Mobility: An Extended Perspective

Masao Kakihara & Carsten Sørensen
Department of Information Systems
London School of Economics and Political Science
London, Great Britain
{m.kakihara; c.sorensen}@lse.ac.uk

Abstract

The emergence and convergence of Information and Communication Technologies (ICTs) are fundamentally transforming the use of technology, and in particular concerning the issues of mobility. The current debates on mobility, however, almost exclusively consist of functionalist analyses of how particular mobile technologies can alleviate geographical barriers for human activity. This paper reconsiders, from a theoretical perspective, the concept of mobility. We argue that mobility should not exclusively be linked to human corporeal travel. The concept also relates more broadly to the interaction people perform. In order to appreciate the relationship between mobility and human interaction, three interrelated dimensions are discussed — spatial, temporal, and contextual aspects of mobility. In order to characterize the social topology of ICT supported mobilized interaction, we suggest and discuss the adoption of a fluid metaphor. Based on these discussions, a case of a new mobile technology system introduced in a Japanese distribution service firm is discussed.

1. Introduction

The last two decades of the twentieth century has seen various transformations in our society as a whole. The industrial society that has flourished since the seventeenth century has entered the final stage of its transformation: into the so-called post-industrial or information society [3, 49]. In most of the developed countries, our economic activities of producing, sustaining and consuming wealth has increasingly become dependent upon service and information-related sectors. In particular, information and communication technologies (ICTs) have played a critical role in this transformation process. Because of their pervasiveness and our intensive use of them, ICTs have changed ways of living in virtually all realms of our social lives. ICT is of course not the sole factor of this transformation; various "old" technologies have also played a significant part. Modern transportation technologies, for example, have since the early twentieth century become far more sophisticated and powerful in terms of effectiveness and usefulness. The train and airline infrastructures are highly integrated with ICTs such as electronic reservation systems and traffic control systems. They are essential "blood vessels" for transportation in a global society. It is therefore important to recognize that the fundamental nature of technological revolution in the late twentieth century is the dynamic and complex interaction between old and new technologies and mutual shaping between the reconfiguration of the technological fabric and its domestication [7, 36, 46, 58].

This paper concerns the concepts of *mobility,* which manifests such a transformation of our social lives combining new and old technologies. It is now widely argued that our life styles have become increasingly mobile in the sense that the speed of transportation and hence geographical reach within a given time span is dramatically augmented by modern technological developments and sophistication such as train and airplane systems. However, in spite of the upsurge of concern with mobility in our social lives, current research perspectives define the notion of mobility quite narrowly, exclusively in terms of *humans' independency from geographical constraints*. For example, Makimoto and Manners [37] argue that within the next decade or so, a large part of the facilities and tools at home and in the office will be reduced enough in size to be carried, making people "geographically independent" (p. 2). People who use such mobile technologies, it is claimed, will be "free to live where they want and travel as much as they want" and thus they will be forced to consider whether they are settlers or true "global nomads" (p. 6). Their argument of the significance of mobility, or nomadicity, is clearly confined to the corporeal characteristic of humans freed from geographical constraints thanks to mobile computing technologies and services such as mobile phones and personal digital assistants (PDAs). A similar perspective has been promoted by many others [e.g. 10, 15, 27, 56].

Considering such a confined situation of the debates on mobility looking only at human geographical movement, we reconsider in this paper the concept of mobility and try to expand our perspective towards it. To do so, we argue that "being mobile" is not just a matter of people traveling but, far more

importantly, related to the *interaction* they perform — the way in which they interact with each other in their social lives. New configurations of social-technical relationships resulting from the diffusion of ICTs afford various dimensions of mobility to humans' interactivity with others in their social lives. We here suggest expanding the mobility concept by looking at three interrelated dimensions of human interaction; namely, *spatial*, *temporal* and *contextual* mobility. These three dimensions of human interaction have been dramatically mobilized by intensive use of ICTs, especially mobile technologies, in our everyday lives. In the following, we will discuss each of these three dimensions in detail and draw implications for future debates on mobility. We then will seek an appropriate way of characterizing the social consequences of mobilization of human interaction and suggests a *fluid* metaphor. Based on the discussions, a case of a mobile work practice in a Japanese firm will be briefly addressed. Finally, we will provide a few concluding remarks and issues to be explored in future research.

2. Spatial Mobility

Spatial mobility denotes the most immediate aspect of mobility in our social lives and is manifested by, for example, dramatic increases in both international tourism and business travel in the twentieth century. It is estimated that tourism accounts for 10% of global employment and global GDP [57]. It has been argued that people in the post-industrial era are geographically independent "nomads" supported by various technologies [e.g. 11, 37]. The rapid diffusion of ICTs in general and mobile communication technologies such as mobile phones and PDAs in particular has further energized human geographical movement, or nomadicity, in urban life, work environments and many other societal milieus [6, 12, 27, 28]. It is interesting that support technologies are not exclusively comprised of the newly emerging ICT infrastructures but on the situated use of both old and new technologies [9].

