing an appropriate action. For example, interruption of a family meal at home by a business caller on a cell phone is different than receiving the same call in one's car. Decisions to answer the call, how long to talk, and what to say all become contingent on location as well as the situation of the event in time.

In summary, temporal, contextual and spatial dimensions combine to influence nomadic users' actions. Together they form the user's practical-evaluative dilemma in the present, as designated by the plane in Fig. 1. By locating the actor's orientation

to the past and future (using the temporal dimension), the actor's social roles (using the contextual dimension), and the actor's location (using the spatial dimension), we gain the analytical leverage needed to explain the behavioral choices of nomadic computing users. The empirical study reported next demonstrates the utility of the framework and contributes to a more finely grained understanding of nomadic computing use and effectiveness.

4. Method

4.1. Research design

We employed a multiple case study design using the individual nomadic computing user as the unit of analysis. Our dual case methodology (Leonard-Barton, 1990) studied four cases: two longitudinal and two retrospective. We collected the data in two phases. In the first phase we collected retrospective data on all four cases. Taking all four cases together, we were able to establish common patterns of nomadic computing usage as well as differences between individual users that we could attribute to differences in temporal, contextual and spatial dimensions. This allowed us to establish a baseline of patterns of technology use at a particular point in time for all cases. In the second phase we studied two cases longitudinally. The two longitudinal cases allowed us to make within-case comparisons across time, supporting a dynamic analysis of the temporal dimension. A longitudinal perspective provided insight as to why users' patterns of nomadic computing usage changed over time, based on the baseline provided by the retrospective data. The longitudinal cases also addressed the limitations associated with retrospective research wherein participants forget key events or minimize their importance.

4.2. Data collection

The site chosen for the study was a department within a prominent mortgage financial institution in the United States. Four of six loan officers within the department were invited to participate in the study because they were highly nomadic workers using mobile technologies. The loan officers had been in their positions and using nomadic computing environments for more than two years prior to the study and were able to describe how their use had evolved over time. As such they were considered to be representative sources of relevant information about changes in nomadic computing use (Miles & Huberman, 1994).

We used in-depth interviews, observations and documents as data sources across two waves of data collection. In the first phase, a detailed interview protocol was designed and used to guide free flowing conversations with subjects participating in both the retrospective and longitudinal studies. On average, interviews lasted 90 minutes. Interview topics included the background of the organization and the user, travel patterns, devices used, past practices, current interaction patterns and future goals with regard to technology use. Users were also asked how they used their

nomadic computing environments within their personal and business lives and how effective or ineffective they were. Subjects were encouraged to demonstrate features of their computing devices and tell stories about their patterns of technology use. In order to examine the combined influence of time, space and context, subjects were asked to describe past and present scenarios of technology use in specific locations and contexts, intentions for technology acquisitions, and how these would be used across space and context. Interviews were also conducted with four other organizational members to gain a fuller understanding of the background and history of the organization.

The second wave of data collection began three months after the initial interviews and ended three months later. Only two of the Loan Officers were interviewed in this phase. Again, we used a protocol to guide the interviews, which lasted 45 minutes on average. Topics discussed included changes in practices, travel patterns and personal and organizational roles and the reasons for the changes. During the second phase we also observed the Loan Officers' mobile activities by visiting them at an offsite location. In all, ten interviews were conducted, tape recorded and transcribed for analysis.

4.3. Data analysis

Data analysis involved subjecting the interview transcriptions to interpretation using coding as the analysis technique. As is common in interpretive studies, only one researcher was involved in coding (Schultze, 2000) while the second researcher participated in analysis and interpretation as the coding proceeded. This strategy increased the dependability and reliability of our analysis (Miles & Huberman, 1994). Two main stages of coding were completed, each comprised of many rounds of code assignment and induction to higher level concepts.

In the first stage, a master list of interpretive codes was developed based on the three dimensions of the theoretical framework (Miles & Huberman, 1994). The initial master list included codes for past, present and future practices, business and personal contexts and technology use in different spaces such as at home, at the office or on the road. Using Atlas TI qualitative analysis software, we performed the analysis case by case. For each case we assigned the interpretive codes to sections of the interviews that spoke about incidents, events, processes, actions, assumptions, and consequences surrounding nomadic computing technology use. In order to examine the combined influence of time, space and context, a single quotation was sometimes assigned multiple codes, reflecting the presence of multiple elements of temporal agency as well as the contextual and spatial elements relevant to the quotation. The first round of coding revealed several additional concepts, which were assigned new interpretive codes. These concepts mostly reflected the advantages and disadvantages of the nomadic computing environment and the contradictory forces shaping patterns of use. Subsequent interviews in phase 1 probed further into these aspects of nomadic computing, allowing the newer concepts to be confirmed across multiple cases.

In the second stage of analysis we examined the longitudinal cases for changes in practices and reasons for those changes. As in phase 1, each quotation was assigned

Table 1
Pattern and interpretive codes with examples

Category (pattern codes)	Dimensions (interpretive codes)	Description
Agentic Processes	Iterational	Practices that reflect past patterns of action
	Practical-evaluative	Practices that reflect present patterns of action
	Projective	Future goals for technology upgrades, acquisitions or changes in practices
Context	Individual	Role from user's personal life when practice is enacted
	Institutional	Role from user's business life when practice is enacted
Space	At home	Reference to use of nomadic computing environment at user's home
	On the road	Reference to use of nomadic computing environment while traveling or at an offsite location
	At the office	Reference to use of nomadic computing environment while at the office base
Social process	Intersubjectivity	Interaction between two or more individuals which may influence practice. Forms of interaction include, dialogue, email messages and phone conversations
	Reflexivity	Self deliberation about technology practices
Opposing forces	Unrestricted access	Use of nomadic computing environment to allow unrestricted access to nomadic user
	Restricted access	Use of nomadic computing environment to restrict access to nomadic user
	Merging	Activities resulting in the merging of personal and business devices and spaces
	Separating	Activities resulting in the separation of personal and business devices and spaces

multiple codes to reflect the combined influence of time, space and context. Throughout the rounds of analysis in each stage, we added, deleted and merged pattern codes that were conceptually similar (Miles & Huberman, 1994). Linking the pattern codes together facilitated the elaboration of the theoretical framework. Table 1 presents samples of the codes generated in the analysis.

