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The Gig Economy and Information Infrastructure: The Case of the Digital Nomad Community

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Ongoing discussions of the gig economy have focused on the critical aspect of digital mediation, and in particular the role of applications and platforms such as Uber or TaskRabbit. We extend this discussion by considering more decentralized contexts of gig economy, in which individuals do not rely on a single dominant, central intermediary, but rather exercise a higher degree of agency in arranging and aligning multiple digital platforms to support relevant work practices. We employ the concept of information infrastructure to describe the emergent configuration of heterogeneous digital platforms leveraged by digital nomads as a community of location-independent, remote workers. Using both forum analysis and in-depth interviews, we examine how the digital nomad community dynamically brings together and negotiates digital mediation in the form of an information infrastructure.

CCS Concepts: • **Social and professional topics** → **Computer supported cooperative work**;

Additional Key Words and Phrases: Gig economy, digital nomads, information infrastructures, digital platforms

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1 INTRODUCTION

The term ‘gig economy’ has developed in academic and business discourse as a description of a professional space which espouses micro-entrepreneurship, self-employment, and computer-mediated, peer-like exchanges [23, 71]. These exchanges are enabled by a large number of sophisticated digital intermediaries, applications, or platforms, which can rapidly match workers to employers, facilitate transactions, and establish trust [7, 13]. Because the essential benefits of the gig economy model are supported by digital mediators, an understanding of the gig economy requires an examination of its underlying technologies and mediation mechanisms [26, 48, 50, 71].

There are a host of technologies and organizations involved in the gig economy, representing many different business models and organizing logics. The classic examples of these technologies include transport and travel services like the ridesharing app Uber and the handiwork-on-demand site TaskRabbit, as well as freelance work marketplaces like Upwork. However, the essential characteristics of the gig economy, which set it apart from traditional employment arrangements, are a set of organizing paradigms which expand further than these specific technology-driven business models [49, 72]. Research has characterized the sharing economy, and more specifically

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the gig economy, as a broad trend in how peer-like exchange or sharing has entered into various contexts [15, 61]. In this characterization, gig work might be facilitated and conducted on a digital platform organized by a central player, but it may also enter into more distributed, community-driven contexts [5, 21, 72].

Much of the discourse surrounding the gig economy and other peer-like systems has focused on exchanges facilitated by a dominant third-party intermediary, such as Uber, Taskrabbit, Fiverr, Kickstarter, or Mechanical Turk [e.g. 7, 27, 34, 40, 45, 50, 69]. In this model, individuals are more interested in lower costs and convenience than social interactions with other transactors [15]. Transactions are often anonymous, decentralized, and facilitated by matchmaking mechanisms through the intermediary rather than through a foundation of social ties [20]. The organizing paradigm of this form of gig economy is often intertwined with the concept of digital platforms, in which the platform is a locus for users to take advantage of the scaling and organizing potential of a network [9]. However, while the platform is open and allows its user base to grow and interact exponentially, its architecture follows and reinforces the specifications of an individual designer or particular business model [11, 29].

A broader conceptualization of mediating technologies would expand our understanding of digital mediation in more distributed contexts of the gig economy. There is a need for empirical studies that go beyond the interactions of people with single digital platforms by integrating instances of the gig economy wherein individuals engage with a distributed assemblage of digital platforms as a community. Ertz et al [21] describes this paradigm as “empowerment,” a state in which people “are empowered to collaborate directly with each other. They organize, arrange and negotiate informally the terms and conditions of the exchange” (p. 1). As opposed to more common research contexts of the gig economy in which activities are mediated by a central third party (single digital platform), empowerment means people enjoy the liberty to develop, navigate, and negotiate various digital platforms, and to decide about their affordances as a whole in accordance with the needs of the community.

In order to explore more distributed aspects of the gig economy, we investigate a specific community of remote, location-independent workers known as digital nomads. Digital nomads are workers whose work does not tie them to any specific place (or to a specific itinerary), and who therefore travel while working. The length of their sojourns in any given place and the length of their nomadism varies, as does their age and profession. They are similar, however, by specific norms and practices of nomadic work, such as maintaining productivity, finding work, developing their skills, and hunting down WiFi [30, 32]. As discussed in the section on related work, the digital nomad community is unique for its level of departure from location and organization-based work, for its strength of self-identity and web presence, and for its active adoption of various digital applications and platforms which support digital nomads’ work [51]. Digital nomads are mobile, technologically savvy, and entrepreneurial, making them a fruitful context for the study of digital mediation in gig work [10].

The primary contribution of this work is towards describing the role of digital mediators in facilitating work practices in community-oriented, distributed gig work. The current description of the digital platforms in the gig economy is predominantly focused on individual platforms with centralized design and control, and is therefore incomplete precisely because it does not accommodate the distributed, decentralized aspects of the gig economy. We reconceptualize this mediation as an ecosystem of heterogeneous applications and platforms, which are together infrastructural in enabling gig work. In order to explore this concept, we present empirical observations of the work practices of the digital nomad community and examine how digital nomads make use of different technologies to support their flexible, nomadic work arrangements. Further, we look at the ways in

which digital nomads leverage a multitude of digital platforms and services to innovate and carry out practices for finding work, developing skills, and conducting transactions.

To explain the integration and mediation of various digital platforms in the work practices of digital nomads, we draw on the literature of information infrastructures (II). The concept of II directs attention to the ways in which a community of workers engage in bottom-up practices and fashion a large diversity of digital platforms into evolving, emergent information infrastructures [16]. IIs are not designed from the top down, but rather emerge from the complex interactions among many technologies and participants [28, 31, 75]. This perspective allows for digital platforms to be considered in relation to other technologies and situated as they are in broader sociotechnical systems [67].

2 RELATED WORK

2.1 The Gig Economy and Digital Platforms

The term ‘gig economy’ has developed in recent economic discourse to describe a system of flexible, on-demand, and transient work arrangements [24, 48]. Organizations increasingly prefer to hire large numbers of short-term workers for specific projects, keeping only a small staff of permanent employees. The impermanence of these work relations enables (or demands) a great deal of independence, flexibility, and entrepreneurialism on the part of the gig worker [23, 25]. Relying heavily on digital platforms, gig workers must continually arrange short-term gigs, as well as acquire their own resources and training [23, 71]. The gig economy has a number of closely associated concepts, including the sharing economy [e.g., 72], collaborative consumption [e.g., 21], the collaborative economy [e.g., 41], and peer-to-peer economy [e.g., 77]. While these terms describe different phenomena, they all involve a move away from hierarchical organizational models and towards a population of freelancers, crowds, or peers that engage in economic transactions in a more distributed fashion and with a more flattened structure than conventional consumption markets [15, 21, 72].

Employment in the gig economy involves a variety of digitally-mediated relationships ranging from semi-permanent employee relationships to anonymous crowdsourcing or on-demand labor relationships. Trust and reputation, as social resources, play a key role in facilitating reliable transactions [26], and gig economy platforms are sensitive to the way in which social connections are maintained in the digital space [61]. Specifically, reputation and trust have been identified as key factors in supporting exchanges between anonymous or semi-anonymous peers. Users of digital platforms must have trust in digitally-arranged exchanges if they are to hire workers or collaborators based on a profile or rating [72]. Ikkala and Lampinen [34] connect the establishment of trust to the dynamics of the digital platform, which facilitate exchanges between users by mediating monetary transactions (making sure that everybody gets paid) and by resolving client and provider disputes as an authoritative third party. The platform is in this way a “broker” between users, and orchestrates transactions on a market-like basis, with compensation as the assumed driver of exchange [2, 9]. Community-based forms of gig interactions with underlying grassroots mechanisms are similarly empowered by digital platforms. As an example, Time banks (e.g., TimeBanks USA and Just in Time) provide virtual and local vehicles for connecting and strengthening communities of interested peers (with less focus on transactions and revenue generating business models) [5].