However, the emerging nomadic nature of human life only signifies a fraction of the whole debate area concerning the concept of mobility. The nomadic society is just a manifestation of the increasing *corporeal travel* of people by foot, car, train, airplane or other means of transportation. As Urry [51] explains, there are several other aspects of spatial mobility in the modern society. *First*, the mobility of *objects* should be considered. Traveling objects are often associated with the movement of people, although objects may follow much more complex and diverse routes than people. The travel of objects is intertwined with human dwelling and traveling norms. Lury [35] argues: "objects move in relations of travelling-in-dwelling and relations of dwelling-in-travelling in the practices of global cosmopolitanism" (p. 83). More conspicuously, this can be observed in the case of the Sony Walkman, which indicates the interplay between corporeal and object travel: "It is virtually an extension of the skin. It is fitted, molded, like so much else in modern consumer culture, to the body itself… It is designed for movement – for mobility, for people who are always out and about, for travelling light. It is part of the required equipment of the modern 'nomad'… it is testimony to the high value which the culture of late-modernity places on mobility." [13: pp. 23-4]

Second, along with the mobility of objects, we also need to take the mobility of *symbols* into account. Global satellite television networks, for example, broadcast visual images and sound enabling billions of people to receive news almost simultaneously. Likewise, the internet has become a place where an immense amount of information, sound and images travel beyond national borders. The convergence of various media including telephone, television and the internet has supported and further facilitated our social and economic activities today requiring rapid exchange of symbols.

Third, symbolic travel on the internet generates another distinct spatial reality: the mobility of *space* itself. As computers dematerialized the means of communication and interconnected millions of people, such a loosely connected network of computers brings forth a virtual spatiality — a "virtual community" or "cyber community" [5, 24, 25, 43]. In such computer-mediated communication among people, geographical distance no longer remains a fundamental aspect of the interaction — the boundary between "here" and "there" dissolves. Jones [24] points out: "cyberspace hasn't a 'where'… Rather, the space of cyberspace is predicated on knowledge and information, on the common beliefs and practices of a society abstracted from physical space" (p. 15). In this sense, it could be argued that in this cyberspace the notion of 'space' itself is reconfigured and mobilized in relation with human interest-centric communality rather than geographical proximity.

In summary, spatial mobility refers not only to extensive geographical movement of people; it also signifies the global flux of objects, symbols, and space itself, and as such evokes complex patterns of human interaction. It is obvious that the current debates on mobility only concerns geographical movement of humans and that such a perspective is quite incapable of capturing the complex, emerging reality of mobility in our social lives. The mobilization of spatiality in human interaction results from the complex and rapid flux of all entities in our living world including not only humans but also objects, symbols and images. However, spatiality is not the only aspect of societal mobilization of interaction among people induced by ICTs; it also closely relates to at least two other dimensions of human interaction, namely, *temporality* and *contextuality.*

3. Temporal Mobility

Technology inherently influences temporality of our social activities. Efforts to invent new technologies and introduce them into existing work settings are frequently motivated to a large extent by the desire to accelerate the pace of work and to save time. Typography, for example, is a modern printing technique employed to speed up the production of documents such as newspapers and books compared with traditional printing methods. Likewise, factory assembly lines clearly aim at improving the temporal efficiency of production of goods.

It is obvious, however, that speeding-up and saving time are not the only temporal transformations of social activities induced by new technologies. Barley [2] studies the temporal order and changes in work places brought about by the introduction of new technologies, arguing: "The temporal order of the workplace therefore serves simultaneously as a template for organizing behavior as well as an interpretive framework for rendering action in the setting meaningful." (p. 125) In order to investigate temporal order in work places, he distinguishes between *structural* and *interpretive* aspects of temporality. Structural attributes are measured by largely objectified parameters, among which sequence, duration, temporal location and rates of recurrence are particularly important. In addition to those attributes, he also points out the importance of interpretive aspects of temporality: how people in the work place interpret the change of those structural parameters. He insists: "such interpretations not only enable us to lend meaning to events in our work worlds; they lead us to form opinions and make pronouncements about the behavior of persons operating in alternate temporal systems." (p. 129) From the investigation of the impacts of computer-based radiology equipment on temporality and social relations in hospital radiology departments, he argues: "new technologies may enhance or inhibit conflict by triggering changes in the structural allocation of events that, in tern, shift interpretive temporal frameworks" (p. 160). Thus we can conclude that temporality encompasses a variety of aspects, which influence and are influenced by the introduction and use of technologies.

Furthermore, inspired by Hall's [21, 22] work, Barley characterizes temporality using the dichotomy: *monochronicity* and *polychronicity.* The former refers to situations where people seek to structure their activities and plan for events by allocating specific slots of time to each event's occurrence. The latter signifies situations where people place less value on and accept divergence of structural and interpretive attributes of the temporal order. Barley found in his investigation of temporal order and its change in hospital radiology departments that the newly introduced technology increased the monochronicity of actors' activities by restructuring structural and interpretive framework of temporality.

However, considering the recent diffusion of ICTs into a wide range of our social lives, polychronicity rather than monochronicity of human interaction seems to rapidly increase. Applying Barley's analytical framework in their analysis of a Korean trading companies, Lee and Liebenau [29, 30] found that a new EDI system restructured the temporal order of the companies' business operations, increasing polychronicity in the work setting. It is obvious that by using email or other asynchronous ICT applications, people become able to deal with multiple tasks simultaneously. It is no longer strictly necessary to share the same time period exclusively with a particular person or group. Moreover, whereas telephones and fax machines reduced the response time from weeks and days to a few seconds, the computers and the Internet make it further contracted into nanoseconds [40]. ICTs allow information and ideas to be instantaneously transmitted and simultaneously accessed across the globe [51]. Thus it could be argued that such "instantaneity" of time in the contemporary society in general and in cyberspace in particular further increases polychronicity of human activities.