In conducting our analysis we cycled through multiple iterations to confirm the fit between the data and the theoretical account (e.g., Barrett & Walsham, 1999; Garud, Jain, & Kumaraswamy, 2002). Klien and Myers (1999) refer to this process as a hermeneutic circle, which cycles between the examination of parts (data) and the emerging whole (theory). In order to corroborate the evidence collected and to enhance the confirmability and credibility of our findings (Miles & Huberman, 1994), we submitted the results to study participants, who verified them as credible and accurate.

5. Results

In this section we first describe the organizational context for the four nomadic computing users, followed by details of their nomadic computing environment.

The four cases of the nomadic loan officers are then presented: purely retrospective cases first, followed by the longitudinal cases.

5.1. *Organizational context*

The data were collected in 2003 at HomeLender (a pseudonym), a home mortgage corporation serving the southeastern United States. Founded in 1985, HomeLender quickly became a major competitor in the mortgage financing industry and was consistently ranked as the number one lender for homebuyers in its area. At the end of 2003, HomeLender employed 1400 associates, of whom 950 were loan officers. One of the organization's main objectives was associate satisfaction. In 2003, HomeLender was ranked as the number one place to work in its area by local business publications and in 2004 was ranked highly on *Fortune's* list of best companies to work for.

In 1995 HomeLender became the first mortgage lender in its area to introduce laptop computer loan origination, which gave Loan Officers the capability to accept and process loan applications at either HomeLender stores or customer locations. In 1999 the organization added the capability to accept mortgage loan applications over the Internet. Using an Internet connection, associates could access a consistent computing environment, anytime anyplace through use of laptop computers. This development paved the way for a truly nomadic computing environment within HomeLender.

To promote its technological initiatives, HomeLender created a special unit, known as the "E-unit," to service loans that originated over the Internet. A significant amount of technical resources was dedicated to the E-unit. The focus of this case study was the loan officers within the E-Unit, which had six mortgage consultants and 14 support staff. As described by one loan officer:

"The purpose of the E-unit is to pilot new programs and technology with the HomeLender internal clients and once the pilot is in place then it is exported out to the rest of the company. I would just say the E-unit is the most efficiently, highly productive, cutting edge department in the company for the sales force."

Four of the mortgage consultants within the E-Unit were highly mobile, spending 50% of their time traveling to bring in business. In addition to visiting HomeLender locations, they visited real estate offices with which they had formed partnerships. These real estate offices were known as the alliances.

Before the implementation of laptop loan origination, a manual system for managing customer relationships had been instituted through use of a common paper composition book, which was used as a journal to track work related activities. Three of the loan officers interviewed had been with the organization for more than ten years and were able to trace their initial use of the composition book to their first day as a HomeLender employee. As one senior loan officer recalled, his boss had introduced him to the composition book.

"This is something HomeLender taught me. The composition book. When people called me to be pre-qualified, they would call me on the phone and

say, "so and so said to call". I am just wondering what amount of money I can borrow. This is the old fashioned way. I write down your name, and I write down your salary, and I write down your debt, and I write down basically just a note to myself so I can refer back to it. To this day all loan officers carry these things around so people still use them. Some people use it as a to-do list too. They just flick a page every day and just start writing down the stuff to do. The company buys them. My boss who now runs this company was the one who taught me to use this."

More recent hires were introduced to the composition books in other ways. Some were able to trace their initial use of the composition book back to their school days when they used the books to record assignments. Their subsequent use of the composition book included recording things to do, expense claims, phone numbers and notes of conversations. Thus the use of the composition book was a traditional practice, still prevalent in the organization.

5.2. Properties of the nomadic computing environment

The hardware in use was a standard laptop computer with wired network capability that the company issued to loan officers. The IT department was slowly making the transition to wireless applications and some loan officers had wireless modems. The Microsoft Office Suite was the standard office application, and Outlook was used for scheduling, maintaining contacts, tasks, and email. The main application in use was Loan Soft, which facilitated the processing of loan applications while the user was mobile. Loan processing could take place anytime, anyplace once a connection to the Internet was established. Loan officers could enter a loan application, check credit and approve a loan within minutes. The HomeLender website had a page for each Loan Officer as well as information on the organization and its products. They could accept loan applications through the website when notified with an email message. The organization also provided an Intranet to distribute information to its associates. Loan Officers were able to retrieve information on bond rates and loan products from the Intranet. Formal training was held on all applications used by associates, although training sessions were optional.

5.3. Four cases of nomadic computing use

The four selected cases represented diverse users with different roles, responsibilities, educational backgrounds and genders. Users were the vice president of the E-Unit, an assistant vice president, a sales assistant and a junior loan officer. However, departmental affiliation was the same, and the laptop and applications initially given to each user were identical.

Each case is reported using a similar format. Following a brief introduction to the person, we relate each case to the three elements in Emirbayer and Mische's (1998) definition of human agency: practical-evaluative (present), iterational (past), and projective (future). For the two longitudinal cases (#3 and #4), we also include

a section describing the change in behavior for each case. While this does not represent a full analysis of the cases, a presentation order that matches the temporal dimension of the research framework in Fig. 1 should facilitate the later analysis in Section 6.

5.4. Retrospective case #1 – Rookie

“If you sit around you are usually going to miss out”

Rookie was a Loan Officer who had been with HomeLender for four and a half years. He was single and had no children. His father was his only surviving parent and he had no siblings. He was involved in several sports clubs and associations. He also met with a group of young professionals on a monthly basis.