Digital platforms are a critical mediating unit in gig economy systems because they provide a digital space, where essential aspects of the gig economy take place [13, 48, 50]. Following Cusumano [9], the platform is a digital mediating system which creates value through the network effects of component and associated products and services. The platform has become a crucial element in the rapid development of sharing and crowd-based work, and has consequently become

a central point of study in CSCW [12, 13, 60]. In this framing, the problems of coordinating work between people is comparable to distributing work amongst computer processors [39]. Similarly, research has observed that the success of platforms is dependent on a certain scale, due to the benefit (or requirement) of platforms for network effects between users [70]. A key aspect of platforms is therefore the fact that they support the network effects and scaling needed to make a peer-like gig economy system efficient, and also provide the service elements, such as payment processing or screening which enable individual peers to carry out exchanges across a network [72].

The technical aspects of the platform are also engaged in negotiation with work practices and social ties, or as Raval and Dourish [62, , p. 97] describe it, “the way in which algorithmic processes insert themselves into a labor relation.” The somewhat secretive algorithmic processes of peer-to-peer systems have even been the object of “algorithm audits” [27]. A bounded platform can provide a space for the creation of trust between actors, and itself promote greater social ties [7, 45]. Trust is developed in direct relation to material aspects built into the platform, such that the social space created by a platform is brought into line with its designed features. As an example, Raval and Dourish [62] examine the motivation of ridesharing drivers to meet rating requirements and maintain work flexibility, aspects of a larger development of normative work relations surrounding the structure of the platform.

Discussions of the gig economy, along with terms including the sharing economy or collaborative consumption, have highlighted a number of abstractions of the organization of exchanges between people, but despite the breadth of these concepts, most previous investigations of the gig economy have focused on a specific model in which peer-like actors make exchanges through a single third party. While some studies have examined the effects of other applications, such as social media sites, in conjunction with a platform, the emphasis has usually been placed on the relationship between workers and the dynamics of a central platform [e.g., 7, 27, 34, 40, 45, 50, 69, 73].

A broader conceptualization of the gig economy, however, allows for an investigation of more distributed technological paradigms. Working from the concept of collaborative consumption, Ertz et al [21] describe exchanges mediated by a central platform as a form of “quasi-empowerment” because the exchanges represent collaboration between peer-like actors, but a mediator exercises control over the organization of transactions. This describes a large number of gig work arrangements, such as driving for a ridesharing app like Uber, or performing on-demand labor through Taskrabbit. Ertz et al [21], however, outline another model of exchange in which empowerment is accomplished by allowing users to collaborate directly with each other, and to wield a great deal of agency in coordinating and organizing the exchange. This model presents a population of agentic users engaged in the bottom-up definition of social exchanges. By contrast, the established model of the platform, despite being generative of various uses and affordances for a large user base, is commonly organized by one organization or a consortium of organizations, so the control mechanisms are often centralized [11, 29]. In order to capture the bottom-up quality of the distributed gig economy model and various digital platforms that are brought together and aligned to support it, we next describe the concept of information infrastructures.

2.2 Information Infrastructures (II)

Information infrastructures (II) have come about in the literature as a way of understanding “systems of systems” [16, 59]. Due to their size and complexity, IIs escape the frame of traditional theories of information technology or design which are encapsulated within any single organization [75]. As technologies have become increasingly interconnected, in large part through the internet, many discussions of individual applications or IT implementations have graduated to discussions of expansive systems and infrastructures that are shared and used by a larger community [29]. IIs are

generative, [31, 75], meaning that they are flexible systems, and open to local adoption. As such they are “never fully complete ... they have many uses yet to be conceived of” [78, , p. 43]. The flexibility of infrastructure supports varied and dynamic modes of membership across distributed teams and groups [43].

As heterogeneous, emergent, and bottom-up sociotechnical systems, IIs embody interconnected technological and human elements [17, 75]. They are recursively constructed of simpler but analogous platforms and applications while human actors and communities of interested parties or practitioners are essential arbitrators and intermediaries in distributed environments [65]. Where platforms incorporate a specified set of IT capabilities, information infrastructure is composed of other infrastructures, platforms, and applications [29, 75]. Interconnected platforms and applications are navigable and reconfigurable as II, and benefit from the self-reinforcing mechanisms of network effects. This tendency of infrastructure towards continual organic reconfiguration is a basis for infrastructural growth and extension [31, 65].

To examine II, we draw on the well-established literatures of information and cyber infrastructures which direct attention to reflexive relationship between sociotechnical configurations and micro practices. Rather than being a static structural force, IIs are seen as a verb, ‘infrastructuring,’ and as mutable and extensible entities which exist fundamentally in the realm of practice [59, 65]. These conceptualizations allow for an investigation of how practices manifest new macro configurations as well as how infrastructural elements facilitate practices. We adapt this model by considering it through a practice lens and consider structure to be the contextualizing form taken by the practices of individual contributors.

A practice-oriented perspective features both designers and users as agentic builders of II. Pipek and Wulf [59] break down the designer/user boundary, for which there is understood to be a “design time” and a “use-time,” which are separate operations. They posit instead a “design-in-use” model, in which the flexibilities and boundaries of the infrastructure are altered at use-time. As assemblages of heterogeneous sub-systems, IIs contain internal seams and disconnects [14]. A major obstacle in IIs, and also a significant point of innovation, is the persistent gaps between different technologies [19], but these breakdowns are also a prompt for adaptation and innovation as they open up opportunity for users to infrastructure [65]. In particular, actors may work around the impediment of multiple applications or platforms, aligning their different affordances in order to accomplish tasks.

To explore the role of digital mediation in distributed, community-driven gig economy, we apply the concept of II to the community of digital nomads and the extended array of digital platforms they use for accomplishing gig work. These technologies are highly decentralized in that there is little centralized guiding specification or policy, but the community of digital nomads bring them together into a functioning II.

2.3 Digital Nomads

As a surging community of location-independent workers, digital nomads have received relatively little attention from academic researchers but have been covered to some extent in business journals and other publications interested in emerging work arrangements. It is necessary to understand digital nomads in relation to similar types of work previously studied in CSCW research. Digital nomads can be described as digital workers [55] in the sense that their work primarily involves the manipulation of digital knowledge [74], and requires constant negotiation with digital services, protocols, and algorithms. Furthermore, digital nomads exemplify some of the concerns and characteristics described in studies of nomadic work, freelance work, and flexible work. Specifically, they can be characterized by their nomadicity and by their fluid, independent work practices.

