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Does Fragmentation of Working Time and Working Space Influence the Acceptance of Mobile Technology? A Case of Finnish Physicians

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Abstract

The study aims to investigate the potential effects of individual differences in fragmentation of working time (FWT) and fragmentation of working space (FWS) on individual technology acceptance behaviour. With the aid of previous research into time and space, we introduce the concepts of FWT and FWS. Utilizing the research into the adoption of information systems, mainly TAM and the UTAUT, a research model was proposed and empirically examined, using data collected from 242 physicians working in the healthcare sector in Finland.

The results suggest that our proposed model could provide around a 70% explanation for physicians' future intentions to use a mobile medical information system in various combinations of individual FWT and FWS. FWS has shown moderating effects between beliefs (i.e. compatibility) and physicians' future behaviour but not much for current use of the system, however. FWT effects on technology acceptance have been fully mediated by the beliefs proposed in the model but exceptions were also found. Perceived usefulness seemed to be a very dominant factor influencing physicians' behaviour regarding their acceptance of technology. Contributions and implications are discussed at the end.

Keywords: Technology acceptance, fragmentation of working time, fragmentation of working space, physicians, mobile medical information system, future behaviour intention

TUCS Laboratory
Mobile Commerce laboratory

1. Introduction

Technology has played an important role in transforming our society into the so-called post-industrial (post-modern) or information society. Time and space have been tightly linked together, particularly in people's work. Traditionally, modern work is assumed to be done primarily within a formal physical space, e.g. offices, factories, by formal employees in the firm over an extensive period of time. However, attention has been paid to changes in our familiar understanding of the relations between time and space. Harvey (1989) has used the term "time-space compression" to illustrate how global communication has altered our temporal and spatial horizons. Technology innovation has speeded up the accumulation of economic capital and reduced our perceptions of spatial distance. Giddens (1994) was concerned with the changing nature of these horizons, which he refers to as "time-space distantiation", and argues that social relations between people do not, increasingly, require their mutual physical presence. Manuel Castells, in his voluminous "The Rise of The Network Society" (1996/2000), coined "timeless time" and "the space of flow" referring to the changes in the way we cope with time and space as well as our perceptions of time and space. "The timeless time would appear where the consecutive activities that characterize linear time were interrupted by the cross connections between activities that come with our network society" (Kingma and Boersma, 2002, p353). The space of flow is associated with the increasing possibility for information or knowledge to be transferred from one place to another abstracting from physical space, e.g. in cyber, virtual or electronic space. The implications for work of such changes in space and time have been highlighted in recent IS research (e.g. Lee and Liebenau, 2000; Orlikowski and Yates, 2002; Schultze and Boland, 2000). Through the mediation of information and communication technology (ICT), individuals can deal with an absence of physical "proximity" and "temporal structuring" in organizations. With the aid of Internet technology, virtual team work could be organized across the globe. Although the mismatch in time zones and the lack of physical proximity challenge the efficiency of virtual work between team members (e.g. Massey et al., 2003; Sarker and Sahay, 2003 and 2004), they were generally able to perform the work within their individual physical office that has their own familiar environments.

The move from wired (Internet) to wireless is relocating "space" by projecting the interactive model of human and computer from cyberspace (electronic space) back into physical space (Andrejevic, 2003). It suggests that workers could perform work at various physical places, since anytime/anywhere wireless computing allows the information, knowledge and office function to move with the them rather than being tied to a physical office (Davis, 2002). Focusing on 8 CEOs' managerial work, Tengbald (2002) found that CEOs' work is plagued by expansion and fragmentation of working space. The best use of space is emerging as an important management issue in organizations. It is increasing the productivity of workers by enabling them to work in various physical spaces, rather than only at their physical office.

In organizational management literature, the concept of time, objective “clock time”, as a material commodity remains ingrained (Hassard, 1999). Increasingly, the subjective aspects of time are being examined (e.g. Schriber and Gutek, 1987; Kaufman et al., 1991). With the increasing mobility of people mobile technology, too, has attracted growing interest (e.g. Kakihara, 2003).

The focus of research is thus on the subjective (individual) aspects of time and space, and its potential effects in influencing individual adoption of mobile technology at work. By taking into account individual differences regarding the temporal dimensions and spatial dimensions related to work activities, we can measure how individuals’ working time and working space are fragmented. Consequently, and specifically in this study, we seek to examine new factors that might drive mobile technology acceptance, i.e. individual fragmentation of working time (FWT) and individual fragmentation of working space (FWS).

The structure of the paper is arranged as follows. In the next section, we present the individual aspect of time and space and introduce the concepts of individual fragmentation of working time and fragmentation of working space. The theoretical background underlying the research is then briefly reviewed. The research model and research hypotheses are described next. The methodology issue is followed by a review of our study context and the operationalization of our measuring instruments. The next section presents the important results found in the study. The paper concludes with a discussion of the study’s findings and its implications.

2. Fragmentation of Working Time and Fragmentation of Working Space: An Individual Aspect

Lee and Sawyer (2002) in their pioneer work on conceptualizing time, space, information technology, work and organization, claim that, within the organization context, using IT changes the way in which time and space are structured at work. In turn, the structured perceptions of time and space might build an “interpretive” framework that influences the introduction and use of technology (Kakihara and Sørensen, 2002). In other words, it might influence an individual’s adoption behaviour regarding newly introduced IT, e.g. mobile technology, in organizations. The framework covers the temporal dimension with two domains: the temporal nature of work and individual temporal working behaviour, as well as the spatial dimension with two domains: the spatial nature of work and individual spatial working behaviour. Within an organizational context, individual temporal or spatial behaviours are adapted to the organization culture and the work in general (Francis-Smythe and Robertson, 1999). The temporal and spatial nature of work is largely designed or assigned by the organization. Apparently, individual workers could perform a given work with a specific temporal and spatial nature according to their own temporal and spatial working behaviour.

2.1 Temporal Working Behaviour: Fragmentation of Working Time (FWT)

Francis-Smythe and Robertson (1999) identified 15 individual temporal dimensions by reviewing the literature (p. 277). Here, we try to understand seven individual temporal dimensions of working.

They are:

Schedules and deadlines: work has a specified beginning and ending; a worker has to stick to schedules and meet deadlines;

Co-ordination and synchronization: it assumes a specific ordering of activities, especially when many workers are involved in completing the same activity; that means one can organize the completion of one task in sequence with one or more others;

Pace represents the degree to which activities occur in a regular manner repeatedly; an individual has to follow the pace set by the task demands;

Allocation of time is the amount of time workers commit to an activity;

Variety versus routine, routine implies repetition of work at regular and cyclical intervals: the time when this repetition occurs is rather well defined;

Separation of work and non-work time represents the distinction between the use of time for work or for leisure;

Autonomy of time use corresponds to the degree to which workers have the freedom to control and plan their own time use.