Rookie used a company-issued laptop and personal mobile devices, including a PDA, cell phone and pager. He synchronized contact information and email across his laptop, PDA and cell phone. His PDA and laptop were wireless enabled, giving him the capability to use hotspots and to connect to the Internet via cellular services. Rookie was highly mobile, traveling to meet real estate agents, customers and attorneys on a daily basis. In comparison to the other Loan Officers interviewed, he was new to the mortgage financing business and was not ranked among the highest performers. He was driven to bring in as much business as possible in order to establish himself in the business.

Practical-evaluative element. Rookie wished to generate as much business as possible in a short time, so he used several means to make himself accessible to others within his personal and business contexts while mobile.

“I have got my email, I have got my office phone here, I have got my cell phone and I also got my pager so they can always page me. So there is really no way that they can’t get in touch with me. I am on call basically.”

However, this high level of accessibility as he moved from place to place made keeping track of each piece of communication across the three devices difficult. He therefore decided to integrate his work and personal devices to be more in control of the flow of communication.

“I called Merlin over in IT. I just asked him. I have got the wireless card in my Compaq laptop, I have got my Sony PDA, and I have got my cell phone with the same carrier. I know I can forward emails and rates to my cell phone; can I coordinate my PDA with my cell phone and the laptop all to be synchronized? Is there anyway I can connect all three to where I am never out of the loop? You know, if I have one device where one is down and one is missing I am still alive in some sort of fashion.”

Although the PDA and cell phone were not company issues, the IT department supported Rookie’s request for synchronization. He was the only Loan Officer in the E-unit who requested this service, although several Loan Officers throughout HomeLender engaged in this practice.

Rookie's high accessibility led to him working during weekends and while on vacation. In order to facilitate customer requests on his personal time, he frequently used hotspots and his cellular phone to connect his laptop to the Internet.

"I try not to work on the weekend. But usually I end up having to. Like if an agent calls me on the weekend, and my agent says, "I need to pre-qualify somebody. Can you do that now?" I keep my laptop in my car with me, load it up, plug it into my cigarette lighter in my car, power it up and I can upload and take a loan app."

Even so, the disruptions sometimes proved to be frustrating. As a result, Rookie expressed the desire to establish and maintain boundaries between his business and personal life during certain hours and in specific places.

"It's like I do this all day. I try to get the mindset where from these hours it's all about taking care of customers and between these hours it's about taking care of me. I try to separate my business and personal life. If you combine the two then you really don't have an identity."

Iterational element. Viewing Rookie's actions through the iterational element shows the reinforcement of past practices. Although Rookie was one of the more technically savvy users, his use of the composition book persisted. The composition book was useful for jotting down information needed only in the short term and as a backup medium in case of technology failure. This traditional practice was also more suited for certain places such as sitting in traffic.

"If I have like six messages after I come out of a meeting I will write down what the call is about. . . . It is also a reference point in case sometimes technology crashes. My laptop crashed two weeks ago and I was without it for a day. If I hadn't written down all the calls and things I had talked about that day, and people called me, I would not know what to tell them half the time. So I guess it's my hard drive back up."

Projective element. An analysis of Rookie's behavior through the projective element shows that his will to succeed drove him to keep abreast of technology to make him more effective.

"Well, in our business we always say you are as good as your last deal because we are on commission. So if I don't have a deal and if I am not working I don't get paid. So if you are not on top of your game you are going to lose. So I don't have a choice but to be proficient in the use of these devices."

Consequently, Rookie was willing to upgrade and acquire new technology to enhance his effectiveness.

"What would be my pie in the sky? Gosh, something that would be voice activated so that I would not have to call or dial or do anything. Just maybe a headset or a little video screen in front of my eyes like a pair of shades and I

could talk. Whatever I am thinking or saying it does. That's lazy but how efficient would that be?"

In sum, Rookie faced the challenge of proving that he could be a successful loan officer. He used technology intensively as he felt that it was key to his eventual success. His use of the composition book persisted across time at the office, on the road and at home. Rookie integrated his technical devices and synchronized data across them so that they could now each support both his business and personal activities. In addition to facilitating work during personal time and vice versa, merging devices facilitated role switching within and across personal and business contexts regardless of time and space. New technology acquisitions were considered based on their overall usefulness to both contexts, rather than on their ability to support a specific context, whether personal or business.

5.5. *Retrospective case #2 – Nonchalant*

"I am pretty much established in the business. I am in control of what I have."

Nonchalant was a senior loan officer and assistant vice president within the E-unit. He had been employed by HomeLender for seven years. In 2003 he was ranked in the top 15 of loan producers. He was married and had no children. He traveled twice per week to the alliances. Nonchalant considered himself to be well established in the mortgage finance business with earnings at a significant level. Due to his lengthy tenure in the mortgage industry and level of experience, he felt in control of the flow of his business. As such he did not feel the need to extend himself beyond business hours, although he was not averse to working if needed. He demonstrated some indifference as to whether he needed to be accessible outside of working hours.

"Leashed,² Top Gun and me, we are all pretty established in the business. We don't have to work too much at night, too much on the weekend, stuff like that."

Practical-evaluative element. Nonchalant engaged in several practices illustrating the practical-evaluative element of agency. Nonchalant relied on his assistant, Girl Friday, to filter calls received at the office for him, forwarding to him only those she considered important. This practice controlled others' access to Nonchalant.

"When the phone rings and whether I am here, or at the alliances and she can get it, she generally gets it. A lot of times people call they don't need to talk to me. So she is a huge help from that perspective. She is more of a filter."

Nonchalant also credited the ability to forward his voice mail automatically to Outlook as eliminating the need to make notes from voice messages. The service gave him the capability to replay and store messages at his own convenience, removing the need for the composition book.

² Leashed was a senior loan officer and assistant vice president in the E-Unit who was not nomadic.

“The other thing that we do have that not everybody in HomeLender has is, if you leave me a voice mail it comes up on here (Outlook email).”

Iterational element. Previously, Nonchalant controlled others’ access to him by screening phone calls through use of a “one number service” provided by a major telecommunications service company. The service allowed Nonchalant to consolidate his cellular, home, fax and pager numbers into one number so that he could be reached anywhere. He could also screen incoming calls and decide whether or not to accept them without the caller knowing. However, he had to discontinue this practice when the provider end the service.