As discussed above, the temporal dimension of human interaction is increasingly mobilized by the impacts of various technologies. The temporality of human interaction can no longer be explained from a linear 'clock-time' perspective; it is now highly mobilized into multiple temporal modes based on each actor's perspective and interpretation of time itself. This leads to a complex social environment where monochronicity and polychronicity of interaction among humans are intertwined and renegotiating with each other. Whitehead [54] insists that the temporal nature, or process, of human action is inseparably bound to human's fundamental existence and social reality as a whole. In this sense, the increasing temporal mobilization of human interaction is simultaneously creating new opportunities and constraints for the ecology of social life.

4. Contextual Mobility

In fact, spatial and temporal aspects of mobility in human interaction have been discussed in various research fields in various ways. The Computer Supported Cooperative Work (CSCW) field, for example, has intensively dealt with spatial and temporal aspects in relation to technological innovations such as the internet applications, groupware and various information systems [e.g. 14, 20]. With the use of stationary and mobile ICT applications, people can organize and manage their work activities with fewer constraints, making the work environment flexible and independent from geographical and temporal constraints [4, 28, 31, 34, 55]. However, considering the broad aspects of mobilization of our social interaction induced and facilitated by various ICTs including mobile technologies, another important dimension of mobility needs be addressed: *contextuality.*

Table 1. Three dimensions of mobility and those extended perspectives

Dimensions of mobility	Aspects of interaction	Extended perspectives	References
Spatiality	- Where	Geographical movement of not just human but objects, symbols, images, voice, etc.	[4], [5], [6], [11], [12], [13], [24], [26], [27], [31], [34], [35], [51], [55]
Temporality	- When	- Clock time vs. Social time * Objective vs. Subjective - Monochronicity vs. Polychronicity	[2], [29], [30], [40], [51], [54], [55], [56]
Contextuality	- In what way - In what circumstance - Towards which actor(s)	- Multi modality of interaction - Unobtrusive vs. Obtrusive - Ephemeral vs. Persistent - Weakly & strongly tied social networks	[16], [18], [19], [23], [24], [33], [43], [44], [47], [48], [50], [56]

Human action is inherently situated in a particular context that frames and is reframed by his or her performance of the action recursively. Such contextuality, or situatedness, of human action is critical for capturing the nature of interaction. Suchman [48] argues: "The coherence of situated action is tied in essential ways not to individual predispositions or conventional rules but to local interactions contingent on the actor's particular circumstances" (p. 28). In addition to spatiality and temporality, contextuality in which the action occurs is of equal importance in organizing human interaction. That is, interactional aspects such as "in what way," "in what particular circumstance," and "towards which actor(s)" the action is performed constitute the crucial disposition of interaction just as the aspects "where" and "when" do.

Modern technologies, especially ICTs, influence the contextuality of interaction in various ways since such technologies afford diversified modalities of interaction. Ljungberg and Sørensen [33] characterize *interaction modality* by two dimensions drawn from Schmidt and Simone [44]: *unobtrusive* vs. *obtrusive* and *ephemeral* vs. *persistent*. Interaction can be "more or less obtrusive dependent on how strictly it imposes obligations to notice or react" (p. 125). At the same time, interaction can range from ephemeral interaction, which "only exists in the flux of unfolding activities," to persistent interaction, which "leaves behind a trace for further inspection and discussion" (p. 125). Based on this framework, it is easy to observe that various communication technologies can affect modality of interaction. For instance, a Post-It Note discretely placed on a desk or a telephone message recorded on an answering machine can be characterized as unobtrusive-persistent interaction. Likewise, an incoming email urgently requiring a receiver's reply and/or displaying an alert box notifying the user of the email can be seen as obtrusive-persistent interaction.

As ICTs provide us with opportunities for interacting with others in various interaction modalities, we are now relatively freed from contextual constraints on interaction. Cyberspace is a good example. Computer mediated communication (CMC) not only enables people to asynchronously connect with others in distant areas, it also transforms the contextual constraints amongst those interacting. For example, Multi User Dungeons (MUDs), on-line bulletin boards and mailing list services can alleviate many difficulties for people to interact [50]. Whereas unfamiliarity or weak social relationships among people can hamper natural face-to-face interaction, unobtrusive and persistent CMC media can lubricate the interaction beyond those obstacles [24, 43]. From this point of view, CMC can serve as a catalyst for mobilizing *weakly tied social networks*. Granovetter's [18, 19] pioneering work on "the strength of weak ties" illuminates the fact that the weakly tied social relationship provides people with access to information and resources, such as job information, beyond those available in their own strongly tied social circles. Applying his findings to CMC environments, many argue that CMC provides people with access to a wider range of weakly tied actors and a wider set of contacts, extending communication possibilities beyond various contextual constraints [16, 23, 47, 52].

We then could argue that contextuality plays a critical role in constituting human interaction just as spatiality and temporality do. Contexts in which people reside continuously reframe their interaction with others, including people's cultural background, particular situation or mood, degree of mutual recognition, and so on. In face-to-face interaction among people, conformity of such contextual aspects is very important; same cultural background, shared mood and high degree of mutual recognition are preferable. Yet thanks to various ICT applications and mediated communication media, people nowadays can easily interact with others relatively freed from such contextual constraints, interacting with people in largely different contexts. In this sense, the relationship between interaction among people and contexts in which they are is becoming mobilized in terms of

flexible patterns of interaction across different contexts. It is also clear that such contextual, or relational, aspects of human interaction are increasingly 'uneven' among interacting people beyond neat time-space conditions of interaction. Hence, when considering the mobility, or more specifically societal mobilization, of human interaction, we need to deal with contextuality as well as spatiality and temporality, and, more specifically, *mobilized situatedness of interaction* in particular contexts and relations of social lives.