Tétard (2002) pointed out that, by measuring those dimensions, we are able to identify the actual temporal behaviour of how workers organize their working time to deal with tasks and events. He initiated the concept of fragmentation of working time (FWT)[1]. On the basis of his definition, we interpret FWT very narrowly here as *the degree to which individuals' working time is fragmented by their preferences for different individual temporal dimensions in dealing with tasks and events.*

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[1] Tétard (2002, pp36) have defined the problems of "Fragmentation of Working Time" as: "The whole of effects and consequences on managerial, personal and organisational productivity resulting from the influence of new ways of organising, information overload, interruptions and temporal dimensions of managerial work. These aspects are amplified by business process discrepancies and inefficient information technology support".

2.2 Spatial Working Behaviour: Fragmentation of Working Space (FWS)

Space and time are inter-related concepts when it comes to understanding what work is in an organization. In the spatial dimension of the "interpretive" framework, the first domain concerns the spatial nature of work. It takes place in a relatively stationary physical location or office and does not involve much geographical movement for a worker to accomplish a task (less fragmented space) or requires an intensive mobile life-style to finish a task in different locations (highly fragmented space). The second domain is about the individual spatial preference for working, the way workers organize their work to be done at different locations. Traditionally, workers do their most of their work in an office. In the modern era, with a supportive information system, workers can also do their work in different places or spaces, physically or virtually, e.g. virtual team work. Concerning physical space, we conceptualize the following spatial dimensions of working by adapting research on modality (Kristoffersen and Ljungberg, 1998) or "mobility of people" (Kakihara 2003) and local mobility (Luff and Heath 1998).

They are:

Stationary means workers do their job mostly in a physical space, e.g. office, not involving movement locally or globally;

Wandering represents workers who do work involving local mobility within a smaller area such as a building with very little time spent in any one place;

Travelling describes workers performing a task while travelling in a vehicle, e.g. automobile, airplane;

Visiting means workers performing a task that takes place in one place for a coherent but short period of time;

Home represents a non-working environment characterized mostly by leisure activities.

Workers might organize their work only in one space, e.g. the office, but others might perform a task while they are on the move locally or globally or even use their leisure space to perform a task. Here, fragmentation of working space (FWS), as a measure of spatial working behaviour, refers to *the degree to which workers organize their work in different physical spaces rather than just in a stationary office when dealing with tasks and events.*

By studying the different degrees of individual differences in fragmentation of working time and working space, their potential effects on adoption of technology can be proposed and investigated. By combining those differences, we might be able to classify potential patterns of fragmentation of "time-space" in a certain user group, i.e. the common "time-space" fragmentation profiles revealed in the group. Studying individual behaviour towards technology in different "time-space" fragmentation profiles provides greater insight for management to design proper support or implementation strategies so that IS in general, and mobile technology in particular, can be better exploited.

Here, individual FWT and individual FWS are considered as concepts on which our research focused. They serve as “categorical variables” that identify a user’s profile of temporal and spatial working behaviour. They are not treated as “latent constructs”, as is usual in the behavioural sciences. Therefore, their reliability and validity are not examined.

3. Technology Acceptance: A Theoretical Background

The theoretical understandings for this research draw upon previous knowledge, including technology acceptance outcomes, the technology acceptance model, TAM, and the Unified Theory of Acceptance and Use of Technology, UTAUT.

3.1 Technology Acceptance Outcomes

DeLone and Mclean (1992 and 2003) have suggested a multifaceted construct to measure the notion of “IS success”. It consists of six different, yet related, outcomes. They are quality measures (system and information quality), attitudinal measures (user satisfaction), performance-related measures (individual and organizational impacts) and behaviour (system use).Our primary focus is on behaviour because all other outcomes, e.g. satisfaction and impact, are predicted from use of the system (Agarwal and Prasad, 1997).

System use is understood to represent the essential aspect, property or value of information technology (Orlikowski and Iacono, 2001). It is generally accepted that the usage of information systems at work could increase employee’s productivity in their working time.

One of the main purposes of technology acceptance models and theories is to explain and predict system usage. Previous research has examined usage in two ways: one, by examining the extent of initial actual system use, and the other by measuring intentions to use the system in the future. Behavioural intentions are assumed to change with the passage of time, but they have proved to be good predictors of actual future use (Davis et al., 1989). The temporal dimension of system usage may give rise to different behavioural intentions, attitudes and beliefs as regards the system being formed. These are used in turn, to predict the probability of usage.

In the literature, frequency and volume of system usage are adapted to measure initial adoption behaviour, besides variety of use, e.g. accomplishing a number of tasks or using a number of applications (e.g. Igbaria et al., 1995). IS spreads because of the cumulative decision of individuals to adopt it. Users may be persuaded to use a new system early in the implementation process but the benefits offered may never be achieved in the absence of continued sustained usage (e.g. Szajna, 1996; Agarwal and Prasad, 1997; Karahanna et al., 1999). Some discontinuance behaviour may also occur. Two types of this are; replacement means users use an alternative system instead of the original one that they used initially, while disenchantment means users become dissatisfied with the systems or services and so do not use them any more (Parthasarathy and Bhattacherjee, 1998).

From the volitional perspective, usage could be mandatory or voluntary. One assumption of the TAM is that, given sufficient time and knowledge about a particular behavioural activity, an individual's stated preference for performing the activity (i.e. behavioural intention), will, in fact, closely resembles the way they behave. This assumption only applies, however, when the behaviour is under a person's volitional control (Ajzen and Fishbein 1980)

Although most previous studies have been designed in the context of voluntary use, mandatory use is becoming an important research issue as it is becoming increasingly prevalent in organizations (Rawstorne et al., 2000).

This research focuses on those two outcomes that have been examined in the research of the acceptance of information technology under the context of voluntary use. The outcomes we concentrated on are current system usage in terms of usage frequency and volume, a measure of successful system implementation (DeLone and Mclean (1992 and 2003), and future use intentions, which represent the likelihood that the system will be institutionalized in the future (Agarwal and Prasad, 1997). Those outcomes are influenced or determined by a variety of factors. This study will explore the influence of fragmentation of working time and fragmentation of working space in individual working behaviour, together with the perceptions of usefulness, ease of use and compatibility. These factors are discussed next.

3.2 Individual Beliefs and Technology Acceptance Outcomes

According to TAM, behavioural intention (BI) is a major determinant of usage behaviour. Behaviour can be predicted by measuring BI. BI is viewed as being determined by how a person considers the perceived usefulness (PU) and ease of use (EU) of the systems being studied. "*PU and EU are postulated a priori, and are meant to be fairly general determinants of user acceptance*" (Davis, Bagozzi and Warshaw, 1989).

UTAUT is formulated with four core determinants of intentions and usage: performance expectancy, effort expectancy, social influence and facilitating conditions, together with four moderators of key relationship: gender, age, experience and voluntariness of use.