Nomadic work has been a subject of many CSCW research studies [e.g., 4, 35, 44, 57, 58, 68]. Su and Mark [68] define nomads as workers who travel for most of their working time. Nomadicity is not limited to situations of working while moving or while traveling, but rather encompasses the problem of preparing, arranging, and maintaining access to resources from changing, inconsistent locations [36], leading Cioffi and de Carvalho [8] to characterize nomadicity as “a mobility of resources.” The length and breadth of travel in the nomadic situation is greater than other types of work, and nomadic workers often also must provide and manage their own work-related resources rather than relying on a stable setup or desk-space [4, 56]. A common challenge amongst nomadic workers, then, is assembling or accessing resources for work from many different locations.

Nomadic workers cross geographic boundaries in the navigation of spaces, as well as organizational boundaries, in that many have fluid affiliations with larger organizations, or are entirely freelance and self-managed [44]. Boundaries are also virtual, presenting themselves as gaps and seams between technologies or protocols, or in individual or organizational patterns of usage, or loyalty towards technology [19]. An upshot of this dynamic navigation of boundaries is flexibility, or the ability to transition or transport between contexts through specific strategies for mobilizing resources and spaces [54]. Following the discussion provided in de Carvalho et al [58], we consider nomadicity as a set of practices or “nomadic strategies” for working and mobilizing resources from disparate locations (p. 9).

The phenomenon of digital nomadism can be grounded in this literature of nomadicity, as digital nomads can be understood as an emerging sub-population of nomadic workers with a distinct motivation for world travel adventure and independent remote work. The motivation most often associated with the digital nomad’s mobile lifestyle is travel adventurism and an escape from the office atmosphere [32]. As one of the first academic forays into the term “digital nomad,” Dal Fiore et al [10] highlights the motivation towards adventure in travel and an intentional separation from traditional office work. A large part of the conversation about digital nomads surrounds dispelling or qualifying the idea that digital nomadism is a constant vacation, however [30, 32]. As Thomas [74] notes, digital nomadism distinguishes itself from previous forms of mobile or nomadic work by combining endless leisure travel with remote work. Many of these workers have given up a permanent house and present themselves as “wanderlusting internet entrepreneurs” who may work from a coffee shop in Bali in Indonesia and the next month may be working from a co-working space in Chiang Mai, Thailand.

In addition to their geographic mobility, digital nomads also must be flexible in moving between different jobs and positions in order to make a living remotely, often working as freelancers or self-employed “internet entrepreneurs” [33]. While freelance work has changed rapidly in last few decades, it is clear from previous studies that freelancers have a close reliance on ICTs to maintain professional flexibility and adaptability [64]. These IT-enabled work arrangements provide workers with control over schedules and task selection [73]. Digital nomads, much like many other emerging classes of freelancers, are socially and professionally entangled in the algorithmic and material aspects of digital marketplaces and platforms where they find work [27]. Additionally, as on-demand workers, they have a complex set of motivators for working flexibly and for selecting particular jobs, including their current location and their evaluation of employers [73]. Previous research has documented the prevalent potential downsides of freelance arrangements and other kinds of flexible work such as the conflation of personal and professional lives [1] or social isolation [63].

Recent studies of labor mobility associated digital nomadism with vocational-related concepts such “professional nomads,” “posted workers,” “expatriates,” or “flexpatriates” [47, cited in 51]. However, a distinguishing feature of the digital nomad is that these individuals have presented a strong appeal for establishing a community identity around the term ‘digital nomads.’ Müller [51]

argues that the term “has already become established in the jargon within this social group and is used as a self-description” (p. 346). MacRae [46] presents digital nomads as an emerging community of online entrepreneurs with cosmopolitan lifestyles that are constantly self-represented online and with strong appeal for exotic places like Ubud, Indonesia or Chiang Mai, Thailand. Therefore, even though the digital nomad community exhibits diversity across several dimensions (e.g., type of digital work, industry, form of mobility), these workers share similar practices as exotic travelers by combining perpetual travel with work. These common practices go beyond the core work of digital nomads, and correspond to what bring them together: digital work, an extreme form of mobility and travel, and independence from organizations. Because of these practices, as well as challenges and opportunities of the “lifeworld” of digital nomads, these workers can be viewed as a community of practice (with visible social interactions), who draw upon a similar patchwork of digital platforms. There are a number of digital nomad conferences and programs, such as the Digital Nomad Conference , as well as travel programs like Hacker Paradise through which nomads work and travel together. Another sign of a congealing community identity is the presence of websites like Nomad List , which provide a variety of resources curated especially for the digital nomad. Through these programs and spaces digital nomads have access to a community not associated with an organization, but with a work situation.

This understanding of the digital nomad community and its boundaries is consistent with previous research on the interplay between communities and IIs, where a community can be formed by those who share similar practices “but do not necessarily work with each other or even know each other because of geographical or organizational distance” [p. 547 76] or by practitioners that “share a certain degree of similarity in their practices without necessarily sharing material contexts and specific situations” [p. 550 76]. A community in this sense emerges out of common interest and shared practices (addressing common work challenges), and affords its members opportunities to collectively decide upon and grow II [66].

Finally, the growth of the population of digital nomads is intertwined with the prevalence of digital gig work that is enabled by online platforms [42]. The gig economy has enabled digital nomads to work anywhere in the world by matching online supply and demands activities [12]. Traveling to new cities and countries (every few weeks) involves inherent uncertainty about where they can live and work. Gig economy platforms provide crucial information as well as affordable accommodation and other physical resources for digital nomads [33, 42]. Because their lifestyle involves a great deal of traveling, digital nomads prefer to exchange access to resources rather than ownership of resources [30]. This is most apparent in their use of coworking spaces or coffee shops rather than permanent office spaces.

More importantly, digital nomads must seek out direct connections with clients, professional contacts and collaborators in order to conduct transactions and accomplish work. As independent workers, digital nomads always face the risk of sliding into “precarious work” situations [37] with uncertainty of finding more work, feeling loneliness, and confusion around how to contract [53]. Many digital nomads turn to gig economy platforms to find answers to these common challenges [74]. Working remotely and with few long-term relationships with specific organizations requires digital nomads to rely on online communities and gig economy resources such as online pools of clients and digital matching and trust-building mechanisms [48]. Because of their extensive mobility, social and professional connections also often occur through digital marketplaces or match-making systems [18].

3 METHODS

The empirical base of this research involved analysis of online forums and interviews with 16 self-identified digital nomads. Data were collected from three key forums which were specifically

Table 1. Posts collected from three digital nomad forums.

Forum	Population	Posts Collected
/r/digitalnomad	39,377	1,088
Digital Nomads Around the World	38,987	917
nomadforum.io	7,001	866

focused on the digital nomad community: /r/digitalnomad, a subreddit of reddit.com for digital nomads with 39,000 members, “Digital Nomads Around the World,” a Facebook group for digital nomads with 38,000 members, and nomadforum.io, a subsite of a data aggregation site Nomad List with 7000 members. We selected the three forums for breadth of content, similarity of focus, and their relative openness. Because the II is large and heterogeneous and therefore difficult to consider as a whole, we identified the forums as points of entry, certain applications or platforms through which the internal operations and linkages of the broader information infrastructure can be seen.