“The ultimate in filtering phone calls is the one number service. That would be the ultimate screening device but they took that away from me. I was very disappointed. I guess there are systems you can still do that through, but yeah it absolutely makes you more effective.”

Nonchalant was also a former user of the composition book but ceased this practice when the capability was given to loan applicants to enter their applications online. He attributed his preference for typing to writing as another reason for ending this practice.

“I am probably not as effective when I use the composition book. Like Scribe³ who is upstairs. He writes everything down in a comp book and he color-codes things and stuff. I never had typing classes but it’s just faster for me to type stuff rather than to write stuff down.”

Projective element. Nonchalant intended to acquire a Blackberry device because he imagined that it could make him more efficient. However, he was prepared to wait until he could obtain the specific features he wanted.

“So for the past three or six months or so I have wanted to update this technology. The reason that I haven’t done it yet is because this is the only number that a lot of people have for me. And I didn’t want to do it with my service provider because they are the most expensive. So now that I have portability of my number as of yesterday, probably I will be going in that direction. Now that there is this free-for-all in the cellular marketplace, I can probably get a cool PDA/phone.”

Nonchalant projected how acquiring the Blackberry device would improve his efficiency without disrupting the pace he had set for himself and his personal life.

“Well, certain people I will instant message with. Basically I will be able to carry my calendar around with me all the time in a much smaller version. Girl Friday will be able to communicate with me via one more channel. If I am not here she doesn’t need to call me. She can send an email and I will get it when I am at the real estate office.”

³ Scribe was a Senior Loan Officer in another department.

Nonchalant did not envisage the use of hotspots outside of business hours as a future practice because he wished to maintain clear boundaries between his personal and business lives. The use of hotspots would only serve to blur these boundaries.

“I am not taking my computer with me. I don’t want to. I don’t need to. If I go someplace for lunch and somebody needs to access information and it’s in my computer, they can wait till I get back.”

In sum, Nonchalant was content with his achievements and comfortable with his position in the organization. He was indifferent to making himself accessible outside of working hours. His aptitude for typing made it easy for him to reinvent traditional practices through the use of new technology as long as it did not disrupt the pace he had set for himself or blur the boundaries he had defined between his personal and business lives. Nonchalant sought to separate his personal and business roles by assigning them to set time periods. Thus, technology was used to define the boundaries between personal and business contexts across time and space. New technology acquisitions were contemplated based on their ability to maintain the boundary between Nonchalant’s work and personal life.

5.6. Longitudinal case #3 – Top Gun

“I am just not a technology person”

Top Gun was the vice president of sales and a senior loan officer within the E-Unit. Top Gun’s responsibilities included strategic planning, administration, mentoring, training and public speaking on behalf of the company. However, most of his income came from loan origination. Top Gun had been with HomeLender for 10 years. In 2003, he was ranked as HomeLender’s number two producer. Top Gun was married with three children and served on the board of a prominent national charity. Top Gun traveled to the alliances three times a week to meet with real estate agents and their customers as well as to provide a presence within the alliances.

When Top Gun first joined HomeLender in 1993, he used a date book in which he wrote details of his appointments, meetings and events. Loan applications were hand written. Like most of the other loan officers, his sales manager also trained him to use the composition book. The car phone and the pager were his major modes of communication within his business and personal lives.

More recently, Top Gun used a corporate issued laptop, and personal mobile devices which include text and digital pagers and a cell phone. Although one of the organization’s top producers, Top Gun described himself as a caveman, reluctant to change because of the time required to learn how to use the technology. This disinclination was manifested in his patterns of use.

Practical-evaluative element. Top Gun was faced with the dilemma of either clinging to comfortable and familiar past practices or moving into an uncertain future using new technologies. As a top producer and vice president, he received a great amount of daily communication in the form of emails, phone calls and voice mails. In the past, monitoring his busy schedule was achieved through use of the date book

and composition book. Based on the volume of activity, the prospect of converting these books to Outlook was overwhelming. However, not using Outlook could adversely affect his ability to process loans and his esteemed position within the organization, as online loan applications were received through Outlook. His practical-evaluative dilemma thus centered on how new technology could be incorporated in such a way that the comfort and familiarity of past practices were preserved.

Top Gun resolved this dilemma by delegating the task of using Outlook to his assistant, Executrix. She retrieved Top Gun's voice mail, maintained his contact lists and calendar, and printed task lists for Top Gun so that he could make calls while driving to the alliances. Although produced by Outlook, the lists were in a format that Top Gun found useful. This practice allowed Top Gun to eliminate use of the composition book, take advantage of Outlook's capabilities, and minimize his interaction with the new technologies.

Top Gun spent a large portion of his day traveling in his car, which became a place for work. Instead of writing in the composition book, he would call his office phone and leave notes to himself on his voice mail so that both he and Executrix could access them.

“I took down some information last night from a lady and she had two important points that she wanted to make sure I remembered. So I called my voice mail and left it on my voicemail.”

Top Gun described another current practice that involved older technology applications. Top Gun viewed the pager as outdated because his cell phone could also be used as a paging device. Instead of retiring the pager, however, it became the primary means of communication between Executrix and Top Gun while Top Gun was mobile. When alerted by Outlook about an upcoming appointment, Executrix would page Top Gun to remind him of the appointment. Again, Top Gun was able to maintain distance from the newer technologies by exploiting obsolete devices.

Top Gun used Loan Soft extensively to process loans online. To enhance this application, Top Gun and his sales assistant, Superwoman, designed a customer timeline form, independent of Loan Soft, which captured information from the customer upon first point of contact. Top Gun and Superwoman were the only two people in the E-Unit who used this form, which removed the need to make notes in a composition book.