Perceived usefulness (performance expectancy) measures the extent to which a user believes that adopting the system will enhance his or her job performance. Perceived usefulness proved to be a major determinant of behaviour intention (e.g. Davis et al., 1989; Davis 1989; Chau, 1996; Agarwal and Karhanna , 2000; Venkatesh, 2000; Hong et al., 2002; Gefen et al., 2003) and to correlate highly with various usage dimensions. For example, self-reported current usage (Davis 1989; Szajna 1996), self-predicted future usage (Davis, 1989; Davis et al., 1989; Adams et al., 1992), variety of use (Igbria et al., 1995), behaviour regarding the choice of software packages (Szajan, 1994), user's behaviour in both the pre-implementation and post-implementation stages of a system (Szajan, 1996), continued sustained usage (Agarwal and Prasad, 1997), subsequent discontinuance behaviour (Parthasarathy and Bhattacherjee, 1998) and mandatory use (Venkatash and Davis, 2000).

Perceived ease of use (effort expectancy) measures the extent to which a user believes that using the system is free of effort. Compared with perceived usefulness, perceived ease of use is the second most important determinant of a user's behaviour toward a system (Davis et al., 1989). Some research have found that perceived ease of use does not have a significant and direct effect on users' behaviour intention to use a system, but does affect intentions only through perceived usefulness. (e.g., Szajna, 1996; Chau, 1996).

Compatibility is the third belief we will examine in our research. It measures the degree to which an information system is perceived as being consistent with the existing values, needs, and past experiences of a user. It was originated by Rogers (1983) in developing the innovation diffusion theory. It has been adapted to IS adoption research by Moore and Benbasat (1991) to develop the measurement of the perceived characteristics of innovating. Prior research has shown that compatibility is an important determinant of user acceptance behaviour (Karahanna et al., 1999; Xia and Lee, 2000).

3.3 Individual Difference and Technology Acceptance Outcomes

TAM is tailored specially to study user acceptance of computer technology (e.g. Legris, Ingham and Collertte, 2003; Lee, Kozar and Larsen, 2004). TAM emphasizes the importance of how external variables, e.g. various individual differences, situational constraints, organizational characteristics and system characteristics etc. affect the individual internal decision process and formation of internal beliefs. TAM suggested that those beliefs would fully mediate the effects that all other variables in the external environment may have on an individual's use of an innovation. Full mediation indicates that not all external variables would exhibit a direct influence on usage intention or usage behaviour, whereas, indirectly through their relationship with beliefs. Research in social psychology has approved that individual differences are expected to influence belief formation.

Very recently, Venkatesh, Morris, Davis and Davis (2003) proposed a unified model, the Unified Theory of Acceptance and Use of Technology (UTAUT), based on studies of eight prominent models (particular TAM) of IS adoption. According to the UTAUT, examination of the effects of the four moderators, i.e. gender, age, experience and voluntariness of use, has contributed to a better understanding of the complexities of technology acceptance by individuals. It gives us greater insights into the individual's adoption of an information system, especially the role played by important moderators in the key relationships between beliefs and behavioural intentions.

Theoretically, the UTAUT suggests that external variables have exhibited a significant moderating effect on the relationship between beliefs and usage intention or usage behaviour. The examination of such effects is aimed to detect the important role of "the situation" or individual utility played in individual decision-making (Agarwal and Prasad, 1998). The benefit of investigating such effects is that researchers and practitioners alike could pay attention to the context in which individual adoption behaviour occurs.

3.4 Mobile Technology Acceptance

A number of researchers have studied user acceptance of mobile technology and services such as the mobile Internet, text messaging, contact services, mobile payment, mobile gaming and mobile parking services based on IS adoption models (e.g. Pedersen, 2002; Pedersen and Nysveen, 2003; Pedersen, Nysveen and Thorbjornsen, 2003). They found that usefulness and ease of use are very important factors determining the readiness to use mobile technology. Khalifa and Cheng (2002) found that exposure of an individual to m-commerce influences positively the individual's intention to adopt m-commerce. The results of these studies confirm that in the mobile technology context, traditional adoption models such as TAM could be applied but they need to be modified and extended in order to increase their prediction and explanation power.

One of our primary focuses in this research is to explore the effects of individual fragmentation of working time (FWT) and fragmentation of working space (FWS) on individual behaviour on acceptance of mobile technology within a given organization. It has been rarely examined in the literature.

There are major differences between workers working in a physical office and those working on the move (Perry et al 2001). People encounter many spaces and contexts when working on the move (geographical movements). Thus, they have less control over the configuration of their environment and the way they organize their work. Mobile technologies promise to remove these constraints by allowing workers to access the required information at any time and any place. It also makes it possible for a worker "on the move" to be connected at any time and at any place. Findings from Green (2002) indicate that mobile computing and telecommunications technologies mediate time in relation to mobile spaces, but the practical construction of mobile time in everyday life remains firmly connected to “working time” and “family time”. Therefore, improving the productivity of mobile workers during their working time in a fragmented working space will benefit both workers themselves and the organization. The most obvious “situation” when mobile technology is used is when people are on the move. The exploration of the moderating effect of fragmentation of working space is of great importance. It might provide insights offering a better understanding of individual acceptance of mobile technology.

In summary, our research here aims to explore the relationship between individual variables, i.e. fragmentation of working time (FWT) and fragmentation of working space (FWS), and the usage of mobile technology by examining their potential influences on and interaction with relevant individual beliefs. The constructs and relationships underlying TAM and UTAUT are used as theoretical backgrounds to develop research hypotheses.

4 The Research Model and Research Hypotheses

The research model tested in this study is shown in Figure 1. It is based on the conceptual background described in the preceding section. The model suggests that the influence of the three beliefs on behaviour will vary at different levels of the individual’s fragmentation of working space. Two acceptance outcomes (behaviour) are measured, current use and future behavioural intention. Current use is measured by two indicators: (i) perceived usage frequency and (ii) perceived usage volume. In order to check the potential influence of inertia resulting from the current use of a system on future behavioural intentions, the model also suggests that current use has an influence on future behavioural intentions (Agarwal and Prasad 1997). Concerning the effects of fragmentation of working time on behaviour, the model proposes that it can be fully mediated by the three beliefs.

Consequently, the hypotheses tested here are:

H1: Individual difference of fragmentation of work space (FWS) moderates the relationships between beliefs (PU, EU, COMP) and future behavioural intention with regard to mobile technology.

H2: Beliefs (PU, EU and COMP) fully mediate the influence of individual differences in fragmentation of working time (FWT) on future behavioural intention towards mobile technology.

H3.1: Current usage frequency of mobile technology has an influence on future behavioural intention towards it.

H3.2: Current usage volume of mobile technology has an influence on future behavioural intention towards it.

H4.1: Individual differences in fragmentation of work space (FWS) moderate the relationships between beliefs (PU, EU, COMP) and current usage frequency of mobile technology.

H4.2: Individual differences in fragmentation of work space (FWS) moderate the relationships between beliefs (PU, EU, COMP) and current usage volume of mobile technology.

H5.1: PU, EU and COMP fully mediate the influence of individual differences in fragmentation of working time (FWT) on current usage frequency of mobile technology.

H5.2: PU, EU and COMP fully mediate the influence of individual differences in fragmentation of working time (FWT) on current usage volume of mobile technology.