Analysis of the discussion forums provided a broad context of the community. To generate a depth of understanding about the mutual relationship between key elements of the gig economy and the evolving II of various digital platforms and tools, we conducted interviews with 16 remote workers who self-identified as digital nomads. Therefore, the forum analysis and the interviews offered two complementary views of the research problem. The forums served as an entry point into the communities, providing an overview of the digital nomads’ concerns, their interests, their professions, and their technologies. The interviews provided a more focused view of the individual digital nomads’ perspectives, allowing us to ask individual digital nomads more specific questions about trends observed in the forum analysis. While all of the interviewees were familiar with the forum communities, a number of them did not use the forums regularly and so provided insight on how digital nomads operate outside of the forum groups. Specifically, the participants shed light on more personal modes of interaction which were less observable in the forums, such as personal narratives or perceptions about specific digital platforms. These included more personal relationships, such as that between digital nomads and professional mentors or long-time collaborators. Finally, the interviews were conducted privately (and the identity of interviewees remained undisclosed), while the forum posts represented public interactions.

The forums were browsed chronologically, and posts were excluded from collection using two constraints: 1) the post had no connection to work or practices relevant to work, and 2) they had no responses. A post could be considered relevant for the content of the initial post or for content in the responses. Posts and their comments identified as relevant were scraped from the relevant forums (see Table 1 for more details), and coded using Dedoose, an online application for qualitative data analysis.

Recognizing a range of professions and styles of nomadism within the digital nomad community, we sought interviews from nomads in a variety of different professions. We initially identified potential participants through purposive sampling of digital nomads from a number of different industries, and from different positions in the community. Some of the digital nomads we contacted were active, well-known members of the community, as indicated by activity in the forums, content posted on other websites, or by the number of referrals to their content from the forums. Others, however, were intentionally contacted because they did not have such a significant presence but indicated that they did in fact live and work nomadically. We also varied this group by the source of referral, such that participants were discovered through different forums or blogs. The coding process focused on identifying a set of key practices that define the gig economy in the context

of the digital nomad community and their relationship with various important digital platforms, applications and tools. Open coding [6] started with analysis of forums, followed by focused coding of content from both forums and interviews. The coding process was iterative, beginning with the selection of forum posts, and iterating through rounds of coding and repeated selection of posts. Codes were combined and separated as new posts and themes were encountered.

The interviews were semi-structured, beginning with a set of guiding questions about participants' work style, travel, use of several of digital platforms and the aspects of their work related to gig economy, but developing along the lines of the interviewee's knowledge and interviewer's discoveries. All interviews were conducted via web conferencing software, and took between 50 and 70 minutes. The interviews were transcribed verbatim for coding.

Data collection and analysis were conducted concurrently, such that iterative coding of the forum content informed the selection of new posts as well as the interview process. As coding proceeded, the researchers collected new posts which challenged or expanded existing codes. In this way, the codes were saturated and stabilized. Similarly, emerging themes were emphasized in later interviews, and interview questions allowed for a more directed investigation of developing codes. All data collection for this study of digital nomadism occurred between January and April 2017. The process resulted in 104 separate posts, consisting of 2,871 separate comments. The dates of these forum posts ranged from March 17, 2014 to March 26, 2017. Overall, the coding process resulted in 4 primary and 11 secondary codes (see Table 2).

4 FINDINGS

All of the interview participants were highly mobile, with some variation in the timeframes of their movements; some moved from place to place in a matter of weeks, whereas others stayed in a single place for as long as six months. They were nomadic in that they moved their work and life from one country to another, often without a permanent residence. By extension, they also practiced nomadicity, in that they had to maintain access to resources and establish workspace in a variety of remote locations, such as temporary apartments, coffee shops, coworking spaces, or in transit, such as on a train. In almost all cases, locations were not chosen for professional reasons, but rather work was conducted from those locations the digital nomad wanted to visit.

The participants belonged to a variety of professions, but their work can be described by a couple of common attributes. Many of the participants worked in creative professions [22], such as writing or journalism, digital media production, blogging, digital marketing, web development, software engineering, or user-experience design. Almost all the participants worked as independent workers and collaborated with remote teams (often comprised of other contractors). These professions included a variety of professional relationships which were maintained remotely, including relationships with clients, coworkers, temporary collaborators, mentors, other digital nomads, and informal professional connections. The extent and type of these networks of contacts varied slightly based on the digital nomad's profession, but more significantly, it depended on the digital nomad's professional situation. Some digital nomads who had moved into nomadism after establishing a stable professional situation had large networks of professional contacts. They were also less reliant on the help of the community surrounding the term "digital nomad" on forums and on social media, as they had already established themselves as professional digital workers. Other digital nomads, especially those who had recently entered the lifestyle, relied more on those forums and social media communities for both tangible (e.g., new contracts) and intangible benefits (e.g., sense of identity).

In every case the digital nomad's work was performed almost entirely digitally, through a suite of mobile devices, laptops and (mobile) applications. Most worked from a laptop at various locations, and some had more sophisticated setups involving a computer mouse, portable batteries, or laptop

stands (See Figure 1). Digital nomads' location independence obliges them to rely extensively on work-on-demand online platforms. Most participants are not necessarily able to engage in local work, and so rely on remote gigs, which provide them with a unique flexibility to work while traveling. Despite the diversity of digital work they engage in, our participants share a set of common practices that enable them to a) promote, secure, and conduct independent digital work as a form of non-standard employment [38], and b) accomplish work while traveling. These practices allow them to effectively utilize online platforms, find projects under 'flexible' work arrangements, and complete projects in a defined time (what is considered key elements of the gig economy [23]).

Analysis gives rise to an array of related work practices of participants that define the key aspects of the gig economy in the context of digital nomads (See Table 2), and serve as a focused and persistent view into the enabling role of II. Even though the community shares a broadly defined work context and set of demands, the observed practices were understood as common tactics used by digital nomads to accomplish tasks associated with important aspects of the gig economy. Through these practices participants take advantage of the gig economy while also contributing to its sociotechnical infrastructure. Four of the practices (outlined in Table 2) build upon the gig economy to address demands of independent digital work. The "making place" practice concerns the use of II for addressing challenges of nomadicity, such as finding places for conducting work practices [44].

Most of the digital nomads interviewed, as well as on the forums, took on the weight of business operations as individuals. They often perform not only the task they are hired to perform for any given project, but they must also carry out negotiations with their client, arrange for their own work resources, and actively shop for new work and curate their professional profile, functions often provided for workers embedded in more traditional work contexts. The freedom (or responsibility) each worker has for their own exchanges means that they rely on various digital platforms (as indicated in Table 3).

4.1 Branding and Marketing

An important and common work activity for digital nomads was managing the digital facets of their professional reputation over the web, an activity which we describe as managing web presence. For digital nomads, web presence took the form of easily deployable façades or profiles which represented their skills and experience, or as informal posts and interactions across social media like Twitter. Many digital nomads had profiles on social media networking sites like LinkedIn, but in many cases they built personal websites in order to create more customized profiles, and, in the case of designers and web developers, to show off their skills by example. A photographer and web marketer on nomadforum.io, for instance, created a joint website in which they described their skills and offered free work in exchange for free room and board. The specificity of the offer and the combined profile of their respective skills was only possible through the flexibility of a personally developed website.

Different venues provided different affordances for publishing oneself and many digital nomads used these venues in conjunction for their different benefits. Participants 6 and 13 described how Instagram provided a direct channel for publishing photographs and stories to their readers, while other networking sites allowed for more professional connections. Participant 13, a blogger, described how sharing her media on twitter led to a large amount of publicity for her blog: "Twitter has probably been the most useful social media for me other than Instagram...the New York Times, the BBC writing about my site all of that traditional mainstream media came via journalists that have followed me on Twitter." (P13)

Similarly, participant 14, who works as a journalist, described how retweeting the work of other writers became a means of professional interaction between people in the industry and also a way

Table 2. Key work practices connecting digital nomads with the gig economy.