5. Fluid Interaction

So far we have discussed the dramatic mobilization of human interaction in terms of spatiality, temporality and contextuality facilitated by ICT applications and their domestication into everyday life. As argued above, current debates on the notion of mobility concerning humans' spatial movement only are clearly insufficient for capturing the whole significance of mobilization of our social lives. Nowadays, our interaction patterns have been significantly mobilized by various ICTs compared with those in the pre-ICT age whereby people usually interacted with a quite limited number of neighbors in a local area. Today's social environment of our interaction can no longer be appreciated in terms of static spatiality, linear clock time, or rigid contextuality. In this sense, the mobilization of human interaction facilitated by ICTs is requiring a new way of understanding and explaining social patterns of human interaction. Based on the discussion of the three dimensions of human interaction, we here seek to delineate an image of social environment in which we reside now. In so doing, we apply Mol and Law's [39] ideas of *social topology* and *a fluid metaphor*.

Topology is a branch of mathematics that deals with various geometrical properties and spatial relations. However, it is not restricted by Euclidean three-dimensional geometry; it localizes objects in terms of a variety of coordinate systems. In topology the three standard axes, X, Y and Z, are no longer a fixed or concrete geographical frame of reference. Alternative systems of axes are invented. Applying the basic ideas of topology to our thesis, the on-going societal mobilization induced by various technological innovations can be viewed as the shift of topologies of interaction based on the spatial-temporal-contextual coordinate systems.

In order to capture this shift in social topologies, Mol and Law propose three distinct metaphors drawn from their investigation on the spatial properties of the blood condition anaemia in which there are too few red blood cells in the blood; namely, *regions*, *networks* and *fluids*. *First*, the *region* is a distinct topology whereby objects are clustered together and boundaries are drawn around each particular regional cluster. In short, this topology can be characterized by "boundary." *Second*, the *network* is a topology whereby relative distance is a function of the relationship between components constituting the network. Complex connection of nodes creates the whole network structure. This topology can be characterized by "relationship." *Third* and most important in our discussion, the *fluid* is a topology whereby "neither boundaries nor relations mark the difference between one place and another. Instead, sometimes boundaries come and go, allow leakage or disappear altogether, while relations transform themselves without fracture. Sometimes, then, social space behaves like a fluid" (p. 643). This is a particular image of the topology of anaemia Mol and Law discuss. Anaemia, like blood, can be seen as flowing in and out of different regions, across different borders, using diverse networks.

We here apply those metaphors to forward the understanding of the topological nature of highly mobilized human interaction. The *region* metaphor can be clearly applied to the traditional, geographically dependent human interaction in the pre-ICT age. Social interaction at the time was strictly restricted by geographical distance, linear clock time and rigid local contexts. Even in the early computing era, the region metaphor is pertinent to characterize that computational support then was limited to mainframes with connected terminals. The *network* metaphor can characterize modern life styles. Interaction among people via various media networks such as telephones and the internet has been relatively mobilized in terms of symbolic travel of data, images, sounds and so on. Computer installations comprising of local- and wide-area networks are precisely characterized as networks, and the metaphor can also be expanded to characterize the socio-technical mesh of humans and technologies in organizational settings. The network metaphor is, furthermore, increasingly popular as a characterization of the social morphology of the post-industrial society. Castells [8] argues that "Networks constitute the new social morphology of our societies, and the diffusion of networking logic substantially modifies the operation and outcomes in processes of production, experience, power and culture" (p. 469).

However, given the rapid diffusion and domestication of various ICT applications including mobile phones, SMS (Short Message Service), PDAs, laptop computers, and awareness technologies such as ICQ into our everyday lives, a network metaphor seems increasingly insufficient to explain contemporary social transformations of our living world. Complex social patterns of interaction among people are played under increasing spatial, temporal and contextual mobility. In the environment whereby people can access others virtually "anytime and anywhere" [26] by using mobile phones and PDAs, relational disposition of human interaction is becoming ambiguous and transitory. The patterns of social interaction are dynamically reshaped and renegotiated through our everyday activities significantly freed

from spatial, temporal and contextual constraints. Such a social topology can be a *fluid*. According to Mol and Law, a fluid world is "a world of mixtures" (p. 660) and "variation without boundaries and transformation without discontinuity" (p. 658). A fluid world ensured by multiple mobilization of interaction can be characterized as "the remarkably uneven and fragmented flows of people, information, objects, money, images and risks across regions in strikingly faster and unpredictable shapes" [51: p. 38]. There is no center and no peripheral in the fluid interaction. Thus the multiple mobilization of human interaction clearly demonstrates the social topology neither of a region nor of a network but clearly of a fluid. It could be argued that societal mobilization is a dynamic process of *fluiditization* of the social topology of interaction among people. Technologies such as the mobile phone, SMS, pagers, email, laptops, PDAs, ICQ, provide fluid conversation and awareness spaces potentially mobilizing human interaction patterns.