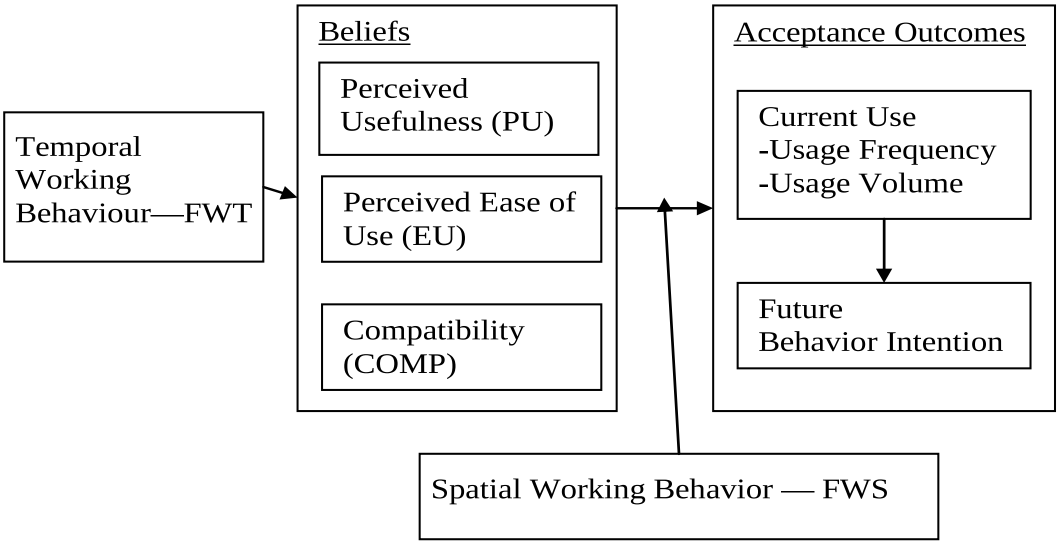

Figure1 Research Model

5 Methodology

A web survey was employed to empirically test the research hypotheses. We outsourced this to Webropol, a company that has experience of web surveying and is located in Helsinki. The answers were returned in Excel format so that was easy for us to perform data analysis and avoided possible data input error.

5.1 The Mobile Information System and the Study Context

The specific mobile information system examined in this research is a mobile medical information system for physicians in the Finnish healthcare sector. The Finnish Medical

Society Duodecim is a leading provider of medical knowledge and information in Finland. It has adapted new technologies to distribute knowledge to physicians, for example, CD-ROM, Intranet, and the Internet (Jousimaa 2001). In 2002, a mobile medical information system was designed to disseminate medical knowledge. It is a set of medical information and knowledge databases; similar contents are also available in conventional printed books, on hospital intranets and the Finnish national Internet portal, Terveysportti (Han et al., 2004 a). The mobile medical information system, referred to as the "mobile package" by the developer, is built on an XML database and can easily be modified to work with most mobile devices with different operating systems e.g. Symbian, Palm OS and Windows CE, etc. In Finland the device most commonly used as a platform is the Nokia 9210 Communicator. Currently the updates are delivered as physical memory cards, the users returning the older ones. In the near future the system will be able to update itself partly or completely through the wireless network. For example, a new drugs' price list was updated successfully through the GSM network in autumn 2003.

From spring 2003, the developer (Duodecim Publisher Ltd, a publishing company owned by the Finnish Medical Society Duodecim) has, with support from Pfizer Finland Ltd, started a pilot trial in which 800 physicians were supplied free with Nokia 9210 communicators equipped with the mobile medical system. Physicians were randomly selected with a balance between general practitioners and specialists, i.e. four hundred per each group.

From March to October 2004, we carried out a questionnaire survey (English version) through the web. The developer tried to send e-mails to those 800 physicians who were involved in the pilot, asking them to answer the survey. Because of changes in some physicians' e-mail addresses we were able to contact only 578 physicians, with 242 usable responses being returned, a response rate of 41.9%. It is necessary to be cautious about those physicians (222, over a quarter of the whole population) who were unable to participate in the investigation because of changed e-mail addresses. They might behave differently from these who answered the survey.

5.2 Operationalization of Research Variables

Items assessing various constructs were adapted from past research with changes in wording to make them appropriate for the mobile medical information system and the healthcare context (See appendix). In particular, items such as perceived usefulness, ease of use and social influence were adapted from Davis et al. (1989) and Venkatesh et al. (2003); items such as behavioural intention and items such as compatibility came from Moore and Benbasat (1991) with reference to Teo and Pok (2003). They were also refined based on the similar study conducted previously (Han et al., 2004b).

Acceptance outcome. Based on previous IS research, four items of future behavioural intention were adapted. Two indicators of current use were included. Physicians were asked to indicate the amount of time spent on the mobile medical system per week, using a five-point scale ranging from "less than 0.5 hours" to "more than 3 hours". Frequency of use provides a slightly different perspective from time of use (Igbaria et al., 1995). It was measured on a six-point scale ranging from "don't use it at all" to "several times a day".

Beliefs. Perceived usefulness, PU, perceived ease of use, EU, and compatibility, COMP, were adapted from prior research and measured on a five-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Some items were negatively worded in order to avoid a possible response bias.

Individual differences in fragmentation of working time (FWT) and fragmentation of working space (FWS). Different dimensions of individual temporal and spatial behaviour described earlier were measured on a five-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

6 Data Analysis and Results

6.1 Sample Characteristics and Evaluation of Nonresponse Biases

Among the 242 usable returned answers, 54 percent were physicians who have had over 20 years experience in medical practice, 36 percent had 10 to 19 years experience. Only 23 have served in medicine less than 10 years. Most of the respondents (i.e. 80% of n =232) were about 40 to 59 years old; only 37 of the respondents were under 39 years old. Nearly 70 percent of the answers were from male physicians. Specialists (SP) seemed to respond to the survey more actively, around 74 percent; about 23 percent were from general practitioners (GP). Most of them, 80 percent, have used the mobile medical system for 1 to 2 years. Only 5 physicians had used it for less than 6 months; eighteen had used it for less than 11 months. The distribution of the respondents was not balanced between gender and working positions as specialists or general practitioners.

The nonresponse bias needs to be properly addressed in survey studies. The potential bias in this study was examined by comparing the responses returned before July (n=149) with those returned after September (n=93). Background data (gender, age, work positions as SP or GP, experience in medical practice and experience of using the mobile medical system) and responses to the question items for the proposed model were compared by computing one-way ANOVA analysis.

It seemed that the distribution of background data (except for experience of using the mobile medical system) for the early and late respondents differed significantly at the

0.05 level. Here, we can not claim that this was a pure nonresponse bias. Since at the beginning of data collection, we found out that nearly half of the physicians involved in the pilot had changed their contact e-mail addresses, we were not able to inform them about the survey, obviously. In order to increase the number of responses, we tried to elicit their contact e-mails by various means, but could get all changed information in time. After September, we got more answers. We argue that the bias found was rather artificial. Since we did not study the effects of those background variables in the proposed model, the bias would not significantly affect our model-testing results. As for responses to question items for the constructs in the research model, the differences were not significant, except for item 2 (I do work in my free time (non-office time)) ($p=0.041$), measuring fragmentation of working time. It was quite close to the 0.05 level. Therefore, the threat of a nonresponse bias is not serious.

