

# Designing for Nomadic Work

Norman Makoto Su and Gloria Mark

Department of Informatics

University of California, Irvine

Irvine, CA 92697-3440, USA

{normsu, gmark}@ics.uci.edu

## ABSTRACT

Nomadic work, an extreme form of mobile work, is becoming increasingly prevalent in organizations. Yet so far there has not been enough research attention on the particular challenges that nomadic workers face in order to design support for their work practices. We employed ethnographic interviews and observations to understand nomadic work practices. Drawing from strategies for survival of pastoralist nomads to guide our design investigation, we focus on an integrated perspective of nomadic work involving challenges related to assembling actants, seeking resources, and integrating with others in the organization. We discovered that nomadic workers need to continually seek out and compete for resources to maintain their mobile offices. They also face challenges in integrating into the organization to maintain visibility and to synchronize with others for meeting. We discuss the design recommendations that emerged from our investigation.

## Categories and Subject Descriptors

H.5.3 [Information Interfaces and Presentation]: Group and Organizational Interfaces – *Organizational Design, Computer-supported Collaborative Work, Asynchronous Interaction, Synchronous Interaction.*

## General Terms

Management, Design, Human Factors

## Keywords

Nomadic work, Mobile work, Ethnography, Anthropology

## 1. INTRODUCTION

*Nomads do not live to migrate; they migrate to live. People who pursue a nomadic strategy do so for quite good reasons.* – [Salzman, p. 40]

A new type of mobile work practice is emerging: nomadic work. Strictly speaking, nomadic workers (NWs) travel to where the work is. Paul Erdős, the Hungarian mathematician, was the prototypical NW who wandered from university to university to collaborate with others. Organizations are beginning to experiment increasingly more with nomadic work as a practice where employees travel most of their work time to meet with others inside and outside of the organization: with workgroups,

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customers, vendors, or other colleagues. In this paper, we present results of a study of a large distributed Fortune 500 company that, based on an independently conducted survey<sup>1</sup>, identified approximately 20% of its workforce as NWs.

We expect that nomadic work will increase. Two key factors are enabling people to be more mobile in their work. First, the technological maturity of IT has led to the practical realization of a mobile workforce. Enhanced power longevity, integrated wireless networking, and practical portability for laptops as well as the pervasiveness of mobile device infrastructures for BlackBerrys and cell phones free employees from being tethered to a single location. Second, some companies view mobile work as a cost-effective measure: flexible hours and movement allow frequent face-to-face interactions to satisfy customer needs; the maintenance cost of spaces shifts from the company to the employee; and employers feel that freedom from the potentially demoralizing containment of cubicles leads to increased worker productivity and a better work/life balance [2]. Yet there is a contrary view: problems with mobile work have been described that plague both workers and management. Concerns such as stress, decreased work productivity and quality, security issues, and high management costs have been identified [17].

This leaves us wondering about the experiences of NWs who travel far more than mobile workers whose technology use and practices have been previously studied such as those who travel occasionally [16] or who are locally mobile within a company campus [5][13][6]. NWs are perhaps an extreme form of what Garrett & Danziger [8] term “flexiworkers”: people who spend at least 10% of their work time in the office, home, and the field. NWs might also be considered a variant of “road warriors,” but are yet different, as road warriors generally travel set routes between the home and client sites [1]. Nomadic travel is far more diverse. We consider nomadic work to have three criteria. First, NWs travel most of their work time. Second, most NWs are not associated strongly with any single home office, nor bound to any particular office. They work wherever they happen to be: at any company site, at home, at a customer site, in hotel rooms, airports, and so on. Finally, NWs are constantly carrying, managing, and reconfiguring their own resources, whereas traditional office workers can rely on a stable set of resources in their “home” space.

How NWs manage and use their resources to support their work practice is especially critical when considering how to design for nomadic work. We approach this question from both a technical and organizational perspective as the challenge of finding and using resources is situated in a larger organizational context. The organizational NW must constantly seek human and technical resources to satisfy their needs, which are intricately intertwined

<sup>1</sup> Survey results were conveyed through personal communication.

with organizational aspects. Therefore, we argue that to deeply understand how to design support for nomadic work practices, it is necessary to understand the nomadic life *in situ* in the organization. To our knowledge, though there have been studies addressing social aspects of mobility (to be discussed shortly), there has been a lack of attention to how organizational design impacts nomadic work. Our perspective on design views NWs in the context of their organizational “society.”

## 2. RELATED WORK

Early literature on mobility focused on how technology facilitated movement in local settings, such as how shared resources assisted in face-to-face communication [5]. Luff & Heath [13] found that the “micromobility” of paper makes it ideal for conveying subtle, ephemeral cues with coworkers, in fact, more so than a newly designed mobile system. The mobile workers in these studies had an identifiable home base in which local practices have been developed, maintained, and implicitly understood over time by a stable set of actors. Moreover, these studies predate the ubiquitous introduction of wireless networks.

Closer to our concept of NWs is found in more recent studies investigating the practices of mobile workers on the road. For example, Perry et al. [16] identified issues for mobile workers in planning for the unpredictable, working in “dead time,” and using remote awareness tools and mobile phones as proxies. Brown & O’Hara [7] expanded the concept of mobility to look at “hot-deskers”—office workers without a fixed desk. They frame their analysis as “work changing place” (e.g., the café transformed into the office) and “place changing work” (e.g., the office as a site for informal interaction opportunities).

Mobility has also been examined from the perspective of work rhythms [15]. Mobility between home and office has been studied with telecommuting [4][10], boundaries between work and home life [19], and wireless networks in the home [24][9]. “Home” is indeed a site of work (among other sites) for NWs, and in fact some NWs actually have more than one home. Infrastructure and mobility has also been studied. Kleinrock [11] notes that incompatibility between technologies threaten to undermine the creation of convenient and capable mobile computing devices.

## 3. PASTORALIST NOMADS AND NWs

To better inform ourselves on the lifestyle and work patterns of nomadic workers, we turned to the literature in anthropology that focuses on nomads. Drawing primarily on research by anthropologists Barfield [3] and Salzman [20], we were interested to learn what the main challenges were for nomads, and what types of strategies they used to meet these challenges.