Work Practice	Description	Sub-practices
Branding and marketing	Using the online space to publicize, create, brand, catalogue talents or services, and market oneself.	Advertising
		Promoting web presence
Transacting and contracting	Carrying out the practicalities of professional interactions online. The concrete acts of engaging with clients, and finding, hiring, and paying subcontractors.	Recruiting
		Payment processing
		Screening contractors / clients
Making place	Identifying and leveraging multiple places and available technologies to conduct nomadic work.	Finding space
		Harnessing technology in place
Professional mentoring and knowledge sharing	Giving and receiving knowledge and know-how online. Sharing experience, information, and professional advice.	Sharing on daily problems
		Keeping abreast of developments
		Professional development
		Peer-to-peer mentoring
Community building	Developing and defining the community as foundation of the gig economy, its values, purpose, exclusionary or inclusionary delineations.	Creating and augmenting community ties
		Consolidating the digital nomad identity

of publishing other journalists he supported to his followers. By making connections with other journalists and publicizing their work to his social media followers, he and they can mutually benefit from promotion to a larger audience. While some participants explained that they did not use their Facebook pages to promote themselves because of its primarily personal context, personal and professional interactions were carried out together on other sites such as Twitter and on personal websites (e.g., participants 1, 5, 6 and 10). In this way professional reputation was established by public interactions and through publishing content in various digital spaces according to their affordances.

The management of personal and professional digital identities directly supported the advertising of services. Conducting work remotely, many digital nomads had to advertise and network dynamically across a number of different platforms and through networks of remote acquaintances and colleagues in order to publicize their services to potential clients. In some cases this took the

form of direct marketing on forums or on social media. However, advertising also involved more nuanced referral and linking techniques afforded by the web space, and in many cases hinged on personal brands and established personal sites or blogs. Participant 16 described how his blog gained attention for both his primary business, and, more significantly, for his legal consulting work. Readers of the blog would transition towards subscribing to the consulting service, and in this way, the personal web presence of his blog served as a stage from which to advertise the legitimacy and value of his consulting service. In this way advertising was closely connected to personal web presence and branding, similarly benefitting from both standardized channels and extensible digital spaces.

4.2 Transacting and Contracting

The transacting and contracting practice represents digitally mediated exchanges carried out between workers in order to conduct business. The most straightforward example of this was payment processing, which concerned how to transfer money in a remote and often international context. This involved navigating and evaluating a large selection of transaction applications, involving the discussion of particular properties of the applications, including hidden fees and ease of use. A discussion on nomadforum.io, for instance, covered the various benefits and drawbacks of different payment methods. As one user asked: “How about the volatility of bitcoin rate - will that affect you personally. I have opened my bitcoin account but haven’t convinced any of my clients to use it because it is fairly new concept for them. Just want to know your thoughts or experience on that?” The problem of transacting, then, was a problem of determining the best application for financial efficiency and which best fitted the established technological and professional practices. Multiple applications could be used together in order to avoid fees or to interact with clients or employees in different countries or under different currencies. Some payment processing applications worked between currencies while others had low fees. These applications were modular and could be easily paired with interactions carried out on forums or on social media rather than necessarily being built into the application on which the exchange interaction occurred.

Digital nomads take advantage of both the digital nomad forums and other freelance marketplaces for exploring and maintaining different elements of contractual relationships that define their work. Contracting here is a formal arrangement organized through a digital platform, and are often fluid arrangements with freelancers. Participant 15 reported that she used a task service called Fancy Hands to outsource small tasks and used the service as an integral part of her startup business. In this case, the problem of contracting was outsourced to a third party service, but others contracted more directly through freelancing markets (e.g. Toptal and Upwork) and also hired directly in the comments sections of forum posts. A number of interview participants also described finding contractors and clients in the population of people following their blogs. Through these methods, a portion of the labor involved in digital nomad projects was not hired and kept on staff, but was instead persistently and remotely accessible as a resource through the various organizing logics of digital platforms.

Included in the process of contracting was the filtering and evaluating of potential contractors and clients. This should be considered separately from the act of contracting itself because it involves its own array of digital mediation protocols and practices. There were two main modes of digitally-supported filtering which were used in conjunction: filtering algorithmically and filtering by word of mouth. Algorithmic filtering was implicit in the use of freelance marketplaces which recommend and search available clients and contractors. Filtering by word of mouth was more complicated and more entangled in social-digital practices. Sometimes this was accomplished in a very straightforward fashion, as in the case of one digital nomad on nomadforum.io, who asked for suggestions for a good accounting office in Bulgaria, and received a contact from a fellow

nomad: “I’ll send you a private message with the details of my accountant, I think they can help you.” Digital nomads also reported asking prior associates or other people in their industry for the names of reliable professionals to hire. Digital nomads in fact used these two modes of filtering in conjunction as part of a comparison and evaluation of freelance marketplaces and their respective affordances for filtering and finding reliable workers.

4.3 Making Place

The term “making place” is inspired by the work of Brown and O’Hara [3] and reflects the act of merging the digital nomad’s repertoire of digital work practices with varying places and available infrastructures in order to erect an efficient mobile workplace and to maintain an effective professional life across disparate locales. Digital nomads find or make spaces which support their essential work practices and also leverage local resources and infrastructures for work. These practices can be characterized as bringing local situations, and whatever resources they might provide, into harmony with nomadic work practices.

As an important aspect of making place, the “finding space” practice refers to the digital nomads’ activities in establishing places from which to carry out their work [44]. While this involved finding literal workspaces, it also involved finding places for living and places for socializing, both of which had fluid boundaries with the digital nomad’s professional spaces. Participants often work from home and need access to WiFi, making their living arrangements also, in part, work arrangements. Similarly, as remote workers, social events and meetups facilitated in-person social networking and the creation of relationships which were fluidly personal and professional.

Finding space practices were intertwined with gig platforms and resources. These spaces were often located, recommended, or rated algorithmically through web applications such as Airbnb, NomadList, meetup.com, or coworkingmap.org. Participant 18 described using meetup.com in order to find events nearby where they could meet locals, other travelers, or expats. The social spaces they found, such as digital nomad meetups or a motorbike trip to a waterfall in Bali, yielded long-term social connections with other nomads and locals. Similarly, they described frequenting coworking spaces in order to make social connections with local startups who were often working there. These professional spaces were found or organized in a makeshift manner through digital coordination.

By “harnessing technology in place,” we refer to the digital nomads’ activities in adopting and leveraging both local infrastructures and other digital technologies in order to make a workspace functional. The most salient aspect or obstacle of local infrastructure is of course internet connection. Most of the interviewees use generic online resources (e.g., Yelp) or more specific websites (e.g., coffeeandwifi.com or workfrom.co) to examine WiFi networks before choosing a place to stay or visit. The overall quality of the Internet in a city or country is a topic of discussion on the forums and is a primary feature of NomadList’s travel planning application.