6. A Case of a Mobile Work Practice in a Japanese Firm

Based on the discussions done so far, we here take a brief look at a case of the recent attempt of firms to coordinate actors' fluid interaction in mobile work environments. Although ICTs have played a significant role in the increasing mobilizations of human interaction and become an effective solution for coordinating actual mobile works, it is still difficult in practice for managers to build technological frameworks for organizing their distributed interaction in the mobile workplaces. This is mainly because current ICT solutions in workplaces are rigidly fixed in "stationary" technological infrastructure in the office based on local area network (LAN) and the intranet. Such approaches are not capable to organize the increasingly fluid interaction patterns among mobile members, particularly outside the office. To be sure, laptop computers and PDAs have become significantly downsized in the last decade; however, most of them are still awkward to bring throughout the working time and even dominated by "desktop metaphor" [10].

Faced with this practical problem, several Japanese firms are introducing a novel technological solution for building and organizing effective mobile work environments: the application of *internet mobile phones.* Whereas the internet mobile phone service in Europe called WAP are still at its infant stage in terms of popularity and diffusion, Japan has seen a surprising spread of internet mobile phones throughout the country in the last two yeas. NTT DoCoMo, a Japanese mobile phone service giant, has introduced a mobile internet service called 'i-mode' in February 1999. Just like WAP service, the i-mode service enables people to send and receive email and to acquire a variety of information on the web from their mobile phones. Thanks to its relatively low cost of subscription, easy use of the service, and a wide range of contents on the web, it has gathered more than 20 million subscribers within a period of two years [42].

Looking at this rapid diffusion of the internet mobile phones in Japan, it is interesting that the internet mobile phones in Japan not only have become daily communication tools for ordinary people, particularly for the youth, but are also increasingly introduced into business fields as an effective solution for coordination of highly mobile work practices. The parcel distribution service industry in Japan is a distinct example [1]. For parcel distribution companies, it is crucial to capture detailed, real-time information about the location of all tracks and their load capacity at a particular time and to coordinate actual route of tracks for efficiently delivering and collecting parcels from a number of customers' offices. Traditionally, in order to cope with this task, most of those companies used radio communication systems by which the Distribution Management Office (DMO) could acquire only quite limited information about the location and situation of trucks through voice-based communication. Further, as truck drivers could not carry out a radio transceiver installed in the cockpit, the office could not reach them while they were away from their tracks for delivery and/or collection of parcels. It is obvious that this situation inevitably resulted in a serious inefficiency, particularly in time, in the distribution operation.

To solve this situation, some distribution service companies have recently introduced internet mobile phone systems for the effective coordination of parcel distribution and truck movement [38]. By providing internet mobile phones to all truck drivers, the DMO has become able to contact drivers virtually anytime, even when they are away from their trucks, and give them appropriate instructions concerning truck route to be taken and updated task orders. The office also can acquire real-time data of truck location, actual load capacity and the parcels left to be delivered by letting drivers send updated data through the customized email system working on their internet mobile phones. Furthermore, the customers' calls for collection of parcels can be efficiently distributed to appropriate trucks in accordance to real-time location information sent from drivers (see Figure 1).

An implication we can draw from this case in the context of this paper is that by using the internet mobile phone system, the companies have created a distinct work environment, *a fluid platform for the coordination* of the highly mobilized interaction of people, objects, voice and data. This work environment can be clearly characterized by its fluid topology where such heterogeneous elements in the distribution operation dynamically interact with each other in both physical and virtual spaces. Based on the three dimensions of mobility of interaction discussed above, this mobilization of work practice can be characterized as follows:

Spatial dimension: It is obvious that the spatial

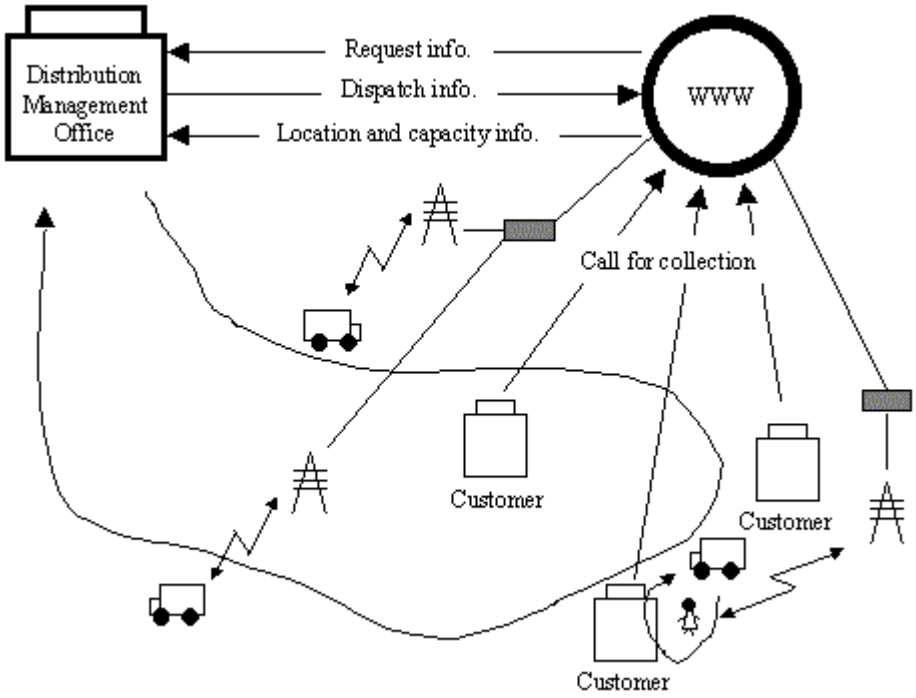

Figure 1. An image of a fluid work practice of a parcel distribution service company in Japan (After [38])