### 3.1 The Pastoralist Nomadic Strategy

Contrary to the romantic images of an idyllic, itinerant traveler unhindered by societal boundaries, nomads in pastoral societies in actuality have movements that are “highly purposeful, oriented towards achieving specific production...goals” [20]. These nomads are mobile mostly to support the practice of animal husbandry [3]. Salzman says it is a mistake to ask what kind of people nomads are; rather, one should ask what strategies they use to be nomads:

*Nomads are not a kind of people but different kinds of people who use a particular strategy—that is, mobility of the household—in carrying out regular productive activities and in defending themselves. We may better understand the lives of these people if*

*we ask what they are trying to accomplish through this strategy, how they implement this strategy, why they do not choose apparent alternative strategies, and in what ways this strategy is tied to the environmental conditions in which they live.* —[Salzman, p. 40]

We discovered that nomads deploy what is called the *nomadic strategy* to meet main challenges: 1) maintaining their “key” animal, 2) hunting and competing for resources and adapting to different environments, and 3) integrating with others who can help their survival. We briefly discuss these challenges.

First, the role of the *key animal* is central for nomads for sustenance in life and work [3]. In each pastoralist area, there is one key animal that serves as the central focus of the nomads: “*Central Eurasian nomads give priority to the horse...nomads of the Tibetan Plateau praise the yak...in the deserts of the Sahara and Arabia it is the camel*” [3]. The key animal is an important form of identity for nomads and is critical to their survival. According to Barfield, some criteria that define the key animal for a nomad are: 1) The animal must be well adapted to the regional ecological conditions so that the nomad can do work; 2) it must be a necessary component of everyone’s herd; 3) its pastoral requirements take precedence over other stock; and 4) it must in some way define a nomad’s social, political or economic relation to the world. To clarify, Barfield’s point is that “*a man without cattle cannot participate in society.*”

Second, the nomadic strategy, which involves the regular movement of homebase and household, is an efficient means of *satisfying resources* for the key animal. According to Salzman, nomadism can be used as an “*opportunistic ‘rapid’ response to the sudden and temporary availability of irregular and unpredictable resources, such as pasture.*” Furthermore, nomads use movement to find more favorable “macroenvironments” related to seasons, altitude, and climate. It can also help avoid detrimental environmental conditions such as disease or predators.

Third, pastoralist nomads are never isolated from others in their environments. Yak breeders in Tibet transport salt to sell in distant markets [3]. The Basseri of Fars sell sheep offspring, milk, and wool in local markets [20]. Sometimes the political state imposes regulatory processes on nomadic migration; e.g., the Qashqa’i needed a permit from the army to use pastures that were nationalized. As Salzman writes, “*arrangements usually exist for the admission to the territory of outsiders, along with reciprocal arrangements for access to outside territories.*”

Thus, the pastoralist nomad must consider all three concerns, all interrelated, for survival. Indeed, when any one of these challenges proves intractable, nomadism often ceases, leading to a sedentary home. The threat of epidemics on key animals, diminishing resources due to competition, and lack of proper markets or freedom in states can all lead to a situation where nomadism is no longer the best strategy and, instead, settling down is best. Again, we stress that each of these elements is intertwined with each other (e.g., the state can reduce access to resources).

### 3.2 The Nomadic Worker Strategy

We found it useful to focus on trying to understand what strategies NWs use in their mobile workstyle. We can extract central concerns from the pastoralist strategy that involve challenges concerning the actants/means that they use for survival (the key animal), how they find resources, and how they relate to

others (who might be non-nomads). We used these foci as a lens on our data to identify the important challenges that NWs face.

### 3.2.1 Assembling Actants

While for pastoralist nomads their relation to their key animal is perhaps unique, it nevertheless bears a parallel to the notion of the central importance of key actants in modern work. The NWs possess certain key actants that are central to their nomadic work life; together this *assemblage* of actants (i.e., the means to accomplish their work) comprise their portable office. We use “actants” here to emphasize that objects *and* humans are assembled. Because of their extreme mobility, NWs rely heavily on their portable office; they cannot participate in their different working environments without a laptop and certain critical applications. For most NWs, cell phones and BlackBerrys are part of this assemblage. We derived the following criteria that we felt characterized the mobile office for the NW:

- The mobile office is a necessary component for the modern NW. It often serves as the only conduit for interactions with colleagues (e.g., via email or instant messaging) and provides access to information that they need for their work.
- Because NWs change their environments so frequently, their mobile office must be able to adapt to different infrastructures. There is not any single infrastructure to adapt to, but rather multiple and different infrastructures.
- A top priority for the NW while traveling is keeping the mobile office operable, e.g., with power and connectivity. The laptop is the most critical element in the mobile office.
- The mobile office is a key enabler for the NW’s flexibility and adaptability to a number of environments.

### 3.2.2 Seeking Resources

When NWs travel they must constantly seek resources to keep their mobile offices operable. They must find power for their laptops, cell-phone reception, a space with a desk or table, printers, and so on. Some resources are nonmaterial, such as quietness or privacy, and must be deliberately sought out. Resources can also include people such as IT support or technical experts. Often NWs must compete for resources with others (e.g., space), and often the locations of these resources are unknown or not readily available. These resources are sometimes sparse and vary in quality and situational appropriateness. So the NW must employ (local) mobility to adapt to unpredictable resources.

### 3.2.3 Integrating with Others

Correspondingly, NWs must integrate with their coworkers, both nomadic and non-nomadic, for collaboration. Organizational policies may not be favorable in helping NWs to integrate with others. Whether nomadic workers can accomplish their tasks in multiple environments is contingent upon the ability to not only be aware *of* others, but also provide awareness *to* others.

## 3.3 A Model for the NW Strategy

The pastoralist strategies served as a lens for us to use in identifying aspects of NWs’ strategies for accomplishing their work. We want to stress that we are aware of the significant cultural differences and goals that exist between pastoralist nomads and NWs, and we do not attempt to push this analogy too far. We studied their strategies to better understand the general concept of nomadism and to help us gain insight into what the main challenges and strategies might be for modern NWs.

Fig. 1 depicts the three foci we have just discussed to understand the work lives of NWs: assembling actants, seeking resources, and integrating with others. Each focal point embodies particular *practices* that NWs are concerned with. Moreover, we stress that each node is interrelated and dependent upon each other. For example, the NW must assemble and carry the mobile office; the operability of the mobile office is dependent upon finding resources; and integrating with others as the NW travels is done primarily through the mobile office.