HomeLender's reputation for protecting associates' well being was reflected in policies that encouraged Loan Officers on vacation to leave their laptops at the office, to be monitored by other Loan Officers. Before the development of wireless mobile devices, this policy made sense because Loan Officers did not have easy means to remain in contact with the organization. However, Top Gun complained that he lost business while away and that it took him a long time to catch up on work when he returned. For these reasons, he ignored company policy and took his laptop with him on vacation.

“Having my laptop gave me the opportunity to check messages on my own time, prioritize them and then deal with them accordingly.”

However, Top Gun sought to reduce the conflicts between personal and business demands by establishing boundaries that were communicated to co-workers:

“I may say that I will be accessible from 2:00 to 4:00 on this day or I won’t be accessible.”

Iterational element. Viewing Top Gun’s behavior through the iterational element reveals several enduring practices. One persistent practice was the use of the date book, which Top Gun used to set appointments for himself and avoid dependence on Outlook. The date book also provided a convenient reference to appointments when he was mobile. The delegation of the use of Outlook to his assistant also reflects the persistence of past practices. Historically, secretaries have been in charge of their managers’ schedules and Top Gun’s use of his assistant reflects this traditional practice.

“The only reason it’s on Outlook is so that Executrix who runs my schedule can see where I am and what I am supposed to be doing, or she would be very ineffective.”

Top Gun’s cell phone use also mimicked how land lines were used in the past. He did not maintain a list of contacts in his cell phone but dialed numbers from memory or from the task list generated by Executrix.

Projective element. Top Gun placed low priority on learning about new technologies and improving his ability to use them. When asked how the future use of mobile technology could make him more effective, Top Gun responded:

“My mind doesn’t work like that. If I have the time to think, it’s not about technology. It’s about how I can bring in more business, or how I can be a better Christian, how I can be a better father, or how I can be a better husband, or something totally different from the technology part. I don’t spend my free time on that. Other people enjoy that and I think that’s great. But I am just not a technology person.”

However, Top Gun anticipated how the acquisition of a wireless modem would make him more effective in the short term. He felt that learning to use the wireless modem would not require much time because it simply plugged into his laptop.

“I am supposed to have one where all I have to do is to be able to plug in and it powers up. I won’t be restricted. I probably will be able to boot up during meetings and conference calls and it will allow me to be in other places in my house besides tied to just my office at my house.”

Change. Three months after the initial interview with Top Gun, significant changes in his practices occurred. As he had projected, Top Gun obtained a wireless modem. In addition, he made two other technology acquisitions that were not corporate initiated issues. First, Top Gun installed a wireless network at his house to maximize the use of his wireless modem and to enhance his productivity at home. Use of the wireless network at home enabled him to spend time with his family and work simultaneously.

“I can be downstairs while the kids are watching a movie or I can be in the bed and typing while I am in the bed. It gives you freedom like the cordless phone does.”

Second, Top Gun acquired an aircard, which allowed him to access the Internet wherever cellular service was available without the need of a hotspot. The transition to the aircard was relatively easy because it could easily be inserted into the laptop whenever needed.

“And that is pretty neat because I don’t have to plug into the network. I picked up an adapter for my car so that I can actually work in my car when my wife is driving or when somebody else is driving. So I can be online while in the car. I did that when I went to Florida last week. I was online working in the car on my cell phone and with the aircard for about four hours. This is a big step.”

Although Top Gun granted new technologies low priority, he saw the aircard as a fairly simple way to extend his productivity without radical change to his every day practices.

“If I can see how it makes me more efficient then it becomes a priority. But technology on a whole I am not that interested in. But if I can find a tool that I see that somebody else is implementing, then I get very intrigued very quickly. So I just have to see the value of something whether it’s technology or anything else. If I see the value in it I will implement it very quickly.”

In sum, Top Gun initially considered adopting new technology as a time consuming activity. To remain comfortable, he tended to cling to past practices that minimized his interaction with the technology. Yet over time, he recognized the importance of technology to increase his effectiveness, so he adopted new devices and services that did not require a large time investment to learn. Top Gun used the nomadic computing environment primarily to support business activities. Traditional practices, such as the use of a secretary to maintain a schedule of appointments, were carried out within the business context. Reinvention of older technologies such as the pager was also primarily intended to support business roles. However, Top Gun’s use of newer technologies allowed him to extend business activities outside traditional working times and places.

5.7. Longitudinal case #4 – Superwoman

“My computer is my first resource for everything”

Superwoman was a junior loan officer within the E-unit, a position she had occupied for two years. Superwoman had been at HomeLender for six years and had occupied positions such as receptionist, processor and underwriter before being promoted to her current position. As junior loan officer, she provided sales support to Top Gun by meeting with customers, originating loans and expediting the processing of customers’ mortgage loan files. Because she touched every customers’ file, her effectiveness was measured through a point of sale (POS) quality score, which was

a measure of deficiencies or missing information in a customer file. Her POS score for 2003 was 3.5%, indicating that only 3.5% of information within the files she processed was inaccurate or missing. The average for the organization was 15%. Superwoman considered herself to be one of HomeLender's top performers in the position she held.

Superwoman was issued a laptop with wireless capability that she used at the alliances, although she did not connect to hotspots. Her favored mobile device was a cell phone. She traveled to the alliances approximately three times per week. Superwoman was also a wife and mother of two children, and her dilemma was how to balance her career and family.

Practical-evaluative element. Superwoman engaged in several practices indicative of the practical-evaluative element. To cope with the challenges of her business and personal life, Superwoman used her mobile devices to multi-task across a wide range of personal and work activities. Her company email included folders not only for business associates but also for those involved in her personal life. Folders for contacts in her business email were next to folders for personal contacts. It was not uncommon for her to read and send work-related email from home before coming to work, claiming that it reduced stress when she arrived at work.

“I could wait until I get here. Top Gun would not expect me to be online at 6:00 in the morning although we were emailing back and forth. But if I wasn't online and checked my email then I would have a lot more to do when I got here.”