On these forums, navigating local infrastructure was in fact a complicated socio-technical problem, and discussions ranged from how many coffees it is polite to buy when working in a coffee shop to methods for bypassing local or national firewalls using VPN software. Given internet access, however, digital nomads are able to mobilize a large array of web services and platforms which provide them with access to essential resources, such as information, collaborators, or web-based workspaces such as Google documents. These technologies and gig economy resources allow the digital nomad to access much of their professional life from anywhere, but they also require that the digital nomad find an internet connection in almost all of their workspaces. This made it essential for the digital nomad to bring local infrastructural affordances into sync with more global, broadly accessible infrastructural elements [67].

4.4 Knowledge Sharing and Professional Mentoring

Digital nomads turned to the larger, remote community of digital nomads for help, and themselves helped others in the community, on both specific technical or work-related problems and broader professional topics. A user on the Facebook group, for example, offered to give advice on how to develop a particular kind of app: “I used to work for AppYourself in Berlin and still work for them on a digital nomad basis. I can probably answer any questions you have if you want to Skype?” As in this case, collaboration occurred through applications which allowed direct interaction, such as Skype or the team discussion site Slack, but it was often coordinated through more public channels, such as the forums, in which people could publish their problems to a group. Problems focused on topics or focused on issues specific to the digital nomad work situation, and would percolate through public digital spaces, such as topic-based blogs or nomad-specific forums towards personal interactions.

Keeping abreast of developments refers to the ways in which digital nomads would benefit from each other’s experience and knowledge of different industries in digital venues. Through direct discussion, they traded first-hand knowledge of technological or business trends with other semi-anonymous users. This information included which skills would continue to be in demand, which cities had good startup scenes, patterns of employment, and specific technology trends such as app development. In many cases these surrounded changes in industry which were relevant to workers and employers. In a discussion about computer automation on reddit, for instance, users discussed the situations in which automated translation might replace human translation, and a user gave his experience as a translator: “I’m a translator, and I don’t know of anyone working above the ProZ-enabled low end of the business who believes they will be replaced by computers soon.” Discussions like this provided digital nomads with access to the kind of informal knowledge exchange necessary to keep up with their dynamic work context; these took place on sites accessible either through the digital nomad community or through industry-specific sub-communities. This included forums and blogs, where individuals gave descriptions of their experiences in different fields, but a number of interview participants also highlighted collaborative software like Slack, on which a large group, defined by a shared professional interest, could exchange information in real time.

Digital nomads also used digital platforms in order to engage in career development knowledge sharing and peer-to-peer mentoring. Specifically, this often took the form of coaching or advising relationships between digital nomads and mentors or mentees through which some more experienced members of the community acted as professional coaches on different grounds for a fee or for free. As an example, participant 14 related how he had come in contact with a professional mentor through his website and contacted him regularly for advice about how to promote a web tool he had developed. In a somewhat similar manner, participants 4 and 13 ran a number of in-person or online events on topics of professional developments with digital nomads who had signed up through their blog or personal website. Participants 5, 8, and 10 presented similar types of knowledge to the digital nomad community using weekly podcasts.

Digital nomads also mentored each other on general business strategy and the mechanics of setting up organizational ties as a remote, location independent worker. On a reddit post about how to develop as a remote worker, one contributor described how to turn freelance work into a career: “Your job from here on out is twofold. 1. Find new clients 2. Find contractors to complete the projects for you. Rinse and repeat. 1, 2 . . . 1, 2 . . . You’re on your way to building your global empire from the comfort of your laptop and smartphone. Congratulations, you’re no longer a freelancer. You are a real life business owner.”

These kinds of interactions over digital platforms provided access for digital nomads to in-person coaching, despite their remote and organizational disassociation. Digital nomads also engaged in web-organized meetups and events particularly aimed at professional development. Some of these were simply social events arranged through event planning sites like meetup.com whereas other were coordinated work-and-travel events specific to digital nomads, which aimed to provide nomads with both social networking opportunities and opportunities for professional collaboration. A user on nomadforum.io described the benefits of the remote work program Hacker Paradise: “Pros: having awesome people around all the time, collaborating professionally with people, learning from people, having other people around who are serious and working during the day and aren’t just there to travel and party.”

In this way, connections were established across the network of remote workers that were qualitatively professional and related to the furthering of individual’s careers and the closer integration of potential collaborators. These groups formed digitally, in professional circles of associated nomads, but also through coworking groups like Hacker Paradise, which bring typically dispersed nomads together to travel and work together.

4.5 Community Building

The efforts of the group of nomadic workers was supported by the creation of a shared identity and under the banner of the term “digital nomad.” Establishing an identity for many digital nomads is crucial, because as a porous and budding community, digital nomads are constantly challenged to define their position, work style, and exposure in relation to the larger work context [51]. Critically, the digital nomad identity is not oriented along organizational or professional lines, but rather along a particular state of personal and professional mobility and displacement. Online forums served as spaces for the definition and development of the identity, and the identity was in fact directly connected to the support of the digital nomad’s profession. These include both nomad-specific technologies and more general web resources like Facebook or Upwork, which digital nomads used for their own means and for supporting various work practices (See Table 3). The identity of digital nomads as a community of location-independent digital workers co-evolve with the general web resources that are brought to bear and those digital platforms, application and IT capabilities that are specifically designed for and used by digital nomads such as Nomad List or NomadBase. In these spaces, digital nomads discussed trends in freelancing, the reputation of remote workers and digital nomads amongst hiring organizations, how to get started as a nomadic worker and find gigs, and how to manage work, personal life, and travel while staying productive. In a discussion on NomadList, a digital nomad who managed a remote team described his perspective as a manager in order to indicate a particular cultural mindset implied by the digital nomad identity: “hiring nomads is hard because nomads all want to work as freelancers etc. Whenever you try to discuss a role or work they are like ‘let me send you my proposal’ etc. I feel that nomads have a mindset that they will be freelancers / entrepreneurs and not part of a team.” These discussions, then, surfaced issues of work culture and identity, and the term “digital nomad” served as a locus around which issues of nomadic, independent gig work could gather.

This identity was reinforced by an active and social population of digital nomads, who made efforts to connect with other digital nomads and build the community as an informational and technical resource. Many digital nomads put significant effort into connecting with other digital nomads, and more generally into solidifying channels of communication for connecting with each other. In some cases this was as simple as arranging meetups through forums or other apps, or determining which cities have the most active digital nomad populations, but it also included developing channels for more professional interactions. A reddit discussion, for instance, covered the ground rules, format, and limitations for advertising jobs to other digital nomads on the site.

Table 3. Both general and nomad-specific digital platforms supporting various practices of digital nomads.