Fig. 1: Three Foci of the NW Strategy

## 4. FIELD SITE AND METHODS

To gain an in-depth understanding of nomadic work in order to inform design for nomadic practices, we performed an ethnographic investigation. The extreme mobility of NWs made data collection a challenge. An ideal study would incorporate observational data of nomadic work in cars, trains, and airplanes across potentially different continents, at all hours; however, this would be prohibitively expensive for the researcher and shadowing would be intrusive for the NW, as the borders of their personal and work lives are blurred. We chose to conduct interviews by telephone, catching the NW wherever he or she was at the time. Some of our informants were at home, hotels, cars, or different worksites during our interviews. Moreover, not all the informants were stationary during our interviews; some were walking to a meeting, driving a car (resulting in a momentary gap of silence as the car drove under a bridge!), or carrying out errands. Some of our informants were in Asia, Europe, or different North American coasts at the time of the interviews.

Our data consists of 22 semi-structured in-depth interviews and one week of observing six NWs at one work site. All informants are from a large, distributed U.S. headquartered corporation, Laputa<sup>2</sup>, which manufactures computer hardware components. Four informants are “based” in Israel, while the other 18 are

<sup>2</sup> The organization and all informants are anonymized.

“based” in the U.S.. Contacts at Laputa recruited nomadic employees to interview with us. Informants came from a wide range of job positions: directors, market research analysts, a technical assistant, strategists, managers, an IT Planner, a research scientist, a publisher, engineers, and an architect. Nine of the informants are involved with the marketing or business side of Laputa. Interaction is a large part of all the informants’ jobs. Our informants’ nomadic lives ranged along a continuum. At the one end were extreme NWs who traveled extensively and regularly (one NW averaged 200 days/year on the road for the last 25 years) to others whose travel occurred in bursts. (In fact two informants each owned two homes in different U.S. states. One NW owned a home in Las Vegas because its airport has the most red-eye flights.) The interview protocol addressed the NWs’ different projects on which they were working, sources of stress, working environments, amounts of travel, technology use, interruptions in the workday, and methods of being reached and reaching others. Interviews ranged from 45 minutes to 1.5 hours and were audio recorded and transcribed.

Observations were conducted through a type of intense participatory observational method called “shadowing.” One author traveled to one office of Laputa and met (arranged by our internal contact) the NWs, explained the study’s goals and then shadowed each employee individually. Shadowing involves following as unobtrusively as possible the informant as they go about their workday. Artifacts utilized, people with whom one interacted, and locations are recorded on a notepad and time stamped to the second. Typically, each NW was shadowed for four hours, either from the beginning of the workday till lunch, or from lunch till the end of the workday. Following data collection, we used a grounded theory approach [22] guided by the concepts in our model. The interview and observational data were triangulated.

## 5. NOMADIC WORK: AN OVERVIEW

Most NWs at Laputa lead a nomadic work life out of choice or, in their view, out of necessity for their work. We identified several reasons why NWs at Laputa lead such a highly mobile life: to share skills, meet with workgroups, and to interact face-to-face. For example, technical staff reported that they are NWs because they had a special skill set that a remote group wanted, but were unwilling to relocate permanently. Another reason for nomadic travel is when the majority of the workgroup is remote from the NW, as one technical assistant explained: *“Most of the time, I think I have to travel. The reason being that I am on a smaller campus...most of the people are on another campus so people from the smaller campuses have to travel there.”* Thus, some NWs travel because they must cater to the group majority.

In another case, a designer noted that he travels to attend meetings because of the cultural norms of his remote fellow coworkers: *“I’ve had industrial designers hide the phone in the conference room because they didn’t want people to call into [the] meeting; they wanted them to attend in person. And, you know, that’s the kind of stuff that I think is—needs to be corrected, it’s a juvenile thing.”* We observed this firsthand during a meeting when someone avoided passing out the telephone bridge number to ensure more in-person participants. One informant mentioned his annoyance at constantly hearing his remote coworkers half-jokingly ask when he’ll settle down and move to where they are because of their consistent preference for face-to-face.

For the most part, however, nomadic practice is used strategically by our informants to establish and maintain face-to-face contact with others. As previously noted, many of our informants are involved with marketing and business—areas where face-to-face contact for buy-in with clients is crucial. One informant explains that his face-to-face interactions as a NW are for *“relationship babysitting.”* Informants reported that traveling for face-to-face interactions was worth it for starting relationships [12] as well as establishing trust [18]. Here, one informant involved in business describes activities that are representative of many of our NWs:

*Traveling to trade shows, talking with VPs, having discussions with university technologists...we try to determine if their interests align with our interests. Once a deal takes place, there is a lot of investigation, talking to competitors, talking with VCs, attending Laputa internal meetings for...gaining some sort of agreement.*

Indeed, NWs must do advance planning to maximize face-to-face time in the destination. Our informants report that at times they have traveled far only to discover few people are at the site with whom they can meet, e.g., as one noted: *“If I go somewhere I want to focus on [human-to-human contact] rather than...not get[ting] the benefit of the trip I’m taking.”* The farther away the destination is, the more crucial it is to ensure meetings happen. One NW explained: *“This is something you must do when you come, you know, 3000 miles across the ocean, you want to make sure that any meeting is pre-planned, heavily coordinated.”*

Nomadic work comes at a high price. NWs generally work long hours when they are on travel. There is little or no “off time” for them. They are expected to attend meetings with colleagues during their “regular” work hours though they may be in a different time zone. One informant described the workload: *“The expectation is that if you fly home at 9 at night, you’ll be in the office at 8 a.m.”* Another said: *“There are attitudes that are bred in the culture that you are always available.”*

### 5.1 Nomadic Workers and the Organization

*One reason for the misunderstanding between nomadic pastoralists and sedentary planners or officials is the very different ways they interpret pastoral assets.* —[Barfield, p. 198]

Laputa’s policy dictates that everyone has cubicles instead of traditional offices. Even top managers do not escape unscathed by this edict—about twelve years ago a policy was enacted for top managers to not have their own cubicles. The phrase “cube farm” is an apt description of what we saw inside Laputa’s campus: rows and rows of cubes characterized the majority of Laputa workspace layout. Like large parking lots, color-coded columns with uniquely labeled identifiers such as “H7” allow one to orient themselves as well as to find their “missing” cube.