dimension of the distribution operation has become much more fluid by introducing the internet mobile phone system. By acquiring real-time information of truck location from drivers' mobile phones, the DMO has become able to coordinate route of truck more flexibly. Truck drivers have been also freed from their own trucks since they can always carry their mobile phone by which they can receive voice and/or data call from the office virtually anytime. Whereas 'parcel trucking service' has nowadays become pervasive among the parcel distribution service industry, this mobile system can offer much more precise and updated information of where the parcel is. Furthermore, it is important to note here that what has become mobilized by the utilization of the internet mobile phone system is not just the physical movement of trucks, dispatchers and parcels but also the transaction of information in the operation. With the integrated web-based information sharing and coordination platform, the accessibility of information has significantly increased, ensuring that various information can 'move' and be transacted much more smoothly among the highly distributed actors, namely, the DMO, customers and truck drivers.

Temporal dimension: The introduction of the internet mobile phone system has also mobilized temporal aspects of the distribution operation. Based on information about truck location and current load capacity that is sent from all drivers, the DMO can instantaneously find the most appropriate truck to respond a new call for collection from a customer. In the previous situation where the old-fashioned radio communication systems are used, this task took quite a long time due to lack of real-time information about truck which created significant inefficiency of the operation. This mobile system can provide the DMO and customers with much more precise and updated information of when the parcel is delivered. In addition, it is easy to imagine that this instantaneity of task coordination can increase polychronicity of the distribution operation, which potentially leads to more multi-task coordination of the operation.

Contextual dimension: The distribution operation has been mobilized in terms of contextuality as well. Whereas actual operation had been rigidly conditioned by various contextual constraints such as drivers' situation and current load capacity of truck, the newly introduced internet mobile phone system has released interaction between the DMO and drivers from those constraints, more dynamically coordinating the complex multi-task operation. Although the actual operation is still conditioned by various local contextual constraints (e.g. road congestion, urgency of customer's call), it is clear that the system provides the DMO with the capability of taking advantage of contextual disposition of each actor.

In sum, this case suggests us that introduction of mobile technology into the work environment inevitably affects not just spatial dimension but also temporal and contextual dimensions of actors' interaction and hence the whole work practice. It is thus crucial to expand our perspective on the notion of mobility, looking at not just geographical aspects of work but the fluid nature of interaction among people, objects

and information in the actual work settings, seamlessly ranging from physical to virtual spaces.

7. Concluding Remarks

In this paper we have explored various aspects of mobility in our social lives and the topological nature of human interaction. To summarize: (1) what has been and will be further mobilized is not just human corporeal movement but more importantly human interaction; (2) the concept of mobility in the contemporary society should be addressed in three distinct dimensions: spatiality, temporality and contextuality; (3) highly mobilized interaction among people creates a distinct social topology as a fluid; and (4) mobile technologies play an important role to create and organize effective fluid work environments.

As we discussed through the paper, the existing understanding of mobility is fixed to social aspect where people move. We of course recognize that geographical movement of people enhanced by various modern technologies, manifesting the nomadicity of human life, is an important aspect of the contemporary society in general. However, in order to appreciate a larger background of the emerging debates on mobility, we need to go beyond such a confined and functionalistic understanding of mobility and to capture various dimensions of mobilization of our social interaction. It is also important to rethink the existing understanding of ICTs, particularly mobile technologies, as a tool of simply making our life style and activity mobile, and to appreciate the dynamic interactivity between humans and technologies, continuously reshaping and further fluiditizing our interactional patterns.

Moreover, important to note here is that fluid environments for human interaction that has been brought about by the diffusion of ICTs can bring us a number of new problems as well as benefits. For example, technologically enhanced, fluid interaction among people can dissolve our activities into minute, instantaneous and ad-hoc events, which are totally "lifted" from real spatiality, ordinary linear sequence of time and actual contextuality [17, 45]. It is easy to imagine that this dissolution potentially leads to such problems as loss of solidarity among humans, an identity crisis of human existence, decrease of mutual trust and a sense of intimacy, a collapse of traditional households and communities, and a spread of short-termism and opportunistic behavior, all of which are increasingly conspicuous in the virtual world on the Net [5, 24, 50]. More practically, fluid work environments supported by various ICTs can create a significant level of *interaction overload* [32, 33]. Further, fluid work practices with mobile technology transform a wide range of taken-for-granted 'boundaries' and 'relationships' in real business processes. Mobile phones, for instance, have a huge potential to dissolve such traditional distinctions as working time and leisure time. In order to cope with these emerging problems, we need to keep our perspective broad and open and seek some complementary means to give coherence and order to increasingly fluid interaction. In so doing, several theoretical concepts and discussions from organization studies seem quite useful; for example, 'Communities of Practice' [53] and 'the concept of *Ba*' [41].

The whole discussion in the paper is an initial theoretical exploration of how we can extend the concept of mobility. Although we believe that the spatial, temporal and contextual aspects of mobility in human interaction are quite fundamental, those remain to be explored in further theoretical as well as empirical work. We also need to further discuss in what ways we best can characterize the mobilization of human interaction and whether employing a fluid metaphor is an appropriate approach. Subsequent empirical validation is especially essential for us to further understand the implications of the theoretical considerations we have done in the paper.

References

This research was partly funded by the Daiwa Anglo-Japanese Foundation through the Japan Foundation Endowment Committee.

References

[1] Anonymous, "Mobairu Bijinesu No Shingan (The Reality and Hype of Mobile Business) (Written in Japanese)," *Mobile Internet*, no.1, 2001, pp. 26-47.