Work Practice	Technology	Examples
branding and marketing	personal websites	e.g. personal websites
	forums	e.g. nomadforum.io, Reddit, and Facebook
	social media	e.g. LinkedIn, Twitter, Google+, Instagram
professional mentoring	forums	e.g. nomadforum.io, Reddit, and Facebook
	freelance marketplaces	e.g. Toptal, Upwork, and Guru
	job boards	e.g. dice.com, Remotive, and Remoteok
	online mentoring services	e.g. nomadcapitalist.com, and digitalnomadacademy.com
transacting and contracting	payment processing applications	e.g. Payoneer, Transerwise, and Paypal
	freelance marketplaces	e.g. Toptal, Upwork, and Guru
	forums	e.g. nomadforum.io, Reddit, and Facebook
making place	lodging, coworking and coliving websites	e.g. airbnb.com, cowoli.com, coworker.com, and desksnear.me
	work-friendly place finders	e.g. workfrom.co, coffices.co, and workhardanywhere.com
	forums	e.g. nomadoforum.io, Reddit, and Facebook
	cloud services	e.g. Google Drive, One drive, and Dropbox
knowledge sharing	forums	e.g. nomadforum.io, Reddit, and Facebook
	personal websites	e.g. blogs, and personal websites
	cloud services	e.g. Google Drive, One Drive, and Dropbox
	social media	e.g. Facebook, Twitter, LinkedIn, Nomadmessenger, and Nomadbase
community building	forums	e.g. nomadforum.io, digitalnomadsforum.com, Reddit, and Facebook
	nomad communities	e.g. The Dynamite Circle and nomadproject.io

Other channels were facilitated by dedicated commercial applications or web platforms aimed at digital nomads specifically, including NomadBase and the #nomad channel of the team collaboration software Slack. Digital nomads used these applications to communicate with other digital nomads, and would engage with the developers of these applications on forums or over social media in order to suggest features or criticize the application's services or speed, sometimes providing specific technical suggestions for improving the application. Developers of applications such as NomadBase and Sailo entered the forums to announce new features or discuss the application with the community. In this way the digital nomad community, spanning a set of social platforms, cultivates a digital space of incubatory social interactions and collaborations.

5 DISCUSSION

Given the distributed nature of the gig economy in the context of digital nomads' community and the diversity of technologies that support it, it is useful to explore these technologies and their mediational role through the concept of information infrastructures (II). The II enables digital nomads' work practices, and it is in turn shaped by infrastructuring practices undertaken by digital nomads. We first discuss the dynamics of the II's support for nomadic gig work. We then explore

the ways in which the professional needs of digital nomads, their entrepreneurial ventures, and their innovations in practice construct, maintain, and extend the II.

5.1 Infrastructural Support for Gig Work

Our investigation of the digital nomad's repertoire of technologies (Table 3) shows deep connections to the digital nomad's conventions of practice, specifically to those nomadic and freelance work practices necessary for the digital nomad's brand of gig work. Their ability to find work, communicate with others, and complete projects is dependent on their ability to access these technologies from coffee shops, coworking spaces, apartments or elsewhere, on demand. These technologies are essential and ubiquitous for the digital nomad's work, and perform many of the functions often supplied to traditional workers by an organizational information system. In this regard these technologies are assumed, transparent, and infrastructural. Learning to work as a digital nomad means learning to navigate and leverage this information infrastructure. Furthermore, the II contains applications and platforms which are specifically designed for the digital nomad's work situation, and the community of digital nomads collects and shares strategies for making use of the infrastructure's more generic applications for nomadic work. These strategies and applications are, of course, embedded in existing work infrastructures and markets, allowing the digital nomad to participate in larger business spheres and communicate with clients on technologies they are familiar with.

Much of the benefits of the II come from its scope, both in variety and in scale. The II does not support a single work practice, or a single aspect of business, but rather supports almost all aspects of the modern digital worker's professional needs. Self-promotion, finding work, conducting transactions, and making professional contacts are all supported by some aspect of the II, and often they occur across the same set of social media platforms and communication applications. The II benefits not only from variety, but also from scale. The gig worker can take advantage of the network effects of large sorting and matching platforms in publishing themselves, looking for work, or getting advice. This is an essential aspect of the gig economy in that it allows the gig worker to rapidly make new connections and new work arrangements and therefore work independently in a more sustainable way. The II then comes into alignment with the gig economy's tendency to benefit from expansive networks mediated by digital or algorithmic matching.

The II is not only very large but also internally modular. Structurally, the II is constituted recursively of scalable, interacting parts, allowing for dynamic use and reconfiguration. It is comprised of many different kinds of platforms and applications, which compete or complement each other with various affordances. Together these technologies cultivate a synergetic relationship within the II. All business ventures carried out by nomads, for instance, benefit from the presence of popular payment processing applications such as Paypal or Transferwise, because it means that their specialized systems do not have to process payments. Similarly, the nomadic worker can recruit temporary or specialized labor from on-demand or freelance labor markets in order to complete a project. This allows for the digital nomad to float business ventures which outsource many functions to other existing applications. The different roles and technologies in the II benefit as a holistic system. The array of web services allows for quickly-built, minimum-effort constructions which aid or configure searching and navigating across the II. Standalone applications can be enhanced with complementary resources, even if only through locating and organizing them, and II could be directly enhanced by introducing new applications.

The dynamism of the II as a mediator lends itself to the flexibility of independent gig work. An aspect of the II which underpins its role in the gig economy, and distinguishes it from the organizational model of the information system, is its emergent, generative qualities. Lacking a centralized designer or design logic, the II is able to undergo innovations and extensions at the

practice level. Digital platforms exhibit ‘generic functional specifications’ that meet the needs of heterogeneous user base, but their design framework is inherently semi-closed and well bounded, reinforcing the control mechanism of the primary organizer (e.g. Google or Microsoft) [29, p. 4]. In contrast, control in II as an ecology of various platforms is distributed and a function of negotiation and shared agreements among the community of users. This means that digital nomads, as independent gig workers, are not constrained by the conventions or installed IT systems of an organization or platform, but rather they are able to pick up new technologies and practices in a highly flexible way, selecting those which complement their specific situation, their current location, or their current client. There are some ‘key players’ in the digital nomad community who contribute directly to the II, such as the founder of NomadList, Pieter Levels, but the II is not centrally controlled and hinges upon the contribution of a large number of available digital platforms (e.g. social media or online forums) and those developed by many digital nomads themselves (e.g. nomad-specific applications and personal websites). In this sense the II is open to the flexibility and entrepreneurialism demanded of the gig worker.

5.2 Growing Information Infrastructure through Infrastructuring

The II constantly evolves due to recurrent and continuous infrastructuring practices of digital nomads, which reflect their evolving need. The digital nomad community contributes to the II through two key forms of infrastructuring practices: 1) extending materiality of the II by building new platforms, and 2) constantly negotiating the II, its components, functionality, and norms of use.

The most straightforward method of infrastructuring is the extension of the materiality of existing technologies, and the building of new platforms. Preceding moments of direct infrastructuring are moments of breakdown, stumbling, and theorizing about new applications or work strategies. In these situations digital nomads identify breakdowns in current systems or seams in the base information infrastructure which are considered problem points. As described in Pipek and Wulf [59], breakdowns prompt innovations, and while specific problems are addressed by dedicated designers, the upkeep and evolution of the information infrastructure is carried out by an active population of users. In many cases these innovations occurred through the affordances of existing applications, such as group files on Facebook groups, Google spreadsheets, and code repositories on Github. As in the process of infrastructuring described by Pipek and Wulf [59], these channels allow for the enhancement and extension of infrastructure by users. These more accessible channels of contribution are simple but should not be underrated as means of infrastructural change, as they are indicators of breakdowns and are themselves potentials for larger constructions. Nomad List, for instance, began as a crowdsourced Google spreadsheet. In this regard the availability of malleable, user-design oriented elements fosters generative design-in-use practices across the II.