On two days of our observation, one researcher took a tally of 25 random cubicle rows in random buildings at the Laputa site. We counted the number of cubes in a row that were occupied. The tallies were taken about three hours apart throughout the workday. In total, 126/517 cubicles were occupied; put conversely, 75.6% percent were unoccupied. This staggering percentage of unoccupied cubicles indicates how mobile Laputa’s employees are.

Locally mobile people represent the majority of workers in Laputa. We discovered that the local mobility of “natives” sometimes impedes nomadic work. Laputa’s organizational culture favors the local population by assuming that only the local population will consume its resources; the NWs’ needs are often

disregarded. That is, two different populations exist at Laputa who are both seeking to construct their own networks of human and non-human artifacts to accomplish their work. Design for nomadic work must consider how the organization can address the interplay between the locally mobile and nomadic needs.

## 6. NOMADIC WORK CHALLENGES

Drawing on the focal points in the model discussed in Section 3, we now detail the challenges related to *assembling actants* (the continual re-creation of the mobile office), *seeking resources* (competition for, and hunting for, resources), and *integrating with others* (maintaining visibility in the organization).

### 6.1 Assembling Actants: The Mobile Office

*The emergence of any key animal as a marker of regional pastoral identity is the product of a remarkable synthesis of ecological possibilities and cultural ideals.* –[Barfield, p. 10]

Perry et al. [16] noted that their informants used mobile phones much more frequently than laptops. At Laputa, the workstyle is markedly different. Laptops were referred to as “*my life blood*” and “*the cornerstone*.” However crucial the laptop is to nomadic work, it is but one (key) component to a mobile office. As one informant mentioned, “*Keep in mind that Laputa’s got about 70% laptops...In fact, when I ask people where’s my office, I point to my backpack and say, ‘That’s my office.’*” For the NW, the office is a mobile one continually reconstructed.

The laptop represents the key actant in an assemblage that attempts to recreate the office. Obviously, the laptop is a miniaturized computer—keyboard, mouse, and monitor all in one. Though central, the NW must assemble various other actants in addition to the laptop in order to replicate the office. The extra work of nomadic work, compared to other less mobile workers, involves the assemblage of this office. Components that are not mobile—network connectivity, power plugs, printers, phones, desks, and chairs—must be found by the NW in their different environments; e.g., a laptop without network connectivity will be deficient in collaborative functionality. Certainly, laptops are not the exclusive domain of NWs. However, NWs differ from traditional office workers tied to a single locale in that they cannot fully rely on the organization to provide them with a stable set of artifacts. Instead, it is the NW’s burden to carry as much of their office with them as possible and, when that is not possible, to search for the resources themselves in order to assemble their office. Our informants report that to be self-sufficient they carry portable printers, backup devices, batteries, SIM cards, and paper artifacts (as well as hygiene articles).

NWs seek to create a portable office that is as complete as possible so as to be self-sufficient. Mobile components of the office other than the laptop are valuable because they provide redundancy: a way to contact others in case one means cannot work. Correspondingly, pastoralists raise several species as key animals so that if a major misfortune such as disease or drought hits one species the other species might survive. For example, the wide coverage of BlackBerrys proves useful in customer sites as one NW described: “*Usually, I get no access at a client’s site. The only access I can get is via modem, which is pretty much impossible these days. Typically, my only connectivity is through a BlackBerry device.*” Hence, the portable assemblage enables NWs to maintain continuity in their work and deal with contingencies as they traverse different environments.

Pastoralist nomads are not hermits. The goods produced by their key animals are sold in local markets, and pastoralists must tap human networks to gain access to resources that are communally shared. Similarly, for the NW, equipping a mobile office does not simply concern inanimate artifacts. A fully functional office has human resources as well. The human infrastructure of IT support, managers, coworkers, and admins are in fact an integral part of a NW’s office. An office requires assembling human and non-human actants to make it functional.

While NWs cannot entirely depend on the organization to provide them with a stable set of actants, they nevertheless seek out particular environments equipped with certain utilities. These prepackaged assemblages of utilities can be found in cubicles, conference rooms, and traveler’s workstations. NWs are cognizant that such settings are *likely* to have prepackaged assemblages, albeit of varying quality and type. NWs can then connect their mobile office with such prepackaged assemblages in environments, creating an overall assemblage that is more complete, and thus closer, to the ideal office. For example, conference rooms offer a myriad of resources in a centralized location: power, network connectivity, whiteboards, phones, tables, seats, and projectors. Cubicles are convenient in providing power and connectivity, but furniture and external accessories are also important in that they provide ergonomic comfort. Both forms provide varying degrees of privacy. Traveler’s workstations dedicated to the NW used to exist, according to one NW:

*‘Traveler’s Workstations’ that’s what they were called. Now what they were was a room somewhere, and be it like a double-cube sized deal, or it might be a stack of four cubes in a row where you show up and there was a PC and a printer and a wide-band connection. And you could just sit down at the computer and type your way onto it.*

Like an oasis in a desert, traveler’s workstations provided a nearly complete office. However, they have largely been phased out at Laputa. A key misunderstanding with the traveler’s workstations was the assumption by management that *the laptop is now the office* and thus everything else becomes redundant. That is, once laptops with wireless connectivity became mainstream, it was believed that people did not need a set space with a chair, desk, monitor, wired connection and a local printer setup. The mistaken assumption is in equating a mobile assemblage with the ideal office assemblage. One informant summed up nicely why NWs want to assemble an office beyond the minimalist mobile one:

*Your own cabinet and drawers, you have the computing facilities to handle your work, a docking station, own setup of your computer, which means you have a place to put your notebook in the right position, your own keyboard, headset. The virtual office usually doesn’t have the things to meet your needs. Those are the basic things you expect. One of the most important things is the chair; you need the chair to be a setup according to your needs.*

While prepackaged assemblages can be a boon to the NW, they are not, as we touch on in the next section, without problems.