6.2 Analysis of Fragmentation of Working Time and Fragmentation of Working Space

Within a given organizational and work context, individual differences in fragmentation of working time could be measured by individual preferences for different individual temporal dimensions in dealing with tasks and events. Similarly, individual differences in fragmentation of working space are measured by individual mobility (geographical movements). Within the healthcare setting, physicians' work, in general, is fluid with many unexpected events occurring during their working time (Berg, 1999). Physicians' work also involves intensive mobility, especially local mobility (Ammenwerth et al., 2000). In order to investigate the pattern of physicians' fragmented working time and working space, we performed a factor analysis (eigenvalue >1) of the question items in the survey (Table 1& Table 2). Factor scores were generated by the Anderson-Rubin method and used in sequential analysis of the model testing.

Table 1 Fragmentation of Working Time-FWT[a]

	Factor	
	1	2
FWT1	.735	-.035
FWT2	.628	.103
FWT3	.730	.248
FWT4	.254	.579
FWT5	.067	.706
FWT6	-.030	.764
FWT7	.729	.075

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Table 2 Fragmentation of Working Space-FWS[a]

	Factor	
	1	2
FWS1	.165	.784
FWS2	.428	-.607
FWS3	.661	-.372
FWS4	.736	-.016
FWS5	.663	-.017
FWS6	.548	.329

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Table 1 showed that the seven individual temporal dimensions were loaded into two factors, indicating that physicians have two different degrees of FWT. Items 1, 2, 3 and 7 were loaded as one factor, whereas, items 4, 5 and 6 were loaded as another. It suggested that physicians whose working time was full of unexpected events and influenced by other people's work schedules preferred to work in their free (non-office) time and perform many activities at the same time. However, physicians whose working time was well scheduled preferred to work according to a routine and usually achieved what was planned. The first pattern has "timeless" characteristics, activities are interrupted by each other, and therefore the working time is highly fragmented. We labelled it as "high FWT". The second pattern still has the "linear clock time" property, thus the working time is less fragmented. We labelled it as "low FWT".

Table 2 presented physicians' different degree of fragmentation of working space. Among the six spatial dimensions we defined, the dimensions of office and mobility "near the office" were loaded as one factor. Geographical movements between the home, other healthcare locations, travelling and visiting patients seemed to constitute another pattern of spatial working behaviour among physicians. The first factor indicates that some physicians still adhere to their physical office to perform their work; their spatial working behaviour is rather stationary, involving some degree of local mobility near the office. We labelled it "low FWS". The second factor suggests that some physicians perform their work at various locations, they are not bound by traditional offices; their spatial working behaviour is more oriented towards highly fragmented. We labelled it "high FWS".

By comparing differences in fragmentation of working time and working space, we obtained four "profiles" for physicians, i.e. physicians with high FWT and high FWS, physicians with high FWT and low FWS, physicians with low FWT and high FWS, and physicians with low FWT and low FWS. We performed four analyses according to those profiles to test the research model.

6.3 Analysis of Measurement Validity

The reliabilities of the latent constructs, i.e. perceived usefulness, perceived ease of use, compatibility and future behavioural intention, were measured using Cronbach's alpha. Item 4 for measuring ease of use was dropped because of low reliability. As shown in Table 3, the values were above 0.70, the common threshold values recommended by the literature (Straub et al., 2004).

The construct validity of the instrument was evaluated by computing discriminant and convergent validity using factor analysis. Discriminant validity is summarized in Table 4. The factor analysis showed that just two factors could be extracted (eigenvalues >1). The items supposed to measure compatibility were also loaded on the factors measuring perceived usefulness. Obviously the main reason for this was that all these constructs seem to be highly correlated with a correlation between + 0.44 and + 0.84. This should of course also be taken into account when interpreting the results of the subsequent analysis. As, however, the two constructs are important parts of the model we proposed, we will regardless of the measurement problems keep them as separate variables in the model. The factor scores was finally estimated separately for each construct using the items indicated in Table 4 by the Anderson-Rubin method. After performing convergent validity analysis of each construct in the proposed model, we found out that items measuring compatibility did not extract two dimensions; they converged to measure one common underlying construct. The convergent validity is therefore satisfactory.

Construct	N of items	Reliability	Mean	S.D	Correlations			
					1	2	3	4
1. BI	4	0.84	4.01	1.13	1.00			
2. PU	4	0.94	3.97	1.12	0.79***	1.00		
3. EU	3	0.89	4.15	0.99	0.41***	0.44***	1.00	
4. COMP	3	0.91	3.93	1.14	0.78***	0.84***	0.47***	1.00

Notes: Cronbach's alpha is reported for reliability. All constructs are measured on a 1-5 scale, strongly disagree to strongly agree. Pearson correlation coefficients are reported. * p<0.05; **p<0.01; ***p<0.001

Table 3 Descriptive Statistics

Table 4 Factor Analysis-Discriminant Analysis

	Factor	
	1	2
PU1	.887	
PU2	.897	
PU3	.882	
PU4	.922	
EU1		.963
EU2		.861
EU3		.794
COMP1	.847	
COMP2	.716	
COMP3	.935	

Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.

6.4 Model-Testing Results

An important assumption of linear regression analysis is the homoscedasticity of the error terms in the regression equations. The violation of this assumption, i.e. heteroscedasticity of the error term, will yield invalid estimation results. SPSS has not implemented any correction for heteroscedasticity, but Professor Andrew F. Hayes has written an SPSS macro that implements the four types of heteroscedastic-consistent standard error estimator (HC), i.e., HC0, HC1, HC2, and HC3 corrections (Hayes and Cai, 2004). In simulations, Long and Ervin (2000) found that type II error was much more dangerous than type I error. For that reason, they recommended that "*a test for heteroscedasticity should not be used to determine whether [an HC estimator] should be used.*" It is better to use an HC estimator whenever heteroscedasticity is suspected. Therefore, we adopted the HC estimator (HC3) to run the regression analysis.

Tables 5.1-5.3 contain the regression results used to address hypothesis 1 through 5. There are four profiles for physicians identified in our study with different degrees of FWT and FWS. The following analysis was conducted for each of these profiles: multiple regressions were run, with future behavioural intention as the dependent variable, and each of the three beliefs, usage frequency and usage volume and FWS as independent variables, together with a multiplicative term for FWS and each of the three perceptions. In addition, to examine hypothesis 5, FWT was included in the regression as an independent variable. Similarly, regression analysis was performed for the dependent variables - usage frequency and usage volume - separately. All other assumptions for multiple linear regression were verified, i.e. multicolinearity was not significant, the error terms were independent and normally distributed.