Superwoman handled most of her personal affairs online intermittently with business throughout the day. She even used email to purchase a pet for her children. Traditionally, this task would have required a visit to the seller of the pet. In her case, the seller of the pet was a work associate in another location who emailed pictures of pets to Superwoman, removing the need to go physically to the pet store and select the pet.

“And I asked her to get me a kitty for my kids for Christmas and she picked it out and said here are your pictures. I mean that's kind of different but cool. And we arranged the whole thing by email. Like this is the time I am going to pick it up. This has nothing to do with work.”

In the past, Superwoman communicated with family and friends by phone, but with her work schedule and high mobility, she found it less time consuming to communicate with family, friends and her children's teachers by email during the day.

“During the day I email my children's teachers, I email my parents, aunts and uncles. That's basically the way I talk, through email, because I don't have time to talk on the phone a lot. I email out my son's baseball schedule. I email it to everybody who wants to come so I don't have to sit down and call every single one of them. We communicate about the holidays where we are going to meet and when and what we need to bring. It is all done via email.”

Although personal and work tasks were intertwined, Superwoman attempted to separate work and personal activity by dedicating certain devices to certain types of tasks. The major modes of communication with business associates were email and the office phone. The cell phone was reserved for communicating with Top Gun and Executrix.

“I don’t want [customers] always calling me on my cell phone. I want all of my borrowers to call me here (office phone). Just to keep it all in one place. Because if you are in the car, driving down the road and a borrower calls, then there you are, trying to take notes on a piece of paper, with your kids screaming in the back seat.”

Iterational element. Of the four cases, Superwoman demonstrated the least tendency to base her choices on past practices and habits. Superwoman stopped using a composition book when she became a loan officer because she found the use of the book unnecessary, as applicants’ details were entered directly into Loan Soft, and supplementary information was captured through use of the customer line form, which she shared with Top Gun. Superwoman had also abandoned her past practice of telephoning family members, now using email. Her cell phone was used primarily for initiating calls to Top Gun and Executrix.

“Well I used it when I was processing and I got a lot more phone calls from borrowers and everything. Then I used it at that point to keep up with whom I had talked to. But most of the phone calls go to Top Gun now. Usually it’s me making the phone calls and not somebody calling me. So I don’t really have to have one of those. I used it as a phone log and not as note taking. I am not a note taker. I don’t do that. I don’t like to.”

Projective element. Viewing Superwoman’s goals and objectives through the projective element revealed that she did not intend to acquire a PDA to access email while mobile, as she thought it would make her life more complicated. Even though she desired to accomplish more things in less time, she also needed to simplify the flow of information by reducing the number of new devices.

“I don’t have the Blackberry thing. This [laptop computer] is enough. This is simple. This is easy. Everything is in one place. And I think this is just enough for me. I just don’t want to get that complex. Just too much gets overwhelming I think. I am sitting down at my computer, answering all my emails. That’s enough. I wouldn’t want to be working at them all day long.”

Change. Six months after our initial interview, changes to Superwoman’s practices were minimal. A mandatory adoption of a new version of Loan Soft resulted in the elimination of the customer line form which captured supplementary customer information. This was made possible by the inclusion of a comments field in the customer’s Loan Soft file. Thus it was no longer necessary for Top Gun and Superwoman to carry blank forms while mobile because the information could now be entered and accessed through Loan Soft via their laptops.

“The number one improvement is the comments section because being able to put comments in that will make the work we do more effective. Like right now if we are on the phone with the borrower we can go in and type notes in the loan and then you can email the notes and it’s never gone from the loan. . . . It’s there forever, not just on a piece of paper that’s going to get thrown away.”

Top Gun had discussed his acquisition of the aircard with Superwoman and she expressed the desire to acquire one. This he promised to do on her behalf by placing a request through the IT department.

“I want one of those because if you go on vacation you can email somebody from the car. And it’s supposed to be really easier. If it’s really easier and really simple then I am all into that. Like when I go on vacation or something I can’t read and access all my emails and get all my stuff done. If I can be emailing from the car, while my husband is driving we can reach three hours sooner.”

The desire to acquire the aircard so that email could be read and accessed in her car indicated a change in her attitudes towards the practice of using email while mobile. Previously, Superwoman expressed reluctance in acquiring the Blackberry device as it would intensify her daily routines by making her always accessible by email while mobile, and also would introduce another communication channel to monitor. Over time, as a result of dialogue with Top Gun, she saw the possibility to increase productivity by adding functionality to a device that was already in use. Superwoman saw this projected practice as efficient because it allowed easier transitions from business to personal life.

In sum, Superwoman faced the challenge of balancing her career and family life and used technology to achieve this balance. She replaced or modified traditional practices if the end result contributed positively to the balancing act. Superwoman used the nomadic computing environment to conduct business activities outside traditional locations and time periods for work, and to handle personal activities within conventional work periods and locations. She contemplated the acquisition of new technology and upgrades but only if the balance could be maintained.

Table 2 provides a summary of the patterns of nomadic computing practice for each of the four persons studied.

6. Discussion

Our study was motivated by two objectives, as stated in the research questions. First, we wished to explain patterns of technology use within nomadic computing environments with reference to time, space and social context. Second, we sought to relate patterns of technology to users’ own interpretations of their effectiveness. These objectives were addressed by designing our research to look for similarities and contrasts within a group of workers who had the same access to technologies, performed similar jobs, shared corporate policies, and were subject to similar nomadic work requirements. Moreover, the longitudinal nature of the research design afforded an exploration of changes in users’ practices over time.