These design-in-use examples of building II are paralleled by the digital nomad community’s proficiency for extending infrastructure in a professional way. Because of the prevalence of web designers and developers within the community and the entrepreneurial culture of the community, digital nomads are not limited to existing platforms, but rather can build their own websites, web tools, web-based business models and even community-based forums in order to mediate their access and exchanges. This has resulted in a number of nomad-specific applications and digital spaces dedicated to the digital nomad’s specific nomadicity and needs in the gig economy. This gives digital nomads an empowered position in navigating technologies and performing gig work, and a direct line into their digital mediators.

In a more sophisticated way, digital nomads extend the II according to their professional needs by evaluating and innovating on existing infrastructural configurations. A clear example of this is the selecting or filtering of applications. Nomads want to know where to find particular resources,

or rather how to use resources or a configuration of resources for a particular function. Through forum discussion or through blog post or implicitly in collaborating, digital nomads select, recommend, and filter the technologies available to them in order to overcome seams and gaps in the current configuration of II. This often appears as posts in the forums where digital nomads ask the community which technologies to use for a particular task. Significantly, these technologies were often not specific to a digital nomad's profession. Rather they were often generic to the problem of conducting remote work, such as money conversion applications with low rates or reliable and easy-to-use web conferencing software. Digital nomads also pick up the technology used by a collaborator, client, or mentor, and sometimes use particular applications because their client is familiar with them. Similarly, digital nomad blogs provide filtering functions through curated lists and reviews. Freelance marketplaces or technologies might be recommended from one user to another or through a list, thereby propagating usage of that service through the network and facilitating its attachment to established practices and services. In this way, the II is configured through the process of digital nomads recommending and sorting through the available technologies in order to find those which best support their nomadic, independent professional situation, and which best complement the array of technologies they already use, or that their clients and employers already use.

Digital nomads also configure the II by experimenting with new ways of using existing technologies. Building on understanding of the affordances of different applications, new practices are constructed which take advantage of certain services or take advantage of certain configurations of services. By comparing the different functionalities of particular platforms and coming up with innovative means of tying them together, digital nomads make use of different platforms as modular parts of an II [29]. Here the community is a site for the development of protocols, such as how to collaborate across time zones, how to best collect payment, how to select projects to work on, or how to market oneself through various digital channels. A pattern or culture of usage, and a relationship with extant mechanisms is posited and potentially recreated or reenacted by other digital nomads. Given digital nomads' agency in choosing between applications and in combining applications, it is possible to see that the protocols or routines, which are the standardized forms of the II across platforms, are malleable to peer-like actors.

From the interactions of digital nomads in finding resources, it is clear that community interactions are important spaces for arranging systems across platforms. A salient aspect of the Web 2.0 paradigm is that value is generated by a community of users. However, the typical platform controls (and often monetizes) user interactions to some degree. In contrast, the community of digital nomads carries out its interactions across many platforms and even builds its own unique platforms. Through discussion on these platforms nomads share tactics for integrating new applications into their workflow as well as how to make the most use of an applications or platforms benefits. This shows that social interactions, both peer-to-peer and across a community forum, are key vectors for both facilitating navigation and discovery of relevant applications but also in shaping interactions and relationships around systems. As a space for sharing, learning, and for the incubation of new strategies for conducting freelance nomadic work through digital platforms, the community extends the materiality of the II. This is a mode of social engagement and contribution that is foundational for peer-like systems in the sharing and gig economies. Large-scale, open resources can benefit from the contributive practices of peer-like actors, given the agency of those actors within an expansive sociotechnical system [31]. Through points of "use innovation," in which the user appropriates, adapts, or works around the affordances of the infrastructure in order to complete a task, the user reconciles the infrastructure with localized practice [59,67]. The social engagement and agency of the digital nomad, and the larger digital nomad community, are therefore key facilitators of infrastructuring.

6 CONCLUSION

The growth of the gig economy will see a greater number of workers operating professionally as independent workers and using technology to mesh their work life into the movements and places of their personal life. Increasingly, workers may find themselves as members of remote teams, and organizations will have to find and coordinate remote, flexible workers to complete projects. Here, we present empirical evidence from the community of digital nomads which sheds light on recent developments in the use of technology by gig workers and which may prefigure future modes of work, and new collaborative contexts. We also present II as an analytical perspective for investigating digital mediation in the distributed form of gig economy. The concept of II directs attention to the emergent collection of technologies leveraged by the community of digital nomads as independent, mobile gig workers.

Technology has a critical role in the new benefits and also the new demands presented by the gig economy. This research highlights the role of technologies as a collection of complementary systems for conducting gig work and for mediating between workers. These technologies, in the form of a broader II, provide a robust support structure for digital nomads and their gig work practices, facilitating many aspects of their professional development, including training, marketing, job searching, and collaborating. The digital nomad community shows that it is possible for community building efforts to cross platform boundaries and make use of the different affordances of a variety of platforms dynamically. In this context, decentralized workers show significant agency in configuring II from the bottom up. They are able to negotiate the fulfillment of remote work practices across established technologies and patterns of use by building new resources (either with programming skills or without) and by enacting new norms and practices of use.

We recommend information infrastructures as a highly-developed perspective and robust framework for investigating this model of the gig economy technologies, especially given its focus on expansive systems and distributed technological arrangements. Specifically, II literature provides a means of discussing work practices across platforms and considers clusters of platforms as highly complex, emergent structures. It also presents infrastructural change as originating from within the II, from users innovating around or circumventing breakdowns. This perspective would allow CSCW research to account for interconnected nature of digital technologies, to go beyond a dominant “here and now” focus [52], and to extend the discussion of gig work in order to examine digital mediation in a distributed context, in which mediation is dynamically rearranged from the bottom up by the community with a high degree of agency.

This study has implications for the design of information systems which enable gig work, specifically concerning their interaction with a larger ecosystem of relevant applications and platforms, and their adoption by communities of users. While the design of platforms and applications typically takes a top-down control model, designing a system which meshes with the digital workers’ array of other tools requires an ecological understanding of digital mediation. Also, platforms must keep a careful balance between empowering users, and maintaining centralized organization, a balance which weighs the openness of the platform’s organizational logic, its relationship with supporting and competing systems, and the agency its users have in carrying out their work. By focusing on the community of digital nomads, this paper describes a variety of digitally-mediated, dynamic work practices, and an array of professional relationships between remote workers, providers, consumers, and collaborators. Together, these practices and relationships outline an emerging professional sphere and have important implications for the design of digital platforms supporting non-traditional work arrangements.

II also presents a promising tool for future studies of cooperative work and the gig economy. Considering the IT system as an II fundamentally shifts the research angle from the perspective of

the singular IT system, which is bounded by technical and proprietary boundaries, to that of the worker, who faces an array of complementary and competing systems with which to accomplish his/her work. This is applicable not only to the most distributed examples of cooperative work, but also to more centralized examples in which the worker uses an outside application to support his/her work with a centralized platform, or switches between platforms, as with drivers who switch between Uber and Lyft to get the best fares. This perspective on contemporary work is promising because it will become more valuable as work arrangements become more flexible, and workers rely less on organizational IT systems maintained by their employers.

Finally, this research has also uncovered a number of areas for future empirical research. While this study focused on the digital nomads' use of II, it is clear from this investigation that the digital nomad community itself represents a particular kind of free-agency which may have some important implications for the future of work, organization, and technology use. This warrants a more focused empirical investigation of digital nomadism, including the digital nomad's core work practices, livelihood, nomadicity, and unique combination of work, personal life and travel.

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