Dependent Variable: Future Behavioural Intention (N=242)				
Profiles	High FWT & High FWS	High FWT & Low FWS	Low FWT & High FWS	Low FWT & Low FWS
R^2	0.708	0.696	0.707	0.688
PU	0.278 (0.008)**	0.372 (0.000)**	0.270 (0.009)**	0.332 (0.000)**
EU	ns	ns	ns	ns
COMP	0.512 (0.000)***	0.407 (0.000)***	0.516 (0.000)***	0.407 (0.000)***
Usage Frequency	ns	ns	ns	ns
Usage Volume	0.095 (0.025)*	0.089 (0.034)*	0.094 (0.029)*	ns
FWT	ns	-0.104 (0.019)*	ns	ns
FWS	-0.095 (0.049)*	ns	-0.106 (0.012)*	ns
PU*FWS	ns	ns	ns	ns
EU*FWS	ns	ns	ns	ns
COMP*FWS	0.209 (0.036)*	ns	0.209 (0.034)*	ns

Notes: 1. Standardized z-score of usage frequency and usage volume is used in the regression 2. Beta (p value) is reported. 3.*p<0.05, **p<0.01, ***p<0.001, ns-not significant.

Table 5.1 Hypotheses Testing

The results showed that our proposed model could explain around 70 percent of the variance in physicians' future behaviour intentions towards the mobile medical information system. They indicated that perceived usefulness was the most important determinant factor that influenced physicians' future behaviour intention regarding the mobile medical information system regardless of the different degrees in fragmentation of their working time and working space. Perceived ease of use was found not to be a significant factor affecting behaviour. The strength of compatibility influencing physician's behaviour was found to be more likely to vary at different levels in fragmentation of working time, significantly for those with a high level of fragmentation. FWS did not present any significant moderating effect when physicians have low FWS in their work practice. The three beliefs presented in the research model seemed to fully mediate the effects of individual differences in fragmentation of working time on physicians' future behaviour intentions, but an exception was found for physicians profiled with high FWT and low FWS. In this profile, FWT seemed to impact negatively on future behaviour intention. Current usage volume of the system influenced future behaviour but not for physicians profiled as low FWT and low FWS. In this profile, only perceived usefulness and compatibility exhibited effects on future behaviour.

Dependent Variable: Usage Frequency (N=242)				
Profiles	High FWT & High FWS	High FWT & Low FWS	Low FWT & High FWS	Low FWT & Low FWS
R^2	0.488	0.503	0.491	0.499
PU	0.515 (0.000)***	0.549 (0.000)***	0.514 (0.000)***	0.534 (0.000)***
EU	ns	0.134 (0.010)*	0.109 (0.038)*	0.143 (0.006)**
COMP	ns	ns	ns	ns
FWT	ns	ns	ns	ns
FWS	ns	-0.115 (0.032)*	ns	ns
PU*FWS	ns	ns	ns	-0.144 (0.037)*
EU*FWS	ns	ns	ns	ns
COMP*FWS	ns	ns	ns	ns

Notes: 1. Standardized z-score of usage frequency and usage volume is used in the regression 2. Beta (p value) is reported. 3.*p<0.05, **p<0.01, ***p<0.001, ns-not significant.

Table 5.2 Hypotheses Testing

Regarding current usage frequency of the system, our model could explain 50 percent of the variance. Perceived usefulness was the significant influencing factor, specially, when physicians were profiled as high FWT and high FWS. In addition, ease of use exhibited an effect on current frequency in other profiles. Fragmentation of working space did not seem to moderate the relationship between physicians' beliefs and their future behaviour. An exception was found in the "low FWT and low FWS" profile, which was negative. It suggested that when physicians had generally low fragmentation of working space, i.e. working in the office or some degree of local mobility near the office, those with intensively local mobility will have the same future behaviour as those who are less locally mobile at significant high levels of beliefs regarding the perceived usefulness of the system. The three beliefs could fully mediate the effect of FWT on physicians' future behaviour.

Our model explained approximately 26 percent of the variance in physicians' current volume of usage of the system. Perceived usefulness showed a strong determinant effect in all the profiles. Perceived ease of use also exerted effects on future behaviour except for the profile of "high FWT and high FWS". The potential FWS-moderating effect in the profile of "high FWT and low FWS", which is the impact of EU on future behaviour, varied at different levels of "low FWS". The effects of FWT on future behaviour were fully mediated by the beliefs, except for the profile "low FWT and high FWS".

Dependent Variable: Usage Volume (N=242)				
Profiles	High FWT & High FWS	High FWT & Low FWS	Low FWT & High FWS	Low FWT & Low FWS
R^2	0.254	0.252	0.265	0.259
PU	0.251 (0.019)*	0.238 (0.017)*	0.259 (0.010)*	0.255 (0.008)**
EU	ns	0.136 (0.012)*	0.117 (0.039)*	0.147 (0.005)**
COMP	ns	0.214 (0.036)*	ns	0.209 (0.037)*
FWT	ns	ns	0.120 (0.045)*	ns
FWS	ns	-0.115 (0.032)*	ns	ns
PU*FWS	ns	ns	ns	ns
EU*FWS	ns	0.089 (0.034)*	ns	ns
COMP*FWS	ns	ns	ns	ns

Notes: 1. Standardized z-score of usage frequency and usage volume is used in the regression 2. Beta (p value) is reported. 3.*p<0.05, **p<0.01, ***p<0.001, ns-not significant.

Table 5.3 Hypotheses Testing

Hypothesis No.	Dependent Variable	Independent Variable*	Moderator	Findings
H1	Future behavioural intention	Compatibility	FWS	Effects significant for high FWS physicians regardless of FWT
H2	Future behavioural intention	FWT	N/A	Beliefs can not fully mediate FWT effects for those with high FWT and low FWS physicians, which has a negative direct effect
H3.1	Future behavioural intention	Usage Frequency	N/A	No significant effect was found in the four profiles
H3.2	Future behavioural intention	Usage volume	N/A	Usage Volume have an direct effect, but not for low FWT and low FWS physicians
H4.1	Usage Frequency	Perceived usefulness	FWS	Effects significant for low FWS physicians with low FWT
H4.2	Usage Volume	Perceived ease of use	FWS	Effects significant for low FWS physicians with high FWT
H5.1	Usage frequency	FWT	N/A	Beliefs fully mediate FWT effects in the four profiles
H5.2	Usage Volume	FWT	N/A	Beliefs can not fully mediate FWT effects for those with low FWT and high FWS physicians, which has a positive direct effect

Note: * only the significant independent variables are showed.

Table 6 Summary of Findings

To sum up, H1 was partly supported; FWS moderated the effect of compatibility on future behaviour intention, significantly for the profile “high FWS”. H2 was partly supported, except that FWT has a direct negative effect on future behaviour for the profiles “high FWT and low FWS”. H3.1 was not supported at all; H3.2 was supported, except for the profile “low FWT and low FWS”. H4.1 was partly supported; it only significantly moderated the effect of perceived usefulness on intention in the profile “low FWT and low FWS”. H4.2 was partly supported, only significantly moderating the effect of perceived ease of use on intention in the profile “low FWT and low FWS”. H5.1 was supported; H5.2 was partly supported, except that it had a positive direct effect on current usage volume in the profile “low FWT and high FWS”. A summary of the findings is presented in Table 6.