### 6.2 Seeking Resources: Human & Inanimate

*Nomadism can be used...to gain access, through special movement, to resources (such as pasture and water) that are sparse in any particular location.* –[Salzman, p. 23]

So far we have described how NWs must continually recreate their offices by using local and portable materials. One of the

major challenges for NWs is finding resources in order to assemble and keep their office operable so as to conduct work.

### 6.2.1 Competition for Resources

A crucial resource that NWs need is power for their laptop. Our informants report that they constantly must search for power resources. Informants also felt frustrated about not being recognized at a site as someone who needs power resources more so than others. One informant complained that scarce power plugs are blocked by non-nomadic workers: *“There’s two power outlets in the entire cafeteria...Usually what happens is somebody sits down there to eat breakfast or lunch, who isn’t interested in the power, but they’ve got the power plug hogged up. It’s just nuts. It’s as bad as the airports.”*

Competition also exists for conference rooms. Laputa has a conference room reservation system, which its employees can use to gauge which rooms are available. But local practices at Laputa paint a different picture of how conference rooms are actually used: *“So we had a meeting...So we couldn’t book a conference room because everyone booked it ahead of time, just in case they might need it.”* Conference rooms are regularly booked full in Laputa, but reservations often go unfulfilled. It is in fact more productive to simply hunt for an empty room. One NW said: *“We were scrambling around for a conference room. <chuckles> people keep reserving conference rooms but never use them so we just kind of walk around looking for one that’s empty.”* In the rare cases where someone has booked a room and arrives to claim the reservation, they can *“kick people out.”* Therefore, we see NWs and the local populace both competing for conference rooms. Indeed, we saw many local workers in meetings, sometimes with two people taking up an entire room that could house ten or more.

### 6.2.2 Uncovering Invisible Resources

A key characteristic of local mobility are the subtle practices surrounding resources. These practices are built up over time and implicitly understood by the local population. However, NWs, because of their constant movement, spend little time learning the nuanced practices surrounding resources endemic to a particular location. Part of this local knowledge is in perceiving where the working resources are. In many Laputa sites, some resources are mirages, unbeknownst to the NWs. We followed one informant as he went to one conference room, tried Ethernet plugs and then went to another conference room and found a working Ethernet plug on the second try. There are no visible *markers* that indicate whether a resource is working and of good quality. NWs inevitably waste time checking the “quality” of a resource, as one described: *“The power guns [in the projector] are burned out in which case your stuff [slides] might just come out looking black because you use a lot of blue in your background.”* The local population has the advantage for resource utilization by generally being aware of where the working resources are (or knowing who to ask).

Existing markers are often less than satisfactory. Printers are firmly tied to a location. One form of marker for printers appears on the laptop when NWs search Laputa’s internal network. These markers name the printer’s physical location and not the nearby printers. As a point of reference, the Laputa campus we observed consists of seven buildings: the longest distance between two buildings is nearly 0.5 miles. A printer far away will not be helpful for a NW. After some time, NWs typically accumulate a long list of Laputa printers set up on their computer. They must continually change their default printer, or, as one complained,

*“Otherwise, you end up printing to some other site.”* Laputa also has paper cards located above or next to the printer identifying their IP, location, and name. But many cards are outdated.

*So there’s all these dead-letter addresses. So you go into a place and there’s a little routing tree that says on 4-3 of R&B there[’s] a color printer here, a laser printer here, a Tektronix over here, right? So you send print to it, and then you get over there and you find out the printer was cannibalized 6 months ago, so it goes into a dead-letter file. But it doesn’t give you a blurb that says, ‘Sorry, nothing here.’*

Who is maintaining these markers? The local IT staff have set up markers but have little incentive to maintain them. For local members, printer setup is typically a one-time operation. NWs are disadvantaged and must *“wander around and take a piece of paper and write down the printer address.”* As a result, some informants reported that they prefer to purchase portable printers that they use in hotels or at work sites and then dispose of them like *“razor blades,”* rather than rely on the company’s printers.

Throughout our interviews, wireless was seen as something quite different from seamless. Because of its invisibility, NWs saw wireless as a black box and were confused as to why it did work one day and not another. How does one “hunt” for wireless? *“When I get it to work, it’s terrific, but I can spend...20 minutes and somehow luckily succeed with no clue in my own mind which magic step it was.”* Many see wireless connectivity as a gamble. One NW complained, *“But now it’s like a, ‘Take your best chance and see if it works.’ If it doesn’t work you wind up being frustrated and you say, ‘Heck with it, I’ll deal with it later.’”* Still another reported, *“They don’t always stay connected...and a lot of people have that problem, no one’s really explained to me why or how to solve it.”* Even using physical cues for the wireless spectrum proves useless: *“You can be sitting right under a wireless modem and still not...get connected.”*

How to debug the wireless infrastructure is particularly difficult for NWs—they do not know whether the fault lies in the environment, the latest automated updated from IT or in their own laptop’s particular configuration. Most NWs end up giving up and finding alternative resources (e.g., Ethernet cables in conference rooms, which require no setup). It is the NW’s burden to debug because they cannot afford to have their laptop away being fixed, and IT support is unlikely to be able to debug remotely because of the possibility that the problem is site specific.

Because they are temporary visitors at a site, NWs face problems tapping into the site’s human infrastructure for support. Pastoralists have similar problems: *“While nomadic and pastoral, the Bharawad [of Gujarat] appear to have been somewhat disfranchised. They did not vote and were not connected to the political structure. Moreover, it was difficult for them to receive services or assistance”* [20]. When assembling the office, NWs need to be aware of who the right people are in their new locations. For example, a researcher who develops hardware prototypes needed a certain brand of remote control for a device he was implementing, so he contacted a multimedia integration engineer named Gary:

*You know, I come out of the lab and...we’ve got a gang there. [But] when you’re out of the way from the site, it’s a lot more difficult to qualify the resources that are available to you...Good buddy Gary that’s here...he didn’t have any remotes that...resembled what I was looking for. Usually he’s a pretty good resource but it took me 3 years to find out he was here!*

It was by sheer chance he found Gary: *“Talking to a guy in Oregon, that knew a guy in New Mexico, that knew Gary here.”*

In another case, an informant asked an admin to help find another admin to get office supplies: *“I’ve asked my admin to locate...a group level connection down here where I could find an admin who would be willing to let me basically utilize their resources just for like basic office supply type stuff.”* NWs thus face problems trying to locate people in remote sites willing to provide support, even though they are nominally in the same organization.