[2] S.R. Barley, "On Technology, Time, and Social Order: Technically Induced Change in the Temporal Organization of Radiological Work," in F.A. Dubinskas ed. *Making Time: Ethnographies of High-Technology Organizations*, Philadelphia, PA: Temple University Press, 1988.

[3] D. Bell, *The Coming of Post-Industrial Society: A Venture in Social Forecasting*, New York, NY: Basic Books, 1976.

[4] V. Bellotti and S. Bly, "Walking Away from the Desktop Computer: Distributed Collaboration and Mobility in a Product Design Team," in *Proceedings of The ACM 1996 Conference on Computer Supported Cooperative Work (CSCW '96)*, Boston, MA, USA, 1996.

[5] M. Benedikt, "Cyberspace: Some Proposals," in M. Benedikt ed. *Cyberspace*, Cambridge, MA: MIT Press, 1991, pp. 119-224.

[6] J. Bergquist, P. Dahlberg, F. Ljungberg, and S. Kristoffersen, "Moving Out of the Meeting Room: Exploring Support for Mobile Meetings," in *Proceedings of The 6th European Conference on Computer Supported Cooperative Work (ECSCW '99)*, Copenhagen, Denmark, 1999.

[7] W.E. Bijker, T.P. Hughes, and T.J. Pinch eds., *The*

Social Construction of Technological Systems: New Directions in the Sociology and History of Technology Cambridge, MA: MIT Press, 1987.

[8] M. Castells, *The Rise of the Network Society*, Malden, MA: Blackwell, 1996.

[9] B. Dahlbom, "Networking: From Infrastructure to Networking," in K. Braa, C. Sørensen, and B. Dahlbom eds., *Planet Internet*, Lund: Studentlitteratur, 2000, pp. 217-238.

[10] B. Dahlbom and F. Ljungberg, "Mobile Informatics," *Scandinavian Journal of Information Systems*, vol.10, no.1&2, 1998, pp. 227-234.

[11] G. Deleuze and F. Guattari, *Nomadology*, New York, NY: Semiotext(e), 1986.

[12] A. Dix and R. Beale eds., *Remote Cooperation: CSCW Issues for Mobile and Teleworkers*, London: Springer-Verlag, 1996.

[13] P. du Gay, S. Hall, L. Janes, H. Mackay, and K. Negus, *Doing Cultural Studies: The Story of the Sony Walkman*, London: Sage Publications, 1997.

[14] C.A. Ellis, S.J. Gibbs, and G.L. Rein, "Groupware: Some issues and experiences," *Communications of the ACM*, vol.34, no.1, 1991, pp. 38-58.

[15] H. Fagrell, F. Ljungberg, and S. Kristoffersen, "Exploring Support for Knowledge Management in Mobile Work," in *Proceedings of The 6th European Conference on Computer Supported Cooperative Work (ECSCW '99)*, Copenhagen, Denmark, 1999.

[16] M. Feldman, "Electronic Mail and Weak Ties in Organizations," *Office, Technology and People*, vol.3, 1987, pp. 83-101.

[17] A. Giddens, *The Consequences of Modernity*, Cambridge: Polity Press, 1990.

[18] M.S. Granovetter, "The Strength of Weak Ties," *American Journal of Sociology*, vol.78, no.6, 1973, pp. 1360-1380.

[19] M.S. Granovetter, "The Strength of Weak Ties: A Network Theory Revisited," in P.V. Marsden and N. Lin eds., *Social Structure and Network Analysis*, Beverly Hills, CA: Sage Publication, 1982, pp. 105-130.

[20] J. Grudin, "CSCW: Introduction to Special Issue," *Communication of the ACM*, vol.34, no.12, 1991, pp. 30-34.

[21] E. Hall, *The Silent Language*, New York, NY: Double-Day, 1959.

[22] E. Hall, *The Hidden Dimension*, New York, NY: Anchor Press, 1962.

[23] C. Haythornthwaite, "Tie Strength and the Impact of New Media," in *Proceedings of The 34th Hawaii International Conference on System Sciences (HICSS-34)*, Maui, Hawaii, 2001, IEEE.

[24] S.G. Jones, "Information, Internet, and Community: Notes Towards an Understanding of Community in the Information Age," in S.G. Jones ed. *CyberSociety 2.0: Revisiting Computer-Mediated Communication and Community*, Thousand Oaks, CA: Sage Publications, 1998, pp. 1-34.

[25] R. Kitchin, *Cyberspace: The World in the Wires*, Chichester: John Wiley & Sons, 1998.

[26] L. Kleinrock, "Nomadicity: Anytime, Anywhere in a Disconnected World," *Mobile Networks and Applications*, vol.1, 1996, pp. 351-357.

[27] T. Kopomaa, *The City in Your Pocket: Birth of the Mobile Information Society*, Helsinki: Gaudeamus, 2000.

[28] S. Kristoffersen and F. Ljungberg, "Mobility: From Stationary to Mobile work," in K. Braa, C. Sørensen, and B. Dahlbom eds., *Planet Internet*, Lund: Studentliteratur, 2000, pp. 41-64.

[29] H. Lee, "Time and Information Technology: Monochronicity, Polychronicity and Temporal Symmetry," *European Journal of Information Systems*, vol.8, no.1, 1999, pp. 16-26.

[30] H. Lee and J. Liebenau, "Temporal Effects of Information Systems on Business Processes: Focusing on the Dimensions of Temporality," *Accounting, Management and Information Technologies*, vol.10, no.3, 2000, pp. 157-185.