7 Discussion

This paper aims to explore the potential effects of individual differences in fragmentation of working time and fragmentation of working space on user behaviour regarding mobile technology. A research model was proposed and then empirically examined using responses from 242 physicians practising in the Finnish healthcare sector. The results obtained from regression analysis using the HC3 estimator showed that the model was able to provide approximately a 70-percent explanation for variances in an individual physician’s future behavioural intention with regard to a mobile medical information system.

The moderating effect of individual FWS hypotheses specified by the model regarding future behaviour intention was partly supported and was statistically significant at the 0.05 level when a high degree of fragmentation was present in the individual spatial working behaviour. It might appear that these provide some evidence of moderation of FWS when it comes to a user adopting an innovative mobile technology. It also indicates that the pervasive usage of mobile technology in work practice largely depends on the degree of mobility. It sounds obvious, but our results also reveal that when a user has a general low fragmentation of working space, even some degree of local mobility, the moderating effect of FWS was not present. We might argue that if a user is not far away from a stationary computer, he or she might not be very likely to use a mobile computer instead. The degree of a user’s fragmentation of working time does not matter potential adoption decision in the presence of FWS as a behaviour moderator. It thus emphasizes the important role played by FWS regarding future intentions to use mobile technology. That might also give a clue as to why it moderated the belief of compatibility with future behaviour in the context of mobile technology. It has been suggested that mobile technology changes work and the way an individual organizing the work fundamentally. The perception of compatibility with changing work practices in dealing with tasks and events on the move would appear to be one of the key drivers for users to adopt mobile technology.

The moderating effects of FWS on current actual use, i.e. usage frequency and usage volume, were not found in the high FWS profiles but in the low FWS profiles. It is not surprising since the spatial nature of physicians' work is basically rather stationary with some degree of local mobility. Intensive local mobility would not induce physicians who have less FWT to use the mobile medical system more frequently, since the negative moderating effect was found. However, physicians who have a high degree of FWT would prefer the system to be easy to use with their increasing level of local mobility. Unless there were major changes in physicians' current work in terms of space, individual FWS might not influence their current actual usage behaviour significantly. The benefits and added value provided by mobile technology could not be achieved in the work practice. The cost of switching from PC-computers to handheld devices might be considered very high for them when their work does not require a high degree of fragmentation of space.

However, as we argued before, individual temporal and spatial working behaviour would seem to be adjusted according to the organizational culture and the nature of the work. The moderating effects of individual FWS on physicians' future behaviour instead of current usage have signalized a possible changing trend in their work and that working might become spatially fragmented in the future. When they realize the trend, the physicians in the study might be strongly motivated to use the mobile medical system in their future work practice.

Individual differences in fragmentation of working time were proposed as an external variable in the research model. It seemed that the beliefs of the mobile system could fully mediate its effect on the acceptance outcome, especially for future behaviour intention. However, it is very interesting that individual FWT also exhibited direct effects on current use in cases of different individual FWS. For physicians whose work space is less fragmented but have a high degree of FWT, their individual FWT would lead them to make a negative decision. It sheds light on the negative effect of fragmentation of working time. If mobile technology were competing with "stationary" technology within a less "mobile" context, individuals who engage in extemporaneous and improvised temporal behaviour would not use mobile technology at all. By comparison, for individuals who have a high degree of FWS, their scheduled and planned temporal behaviour (low FWT) will increase their current volume of usage of the system. It indicates that when people are on the move, they have less control of their spatial environment, but they probably have well-scheduled time in dealing with tasks and events, e.g. catching a flight, attending meetings, visiting clients according to pre-arranged time slot. They also are far from their "stationary" computers, and therefore they turn to the mobile system to look for relevant information with a comparatively longer time. To sum up, we argue that currently, different interactions between individual FWT and FWS might predict the outcome of physicians' technology acceptance differently.

The results have also shown a very strong determining effect of perceived usefulness on all the outcomes of technology acceptance we examined in the research model. It confirmed that professional physicians, as a special user group, will use a certain IS only if it is perceived as useful for their work (Berg 1999; Chau and Hu 2002 a, b). Perceived ease of use was not found to be a significant factor exhibiting influence on physicians' future behaviour intention in the current study. A possible reason for this might correlate with previous research conducted in the professional context, i.e. ease of use had limited or no significant effect on behavioural intention (Chau and Hu 2002 a, b). But, it had significant effects on current usage of the system. At present, when physicians are still at the stage of early exposure to the mobile system, beliefs are a learning process that might change over time. Thus, the current perception of ease of use might not turn out to be so important in the future. As physicians gain more experience of the system, ease of use would weaken its power in predicting their future behaviour. The effect of ease of use was not found for physicians whose working behaviour is highly fragmented both temporally and spatially. A possible explanation is that usefulness of the mobile medical system has benefited their work practice; they are thus more tolerant than others of the mental effort required. Usefulness is the single most dominant factor determining their current usage behaviour.

Current usage volume was found to be a determining factor in predicting physician's future intentions toward the mobile medical system except for those whose working behaviour were less fragmented temporally and spatially. Agarwal and Prasad (1997) have found that current usage can not be considered as a surrogate for predicting future behaviour. They claimed that the "*momentum generated by initial use cannot be relied upon for continued, sustained use for the innovation*". Our findings differ from previous research. It might result from differences in our measuring model. We used two dimensions, frequency and volume, to measure current use of the system. Our results did not find that current usage frequency influenced future behaviour. The effects of current usage volume on future behaviour might result from the additional time physicians have spent on the system, the greater experience and knowledge they get from it by exploring more features of the system, and therefore the greater incentive to use it continuously in the future. But frequency of use did not measure the same aspect of usage. This result advises us that the momentum generated by current time of use, rather than that by frequency of use, could predict physician's future intentions regarding the mobile system.

Before discussing the implications of this study, it is worth pointing out its limitations. One limitation results from the scales adopted to measure the core constructs. Because of the items of compatibility loaded on perceived usefulness, the measurement model lacked strong discriminating validity. The interpretation of the effect of perceived usefulness on physicians' behaviour might have to take the effect of compatibility into account. Moore and Benbasat (1991) found the same problem when they developed their instruments to measure the perceived characteristics of innovating (PCI). Therefore, future research might target more appropriate scales with the emphasis on discriminating validity with other core constructs in the model and try to avoid adoption of compatibility directly from PCI instruments. Chau and Hu (2002 b) have defined compatibility together with peer influence as a measure of “technology implementation context” regarding user adoption of technology. It could be adapted in the future research. Another limitation concerns the dimensions we adopted for measuring individual differences in fragmentation of working time (FWT) and fragmentation of working space (FWS). They are very new concepts that have ever been examined in studies of IS adoption. Our understanding of these concepts is rather inexact. More future work has to be done to develop rigorous models for measuring the two new concepts. Thirdly, the analysis was based on the responses from a sample size of 578, rather than the entire 800 physicians involved in the trial. Possible bias from the group of users who did not participate in the survey has to be considered. Finally, the sample was collected from the 800 physicians who participated in the pilot trial instead of all physicians practicing in the Finnish healthcare sector. Thus, our data lacked information from those “non-users”. Future research should target all physicians. A comparison of users and non-users might reveal more insights into physicians’ behaviour towards adoption of the system. A fuller understanding will help incorporate it into the Finnish healthcare sector effectively, as well as provide a solid basis for generalizing the findings to other user groups in other organizational contexts.