### 6.2.3 The Etiquette of Resource Seeking

The resource most hunted for is an empty cubicle. Unlike conference rooms, cubicles are plentiful and often empty (cf. Section 5.1). NWs employ several strategies to secure cubicles. Some use a strategy of personal contacts at remote sites, e.g.: *“It’s because I’ve got contacts in these locations, so I say, ‘Hey, is somebody gonna be out? Where would [you] suggest I sit?’...I don’t just typically go and just find a spot that looks empty. I usually work with somebody at one of the sites.”* Curiously, some NWs rely on contacts of other NWs who have remote cubicle ownership: *“I know a person who has a duplicate [cubicle] in [-]. It’s kind of a bare bones cube. If he’s not there, I can use it.”*

In lieu of personal contacts, informants described simply finding an open cubicle, *“If no one is using it, then I walk right in.”* We observed layout maps at the end of each cubicle row that assisted NWs in finding cubicles without ownership. NWs have learned to do away with inhibitions and ask outsiders for their space, *“Even if it’s not your group, you can say, ‘Hey, is there somewhere I can work?’”* After some time, NWs learn which cubicles seem available. Tellingly, nomadic workers know when a cubicle has been *“lived in”* by the various *“remnants”* that are signs that a cubicle is being used. It is important to note that NWs are mindful of cubicle ownership and work to find cubicles that can be safely used. One worker described this as a *“friendly understanding.”* When conflicts do occur, NWs typically relinquish the space without any problems. NWs are aware that many people at Laputa telecommute, or are locally mobile, thus facilitating the finding of empty, usable cubicles.

### 6.2.4 Ergonomics as a Resource

Places with prepackaged assemblages have ergonomic actants lacking in environments such as airplanes or cafeterias (whose seats are not adjustable nor meant for long periods of work): *“I’m 5’5”...I usually end up feeling tired in my arms and legs. I am not sitting right and cannot work appropriately. [-] has cubicles with desks and phones so that you are not holding the phone between your ear and your shoulder.”* One NW even went to see the nurse at Laputa: *“I had to go see the nurse yesterday to have my wrist looked at because when I am not working in my principal office, I have to use the keyboards on the laptop. And I am bigger...I am 6’4” and she was saying that the smaller keyboard is a problem.”*

External accessories like a monitor and mouse are also important for ergonomics: *“Yeah, I think that [the laptop’s] light is not constant enough, and when you’re doing work you don’t have your mouse and your big screen around you.”* Even printers in some sense are important ergonomically because paper provides a comfortable way to read large text: *“I still like to print things that are longer than half a page to read so I can take it somewhere and take notes on it. Paper is still a significant role in this world.”*

Cafeterias do offer a different sort of comfort by providing easy access to bathroom facilities and sustenance. Several informants

enjoyed having a cup of coffee while working on their laptop. Tables are larger and ideally suited for informal interactions. Yet cafeterias can prove problematic when NWs seek privacy.

### 6.2.5 Privacy as a Resource

Though NWs seek informal interaction, at times they also seek spaces that are free from distractions. Privacy is a resource dependent on the physical characteristics of the space itself as well as the surrounding scene of the space. Though the cafeteria can be a place to facilitate informal meetings, this environment also leaves NWs open to unwanted interruptions and distractions: *“Cafeterias are a distraction: noisy and people walking around.”* or *“I think it’s [cafeterias] a little bit more open to interruptions.”* This is true of working in other public spaces. One NW described how when trying to work in a public place he is surrounded by people walking around him. (He uses a privacy filter screen with his laptop on flights.)

We observed informal meetings transform into formal meetings by moving from the cafeteria to the conference room. NWs describe the need for privacy at meetings which is not always easy to find. Meetings often involve call-ins where people need to speak loudly, as one NW noted: *“Yeah, we wanted a room that we could close the door.”*

Some NWs enjoyed anonymity, citing the ability to concentrate on their own work in between meetings during *“dead-time”* [7]. Yet however discreetly NWs slide into a cubicle, the potential for distractions is often there: *“A cubicle in an active area...you’re in a little bitty place to work and there’re all these people buzzing around the computers, ‘Hi, where are from?’ ‘I’m from here.’ OK. ‘Let me tell you about my grandson.’ All this kind of junk.”*

Irrelevant information can be very distracting as one NW described: *“The other disadvantage I have of being in cubicles like in [-] ... people that are very loud around me and not all in the same business segment that I’m in. So, while I’m on the phone with customers they might be cursing or they might giving pricing information or they might be giving out information that my customer shouldn’t be hearing.”*

### 6.2.6 Monetary Cost of Resources

Surprisingly, in many of our interviews, NWs were preoccupied with cost. Many NWs expressed concern about the cost of hotel phone calls and day passes for wireless access point providers. Some NWs preferred traveler’s workstations simply because they have an internal phone line without charge. Paradoxically, when NWs use phones of cubicles belonging to other people, the cost may be higher than a cell phone: *“You have to [input] a special code for the phone. They charge really high rates.”* One NW expressed his confusion on policies of whether to use a toll free number or a local number from a pay phone. Some view cost as a *“moral”* dilemma: *“If you need to pay \$30 for a day of [wireless] access. In a moral sense, it is a high cost.”*

Why is there a concern for cost? The following quote is revealing:

*If you have an expense report every week, you are going through personal cash on your Visas, so if you don’t get your expense report in, you are fronting thousands of dollars on your personal card. The best way to deal with it is to have a credit line with my bank to pay off my Visas so I don’t have to pay so much interest. I probably have to front \$50/year on interest payments for my company. And if you don’t have a good admin... I used to have a secretary when I was a manager of people, but now I don’t.*

Laputa reimburses NWs for their travel costs. Instead of a company credit card, Laputa's employees pay for extra costs out of their own pocket, and then must later go through a process to get reimbursements. This requires a lot of effort on the part of NWs—fastidious documentation (e.g., receipts), expense reports, interest rates and processing time. Traditional office employees who do not travel often can easily charge their credit card without worrying about limits. In one of our observations, a NW spent much of his dead-time filling out expense reports, copying them and mailing them back to his home office for reimbursements. He dryly noted that he has to make sure to keep copies in case they get his reimbursements wrong, or if they are lost in the mail. Our interviews also revealed that, to some extent, managers do look at how NWs spend their money: *“I never actually see my [cell] phone bills but I do get some feedback when I use a lot of money on a cell phone.”*

### 6.3 Integrating with Others: Visibility

*It is common to find peasant pastoralists [nomads], such as Sardinian shepherds...with neither political support groups nor control over territory (especially in those communities without pasture common lands); instead, they rely upon far-reaching knowledge of social land use and widespread social networks, depending upon a mix of friendship, payment, and patronage to gain access to pasture, materials, assistance, and information.* – [Salzman, p. 144]

A third challenge for NWs is to integrate with others in the organization. This involves an effort on the part of NWs to ensure that their colleagues and the organization remains aware of their current activities. Otherwise, NWs risk becoming “invisible” or marginalized in the organization.