Table 2
Summary of patterns of technology use

Case	Individual context	Retrospective phase 1			Longitudinal phase 2
		Iterational	Practical-evaluative	Projective	New practices
Top Gun	Number 2 loan producer in HomeLender	Date book replicates details in Outlook	Task of using some features of Outlook delegated to assistant. Contributes to elimination of composition book	No intention to acquire Blackberry device because of time required to learn how to use it	Acquisition of wireless modem & installation of home wireless network facilitates work in other places apart from home office
	Tight time constraints conflict with time required to learn to use technology	Cell phone use mimics landline usage of the past. Phone numbers dialed from memory or list	Loan Soft and user designed forms replace composition book	Upcoming acquisition of wireless modem predicted to increase efficiency. Device is a plug-in to the laptop requiring no significant time investment	Acquisition of aircard enables access on the road to internet, email & applications as long as cellular service is available
	Low priority placed on technology use	Assistant assigned task of managing Outlook schedule	Alerts of upcoming appointments generated in Outlook sent to Pager by assistant		
	Corporate laptop (wired) and personal pagers and cell phones are devices in use	Use of Loan Soft and other corporate applications as intended	Rejects departmental custom of leaving laptop behind when on vacation. Laptop carried on vacation		
Super Woman	Challenged with balancing career and family life	Use of Loan Soft and other corporate applications as intended	Personal and business activities share same time and space	No intention to acquire Blackberry. Device seen as possibly blurring further the boundaries between personal and work life	Upgrade of Loan Soft results in elimination of customer line form

(continued on next page)

Table 2 (continued)

Case	Individual context	Retrospective phase 1			Longitudinal phase 2
		Iterational	Practical-evaluative	Projective	New practices
	Corporate laptop (wireless) and personal cell phone are devices in use		Dedication of specific devices and spaces to either work or business activities		
			Email replaces the phone as preferred medium of communication for personal and business activities. Approach seen as less time consuming and more efficient		
			Laptop carried on vacation		
			Loan Soft and user designed forms replace Composition Book		
Nonchalant	In the top fifteen of loan producers	Use of Loan Soft and other corporate applications as intended	Ability to enter Loan details into Loan Soft coupled with preference for typing to writing leads to elimination of composition book	Intention to adopt Blackberry device when it becomes convenient	

	Happy with achievements and comfortable with position in the organization	Leaves laptop while on vacation to reinforce boundary between personal and business life	Assistant used to filter incoming communications and to restrict access	No intention to use hotspots outside of working hours as seen as further blurring the boundaries between personal and business lives
Rookie	Corporate laptop (wired) and personal cell phone are devices in use Challenged with proving himself as a Loan Officer and becoming established in the mortgage finance business	Use of Loan Soft and other corporate applications as intended	Synchronization of data across personal and business devices making him accessible, anytime anywhere	Intends to acquire Blackberry device. Acquisition of state in the art in technology viewed as further enhancing efficiency
	Corporate laptop (wireless) and personal cell phone and PDA are devices in use	Use of composition book in certain spaces and contexts and as a backup in case of device failure	Laptop and hotspots used during personal time to facilitate incoming business blurring the boundaries between personal and business lives	

We chose to base our inquiry in Emirbayer and Mische's (1998) theory of human agency because of its focus on the individual choice in temporal context. Their practical-evaluative element of agency in particular appeared to be sensitive to the dilemmas faced by nomadic workers as they strived to be effective. Although our primary objective was not to contribute to social theory, we hoped to extend the theory by attending also to space and the social roles occupied by nomadic workers. The conceptual framework used to guide our data collection and analysis reflects the three dimensions felt to be crucial to understanding patterns of use: time, space, and social context.

Despite an obvious variety in the patterns of use across all four persons in our study, commonalities emerged from the data. All workers faced the same fundamental issue: controlling boundaries between business and personal social contexts. Emirbayer and Mische (1998) state that actors are situated in nested and overlapping relational contexts. As past research has shown, actors are members of different social systems arising from both work and non-work related activities and must respond to the contradictions of multiple social contexts (Sahay & Walsham, 1997). Given their common pressure to perform, demanding travel schedules, and the availability of a nomadic computing environment to enable work anytime anyplace, each worker faced a basic dilemma. *How could boundaries between work activities and personal activities be controlled?* From a human agency perspective, these choices are best understood as practical judgments, made in the present but containing elements of past practice and future possibilities, and dependent on space and context. Although individual dilemmas were resolved in different ways, as discussed below, the basic choice was shared in common.

The data also suggest, in response to our second research question, that individuals were effective in controlling their boundaries between business and personal contexts. Each person studied was a high performer in the highest performing unit of HomeLender. Rather than being overwhelmed by the demands of nomadic work and supporting technologies, each worker found constructive ways to use available technologies to cope with multiple and often conflicting demands. We conclude that boundary management is an important aspect of technology use for nomadic workers, one which may play a significant role in their ability to perform effectively.

All four workers studied expressed a desire to separate business and personal roles using traditional boundaries of space and time. Rookie sought to reserve weekends for his personal pursuits and to preserve his "identity," as he put it. Nonchalant said that he did not need to work at nights and on weekends, and he restricted access to himself by relying upon a combination of technical features and human intermediaries. Top Gun argued that technology was not important to him and preferred not to work while with his family or on vacation. Finally, Superwoman deviated from this pattern slightly by allocating personal and business activities to different devices: different phones for different types of calls but email for both personal and business communication. Superwoman was the worker studied who showed the least reliance upon traditional boundaries of space and time.

Although all workers expressed a need to separate business and personal roles, their practices consistently showed them using technology to cross between business

and personal activities without regard to time and place. Rookie did take loan applications on the weekend, and prepared himself to do so by having his laptop computer with him at all times. Nonchalant was not averse to making himself available, but he carefully controlled access to himself. Top Gun's practices changed over the course of the study so that he could accomplish work at home while his family watched television and on the road while his wife drove the car. Superwoman answered email messages at 6 a.m. from home. In each case, the technology played a key role in extending business into spaces and times traditionally reserved for personal activities.

A common interpretation of such patterns is that the boundaries between personal and business contexts become blurred. For example, Davis (2002) suggests that providing access anytime anyplace may enable unnecessary and unproductive interruptions to work and may change organizational expectations, making interruptions the norm. Blurred boundaries are associated with greater ambiguity, lack of control and decreases in performance and well being (Jessup & Robey, 2002). However, our results suggest a different interpretation. We saw each of the four HomeLender nomads using technology to divide time and space into smaller "slices." Our data further suggest that each nomad was in control of the process rather than overwhelmed. Their boundaries were clear, not blurred, which allowed them to use segments of time in a wide range of spaces (homes, automobiles, offices) more productively. Superwoman's case perhaps illustrates the thinnest slicing of business and personal work, as she alternated between using email to buy pets for her children and to communicate with clients and colleagues. Her high performance ratings do not suggest a woman out of control in the face of competing job and family demands. In sum, each of the nomadic workers studied had become effective micro-managers of the boundary between personal and business social contexts.