[31] R. Lindgren and M. Wiberg, "Knowledge Management and Mobility in a Semi-Virtual Organization: Lessons Learned from the Case of Telia Nara," in *Proceedings of The 33rd Hawaii International Conference on System Sciences (HICSS-33)*, Maui, Hawaii, 2000, IEEE.

[32] F. Ljungberg, "Exploring CSCW Mechanisms to Realize Constant Accessibility Without Inappropriate Interaction," *Scandinavian Journal of Information Systems*, vol.11, 1999, pp. 25-50.

[33] F. Ljungberg and C. Sørensen, "Overload: From Transaction to Interaction," in K. Braa, C. Sørensen, and B. Dahlbom eds., *Planet Internet*, Lund, Sweden: Studentlitteratur, 2000, pp. 113-136.

[34] P. Luff and C. Heath, "Mobility in Collaboration," in *Proceedings of The ACM 1998 Conference of Computer Supported Cooperative Work (CSCW '98)*, Seattle, WA, USA, 1998.

[35] C. Lury, "The Objects of Travel," in C. Rojek and J. Urry eds., *Touring Cultures*, London: Routledge, 1997.

[36] D.A. MacKenzie and J. Wajcman eds., *The Social Shaping of Technology* (2nd ed.), Buckingham: Open University Press, 1999.

[37] T. Makimoto and D. Manners, *Digital Nomad*,

Chichester: John Wiley & Sons, 1997.

[38] S. Matsui, "Butsuryu Kanri Joho No Mobairu Netowaku Hatten No Kadai (Mobile Netwrok Solution for Distribution Management Information) (Written in Japanese)," *NRI Research News*, no.1, 2001, pp. 9-10.

[39] A. Mol and J. Law, "Regions, Networks and Fluids: Anaemia and Social Topology," *Social Studies of Science*, vol.24, 1994, pp. 641-671.

[40] N. Negroponte, *Being Digital*, London: Coronet Books. Hodder and Stoughton, 1995.

[41] I. Nonaka, N. Konno, and R. Toyama, "Emergence of "Ba": A Conceptual Framework for the Continuous and Self-transcending Process of Knowledge Creation," in I. Nonaka and T. Nishiguchi eds., *Knowledge Emergence: Social, Technical, and Evolutionary Dimensions of Knowledge Creation*, Oxford: Oxford University Press, 2001, pp. 13-29.

[42] NTT DoCoMo, Increase of Subscriber Number of i-mode, http://www.nttdocomo.com/i/i_m_scr.html, Last access: 25th September 2001.

[43] H. Rheingold, *The Virtual Community: Homesteading on the Electronic Frontier*, New York: First HarperPerennial, 1994.

[44] K. Schmidt and C. Simone, "Coordination Mechanisms: An Approach to CSCW Systems Design," *Computer Supported Cooperative Work: An International Journal*, vol.5, no.2&3, 1996, pp. 155-200.

[45] U. Schultze and R.J. Boland, Jr., "Place, Space and Knowledge Work: A Study of Outsourced Computer Systems Administrators," *Accounting, Management and Information Technologies*, vol.10, 2000, pp. 187-219.

[46] R. Silverstone and L. Haddon, "Design and the Domestication of Information and Communication Technologies: Technical Change and Everyday Life," in R. Mansell and R. Silverstone eds., *Communication by Design: The Politics of Information and Communication Technologies*, Oxford: Oxford University Press, 1996, pp. 44-74.

[47] L. Sproull and S. Kiesler, *Connections: New Ways of Working in the Networked Organization*, Cambridge, MA: MIT Press, 1991.

[48] L.A. Suchman, *Plans and Situated Actions: The Problem of Human-Machine Communication*, Cambridge: Cambridge University Press, 1987.

[49] A. Toffler, *The Third Wave*, London: Collins, 1980.

[50] S. Turkle, *Life on the Screen: Identity in the Age of the Internet*, New York, NY: Simon & Schuster, 1995.

[51] J. Urry, *Sociology beyond Societies: Mobilities for the Twenty-First Century*, London: Routledge, 2000.

[52] B. Wellman, "From Little Boxes to Loosely-Bounded Networks: The Privatization and Domestication of Community," in J. Abu-Lughod ed. *Sociology for the Twenty-First Century: Continuities and Cutting Edges*, Chicago, IL: University of Chicago Press, 1999.

[53] E. Wenger, *Communities of Practice: Learning, Meaning, and Identity*, Cambridge: Cambridge University Press, 1998.

[54] A.N. Whitehead, *Process and Reality*, New York, NY: Macmillan, 1929.

[55] M. Wiberg, "Knowledge Management in Mobile CSCW: Evaluation Results of a Mobile Physical/Virtual Meeting Support System," in *Proceedings of The 34th Hawaii International Conference on System Sciences (HICSS-34)*, Maui, Hawaii, 2001, IEEE.

[56] M. Wiberg and F. Ljungberg, "Exploring the Vision of "Anytime, Anywhere" in the Context of Mobile Work," in Y. Malhotra ed. *Knowledge Management and Virtual Organizations*, Idea Group Publishing, 2001, pp. 157-169.

[57] WTO, *Yearbook of Tourism Statistics 1996* (49th ed.), Madrid: World Tourism Organization, 1997.

[58] S. Zuboff, *In the Age of the Smart Machine*, New York, NY: Basic Books, 1987.