#### 6.3.1 Maintaining Visibility in the Organization

Some NWs in our sample described that their nomadic lifestyle makes them liable for becoming invisible in the organization. One informant commented: *“Because right now, I'm an out of sight, out of mind kind of guy...unless people need something from me, or have a deliverable that they owe me...it's an interaction that just doesn't happen naturally, you know. So, I often have to be very proactive just to get people to remember that I'm there.”* Another informant noted that because they frequently travel, NWs can “fall off the radar screen” of colleagues. Events at the home site continue to occur without the NW's presence, as one recounted: *“They're having a lunch for one of my coworkers today to celebrate his 20th anniversary working at Laputa. I couldn't make that. I would have loved to.”* An informant described his frustration at not being aware of similar work to his: *“Oh, just like finding out about what people are doing. Like I'm building my widget and then I found out that they're building another version in a lab...It's kind of annoying that I found out about it third-hand.”*

Some nomadic workers strategically combine face-to-face and electronic contact to remain visible to others. One informant described that for him, traveling to meet face-to-face is actually an investment in email. Why? Because he reports that when he meets someone in person then they are less likely to throw his email in the trash. He feels it makes email and phone contact more effective. Others concur that their face-to-face contact leads colleagues to be more responsive to their emails and phone calls.

Still other informants describe that they strategize where to situate themselves when they travel to another site in order to maximize

their informal interaction. This may mean sitting in cubicles where they can get “hallway contact” or the cafeteria for spontaneous informal meetings, as one informant described: *“You run into people who you might not otherwise talk to, so there's a networking advantage of just being there and being seen.”*

Those who have home bases position themselves in places where people can expect them, as one explained: *“To me, I put myself into the flow because that makes me valuable. People come into my office and ask me questions.”* However one informant complained, *“Well, the irony is that, you know, the design team prefers to work person-to-person and they do that, and when I [travel] to [---] there's a lot of times when there's literally no one in the studio area.”* This quote is indicative of a problem stemming from Laputa's mobile population. NWs themselves cannot rely on informal interactions at their home sites because the “natives” themselves are mobile (e.g., telecommuting). Aware that many of Laputa's workforce is mobile, NWs sometimes have to gauge whether a certain meeting will be well-attended in person (e.g., by looking at who is on the invitee list). If the meeting will largely be made up of call-ins, it may not be worth the trip. Thus, nomadic workers strategically use travel to increase their visibility in the organization, yet the success of this strategy depends on their being able to find others where they travel.

#### 6.3.2 Synchronizing with Others

Another challenge for NWs is to synchronize with colleagues when they are in different time zones. All of our informants reported that they work in multiple projects, with different networks of people. Therefore, NWs must synchronize for communication and coordination with multiple sets of people who may themselves be NWs traversing different time zones. One nomadic worker described his odd schedule: *“My first meeting was 4 a.m. U.S. time with a meeting I had to do with my Israeli team...5 a.m. to 6 a.m. was a meeting with a project team where some of the people are in Arizona. Some of the people are in the U.K. and me over here and two people from Israel.”*

Despite these early morning hours for meetings, this NW was still expected to attend a dinner later in the day locally with others. Thus, NWs must manage communication both with remote and local colleagues, who may be physically (and mentally) in different time zones. Sometimes physical collocation does not lead to straightforward scheduling. Different cultures pose challenges for time synchronization. One NW reports that in Asia people work late, and when there he may get a call at 11 or 11:30 p.m. at night.

Information workers switch between synchronous and asynchronous technologies depending on needs, such as using IM to get a quick response [14]. NWs, on the other hand, are not always in a position where they can exercise their preferences for synchronous or asynchronous technologies. One nomadic worker described that often email is not immediate enough. He works under tight deadlines and may need to launch a project. Time zones and location impose constraints on using synchronous technologies. He may not be in a location with cell phone reception or Internet connectivity to get immediate responses. Pagers require one to be in an area with reception until the call is returned and the NW may not have this luxury. Sometimes due to travel the NW cannot communicate critical information to people at the time they need it. Whereas many informants rely heavily on IM or cell phones for quick communication, they have to resort to asynchronous email when time zones are too disparate. There may

not be a large enough block of shared time at a reasonable hour to schedule a meeting.

Many of our informants described that their colleagues are not aware of, or if they are, may not respect, the nomadic worker's current time zone. One NW described: "*People in the U.S. who are not aware of the time zones, schedule meetings at impossible times.*" Though an overhead, some NWs put in extra effort to inform their colleagues continually of their current time zone. One informant writes this in the header in his email to be obvious; another updates messages in his voicemail; still another informs others in his emails in which continent he is currently.

Current scheduling systems do not take a person's current time zone into account when a meeting is scheduled. Scheduling is often done, as one informant explained, in a "*shotgun*" manner: "*peppering people's schedules with bullets*" to see who can meet with the customer. Often the nomadic worker gets "hit" without regard for what time zone he or she is in. Informants describe that unfortunately the NW is the one who has to adapt to the time zones of others for meetings.