A human agency perspective proves valuable in our analysis because it helps to explain both similarities and differences across cases. The similarities are understood as shared dilemmas of boundary management. Given that most people in modern societies play a variety of social roles, boundary management has become a familiar process with traditional solutions. As information technologies have become wireless and mobile, traditional boundaries may be revisited. Our analysis suggests that a finer and more nimble approach to boundary management is associated with effective performance of nomadic workers. Even the more recalcitrant and established members of HomeLender's E-unit used technologies to improve productivity by squeezing work into homes, cars and vacation spaces and into times traditionally reserved for personal activities. Thus, the results show that stakeholders' intentions cannot be relied upon as a prediction of future use. Technological capabilities evolve rapidly, and present contingencies place limitations on what users can accomplish. The theory helps us to understand the temporal influences on choices across time, noting how dilemmas change along with opportunities for resolving them.

A human agency perspective also explains variation across individual practices by noting the differences in past experiences (the iterational element) and differences in social contexts. For example, both Superwoman and Top Gun were married with children, so the social demands placed on them differed from Rookie, who was single with no children, and Nonchalant, who also had no children. Superwoman's role as

mother also differed from the other three, who were each male. In general, no two patterns of nomadic computing use could be expected to be identical, even where technologies and corporate settings are common. A theory of human agency expects differences in behavior to occur and provides a conceptual framework for interpreting those differences.

Two features of technology appear to play a role in user agency. Most obviously, the wireless capability of telephones, laptop computers, and other devices make them portable and enable the extension of business work into places and times where it was previously not feasible. Less obvious is the complexity of technologies in terms of the investment required to master them. Both Top Gun and Superwoman resisted different devices because of the time required to learn them or because they added complexity to existing configurations of services and devices. However, when offered simple tools such as Top Gun's aircard, adoption and use quickly followed. Thus, functionality is not the only consideration in judging the usefulness of devices within a Nomadic a computing environment. Although designers may create what are considered "useful" nomadic computing artifacts, we cannot predict that these artifacts will be adopted or what usage patterns will follow because we do not know what comprises users' temporal orientations or how those orientations may change. In addition to functionality, simplicity and ease of mastery are also important to nomadic workers.

Although Emirbayer and Mische (1998) emphasize the temporal aspects of human agency, they say less about spatial aspects. The spatial dimension plays a critical role in studies of nomadic work, and ignoring the spatial dimension relegates the analysis to fixed contexts, e.g., an office location (Avery & Baker, 2002). In fixed work locations, social boundaries are easier to define than in nomadic work. Including the spatial dimension in our framework and analysis thus plays an important role in explaining the patterns of nomadic work, particularly the use of technology to control social boundaries.

7. Conclusion

It has been widely recognized that users' engagement with nomadic computing environments can result in new forms of use, new social actions, unanticipated responses and unintended consequences (Davis, 2002; Jessup & Robey, 2002; Lyttinen & Yoo, 2002a, 2002b). Until now, we have only been informed by anecdotal evidence of these consequences. In this paper, we have applied the temporal theory of human agency (Emirbayer & Mische, 1998) to engage in a cross-case analysis of four nomadic workers. We sought to explain their patterns of technology use and how those patterns contribute to users' own evaluations of their effectiveness. The analysis was interpretive with a focus on understanding the contextual nature of action rather than developing causal relationships between agency and effectiveness.

One limitation of the study is that it is focused on a single industry and organization. Future research can probe more deeply as to whether the framework is relevant to individuals belonging to diverse industries and organizations. Further research can also explore the longer term effects of technology use by engaging in longitudinal

studies of greater duration. In addition, studies of larger numbers of workers might reveal greater commonalities in patterns of use. For example, several clusters of usage patterns may become discernible after the methodology is applied across more nomadic workers.

The findings of this paper have implications for both research and practice. The main research implication is the provision of a framework based on the temporal theory of human agency (Emirbayer & Mische, 1998), which recognizes the diverse contexts and spaces that nomadic computing users experience. We have shown that patterns of technology use in nomadic computing environments are influenced by workers' temporal orientations, i.e., their past experiences, future projections and, most significantly, the dilemmas they face in the present. Because individuals have different experiences, they exhibit different practices even when operating with the same technologies and organizational settings. We have augmented the framework to include consideration of space (location) and to emphasize the dilemmas resulting from conflicts between business and personal social contexts. The resulting framework provides a sound theoretical foundation for future research on the social impacts of nomadic computing environments.

An implication for practice concerns how the mobile workforce should be managed. The study shows that in an organizational environment where training was not mandatory, users took the initiative to modify and manipulate the environment to their own suiting and that the IT department supported this activity. Although this resulted in highly effective employees and a very successful organization, permitting users to act as they choose results in a technical environment that is difficult to support. The problem is made more acute when use occurs predominantly outside the organization and where some users merge business and personal technical resources. The management challenge, therefore, is to permit flexibility in use while maintaining control and security.

In conclusion, we have offered an explanation for patterns of technology use that emerge in nomadic computing environments. This explanation rests upon a theory of human agency that emphasizes temporal elements: past, future and present. We have shown that nomadic workers share similar dilemmas in the present, particularly with respect to controlling boundaries between business and personal social contexts. Our findings suggest that effective nomadic workers exercise more fine-grained boundary control, using technology to micro-manage the boundaries between personal and business contexts. They showed no evidence of blurring these boundaries, losing control, or declining in effectiveness. These are important contributions to the emerging body of studies on ubiquitous computing environments and their social consequences.

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