It is not only colleagues with who NWs must synchronize but also with the human infrastructure in the organization. For example, backups, as managed by their local IT support, especially are not suited to the nomadic schedule. Laputa has regular automated backups on the laptops they issue. The backup time is set with respect to one's home office time zone. This can be terribly inconvenient for NWs, as one described: "*[Backups] all happen at the wrong time. You're in the middle of a presentation or at home on a dialup line and it says, 'Do you want to backup your whole computer?'*" Another NW explained: "*It ties up a lot of bandwidth to do the backup and then if I want to whip my laptop off, stop the backups, and go visit a customer you know...it's a heck of a lot easier for me to just do the backups [myself].*"

## 7. DESIGN FOR NOMADIC WORKERS

In our study we have highlighted the importance of considering organizational design in conjunction with technical design for supporting NWs. The following key design insights stem from an integrated approach in analyzing nomadic practices: the importance NWs place on key actants that together form a mobile office assemblage, seeking resources, and being able to integrate well with others in the organization for collaboration.

*Easing the assemblage of actants.* NWs carry their offices on their backs. They carry not only their laptops but a whole host of accessories: printers, backups, batteries, non-digital devices (for "dead-time"), cell phones, blackberries, etc. Thus, designing for nomadic work must address how NWs can transport these technology artifacts especially as they travel through and use them in a number of different locales (e.g., changing batteries in tight airline seats). Some of the burden of carrying peripherals can be offloaded to the sites; e.g., sites can have a stock of batteries, portable printers, etc. available to NWs. The same can be introduced by hotels who cater to nomadic lifestyles. NWs complain that carrying peripherals can be unwieldy and heavy. Designing for the nomadic office includes designing for the ergonomic transport and easy integration of different devices.

*Making infrastructure visible.* Infrastructure is generally invisible to people when it works as expected. However, for the NW, technical and human infrastructure is always in the foreground. The NW must hunt for resources when they arrive at a new site (sometimes even at a site that they have previously visited, as

printers may have moved, the wireless network may have changed, rooms may be reconfigured, etc.). In contrast to Mark Weiser's dream of computing receding into the background [23], we found that the very users of ubiquitous computing need infrastructure to be visible, and not only when they encounter it initially at a new site. As a result, NWs become do-it-yourselfers, forced to become adept at diagnosing and fixing their own tools. Infrastructure could be made visible, for example, through updated maps or indicators of locations of key resources at a site. GPS portable devices could help NWs navigate through new sites via augmented reality software.

*Designing a physical workspace for multiple users and multiple uses.* In shared spaces, ergonomics are generally ignored as these tend to be personalized. In designing physical spaces for multiple users, ergonomics must be considered that can be flexibly configured. Ergonomics refers not only to seating and desk arrangements but also to configurable peripherals, such as an external monitor and keyboard. Soundproofing should also be customizable (e.g., as closeable cubicles or offering pink noise to mask speech). A space should be configurable for informal interactions or closed for privacy when distractions are too high.

*Designing for interaction.* Because informal face-to-face contact helps keep NWs informed and visible in the organization, NWs strategically seek out environments where they can maximize face-to-face contact. Due to the local mobility of most employees, NWs need to be informed who is present at the site they visit and where they are located. This would involve a dynamic updating of people's whereabouts as many people are locally mobile as well as nomadic. Designing for interaction could mean dynamically informing the NW on the optimal place to situate themselves at a site to informally interact with others. For example, people at a local site might choose to notify their whereabouts to the NW when the NW travels to their site. In addition, NWs need awareness of events transpiring back at their various workgroups to maintain work continuity.

*Designing for synchronization with others.* NWs are continually traveling, often across very disparate time zones. One of their challenges is to synchronize with others for meetings and interactions so that they are not overwhelmed by the time zone difference. One design feature that we can envision is a time zone preference that is sent to colleagues with who one collaborates. This notification can state location but also preferences as to what is an acceptable time for being accessed. Another design feature that we envision is a scheduling system that keeps track of time zone histories when members attended previous meetings. The burden of unwieldy meeting times (e.g., 4 a.m.) can then be more equitably distributed (or negotiated) among meeting members. Internal directory services need to become dynamically and remotely updatable (possibly via mobile devices) to account for the fact that not everyone is at their "home" office; data such as hotel number and current location could prove useful.

*Designing for nomadic communities.* NWs at Laputa largely work in isolation of each other. However, pastoralists rarely live in total isolation from each other—they often form complex hierarchical societies. Though some pastoralists such as the Bedouins do maintain relative autonomy from each other, they often form camps made up of multiple family tents. This provides added companionship and security [3]. By creating connections between NWs, one can shift the work of markers from non-nomads, to the people who really care, the NWs. For example, wikis, blogs, and forums can be ideal media for disseminating "tacit" knowledge

(e.g., Where is the best place to sit for wireless connectivity? Who can help me find office supplies?) about company work sites. Sites such as nunomad.com and laptopphobo.com represent virtual communities catering to NWs in general (e.g., travel tips), but company-sponsored technologies will provide more useful concrete solutions to coping with internal company sites.

*Designing for organizational policies.* Organizational policies need to regard NWs as having different requirements from the local populace. Policies such as expense reports or travel restrictions that seldom affect traditional office workers can become insurmountable for NWs. Policies such as ways to offload travel expenses, support for NW reservations for space resources, and providing not only basic resources like connectivity and power but resources that increase ergonomic comfort, privacy and awareness can help mitigate challenges NWs face. Policyholders must realize that satisfying local mobility requirements does not also satisfy the extreme mobility requirements of NWs.

## 8. CONCLUSIONS

One of the outcomes of our study is that design support for modern workers can be informed by examining strategies used by people who have experienced similar challenges for generations, though they may be in different types of societies. Pastoralist nomads, Micronesian navigators, and tribal chiefs are just examples of roles in varied societies that utilize strategies that could be drawn upon for insight. In examining the NW lifestyle, we have drawn inspiration in our analysis from nomadic strategies that have enabled their survival for generations. The pastoralist literature opened our eyes to the notion of examining *strategy* for accomplishing work in a nomadic work style. Though there are many differences between pastoralist nomads and the modern NW, there are some elements central to both their strategies: using principal actants for survival, seeking resources, and integrating with others. In closing, it should be noted that there are some important characteristics between pastoralist nomads and NWs that make detailed comparisons unsuitable, e.g., the religious significance and social capital of key animals, the social organization within pastoralist tribes or kinship relations between pastoralist families. We therefore recommend caution in drawing analogies too closely. Nevertheless we felt that some characteristics of the pastoralist nomadic strategy that have enabled their survival for thousands of years were a valuable lens to deepen our understanding of modern NWs.

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