8 Implications and Conclusions

What motivates individuals to use mobile technologies? The findings of this study contributed to understanding two new concepts relevant to use and future intentions with regard to mobile technology: individual differences in fragmentation of working time (FWT) and fragmentation of working space (FWS). It also makes a contribution to the research into technology acceptance behaviour by extending its theoretical validity and empirical applicability to professional physicians in a new mobile technology context.

8.1 Implications for Future Research

From the perspective of theory and concept development, we have posited and found empirical support for understanding how individual differences in FWS and FWT drive the acceptance of mobile technology.

Technology has changed our perception of time and space dramatically. Our structured “interpretive framework” of time and space has changed and is changing with the utilization of information technology at work. Evidence of moderation, i.e. FWS, raises an important implication for IS adoption research related to information technology, or more specifically mobile technology. The consideration of human interactions with a computer or more specifically, a handheld device, in various physical spaces has to be taken into account in subsequent work. It will provide more insights into what motivates users to adopt mobile technology. Evidence of mediation, i.e. FWT, also has implications for IS research. Implications of time in virtual space have been highlighted in recent IS research, but its influence on users' behaviour when they encounter fragmented working space has seldom been examined. Possibly, in the different context of the fragmentation of working space, individual FWT might exhibit various effects on the technology acceptance model. Previous research, which was quite blind to the perspective of spatiality when examining the relatively "stationary" information system, also seemed to neglect the potential influence of individual temporality on behaviour. The relationships expected to be significant in the study might need to explicitly acknowledge the individual fragmentation of working time and fragmentation of working space with regard to implementing mobile technology. Our research could serve as a stepping stone for others interested in the effects of time and space to further explore their implications for technology acceptance, in particular mobile technology, within an organization. Another implication derived from our study is that in the professional user context, perceived usefulness has emerged as almost the single dominant factor influencing current and future behaviour. The effects of ease of use might be more significant for predicting current usage behaviour rather than future intentions. As for different individual temporal or spatial fragmentations, the effects of ease of use have been shown to differ with varying individual temporal and spatial fragmentation. In our study we made a rough classification for identifying potential individual "time-space" patterns, one of which, ease of use, is a fairly clear predictor of user behaviour towards technology. Future research could continue this endeavour to identify those patterns across different systems and user groups. It would provide more information for mobile system management and implementation, especially when a system supported by mobile technology is in a position where it competes with PC-based systems and the spatial nature of the target user group is rather stationary. Obviously, ease of use can be expected to affect different "time-space" user groups differently.

Several other avenues for future research remain. Perhaps the most compelling question is how to identify other more important moderating variables influencing beliefs and behaviour within the context of mobile technology. We used fragmentation of working space, an obvious and direct individual difference, when using mobile technology at work. Others could focus on other variables. For example, the idea of perceived innovativeness in the domain of IT has been examined to explain "risk-taking" assessment in moderate technology acceptance behaviour (Agarwal and Prasad, 1998a, b) and the technology-task fit conceptions exerting impacts on individual performance (Goodhue and Thompson, 1995; Goodhue, 1998). Our results have demonstrated that an individual assessment of the compatibility of the mobile system exhibited a significant influence on behaviour by interacting with individual FWS. The idea of a “fit”, measuring to some extent compatibility, could be considered for future studies of users’ adoption of mobile technology. In this way, we might be able to avoid one of the limitations of our research, namely that the compatibility construct does not discriminate strongly with perceived usefulness.

We extended the technology acceptance model by examining individual fragmentation of working time and working space to illustrate the possible process of user adoption of mobile technology. Most empirical studies of TAM have examined relatively simple “stationary” end-user technologies in North America. It is not clear whether it would be relevant and applicable to more complex “mobile” technologies in other cultures. Our results have claimed their theoretical validity and empirical applicability within a very special organizational setting, the healthcare sector in Finland. Future research, adapting our results to other organizational settings and other cultures, might be very valuable. It is evident that in other contexts, users might have different individual temporal and spatial profiles when using information technology, mobile technology in particular, at work.

8.2 Implications for Practice

The most significant implication of our findings is that we can offer management advice that can be fundamental in influencing mobile technology acceptance by identifying user’s temporal and spatial dimensions and the degree of fragmentation influencing beliefs in and behaviour towards mobile technology. By studying individuals’ temporal and spatial differences regarding their working behaviour, management can identify possible individual “time-space” profiles/segments. In order to promote mobile technology acceptance to some extent, careful selection of individuals with different temporal and spatial working behaviour to be targeted for new systems is important for managerial action. Providing those who have highly fragmented working space with mobile systems would increase their job performance. Potentially, management could use mobile systems to monitor workers’ activities when they are on the move. The information collected indicates the importance of a “semantic” context in mobile systems (Dix et al., 2000). Without a full understanding of it, a mobile system might not be able to support individual use at any time and any place. Obviously, the same management policy would not be equally efficient for those who have less fragmented working space. We have to be cautious in implementing potential mobile system for them. It is obvious that a “stationary” PC-based system might provide greater added value to a user’s performance. A relevant mobile system might not motivate in the same way in a less mobile context. Individual FWT effects on beliefs in technology and acceptance outcome are not uniform across different dimensions of individual FWS and system usage. Different management efforts should be tailored according to “nonuniform” information. Encouraging workers to work in “dead time” (Perry et al., 2001) exploiting various spaces would increase their performance, as would also possible mass adoption of mobile technology (Andrejevic, 2003).

Our findings suggest that perceived usefulness is a strong determinant of technology acceptance. The developer first has to improve the usefulness of the system. Since the perception of compatibility correlates highly with perceived usefulness, and it exerts significant effects for future behaviour intention with moderating effect of FWS, possible efforts by management might focus on this aspect, i.e. increasing the compatibility of the system with work practice would enhance the usefulness of the system and so produce more use in the future. Ease of use influences current use behaviour but not future intentions. This suggests that the developer should put greater effort into making the system easy to use and design special training programs to promote current use, especially time of use, and usage volume. This would lead to greater motivation for using mobile technology in the future. Igbaria and Iivari (1995) postulated that Finland is a more feminine and slightly more collective society, so that individuals’ abilities, experiences and organizational support, rather than perceived usefulness, are likely to play a major role in affecting usage. Thus, organizational encouragement to use the system at work as much as possible is a must. In addition, encouraging physicians to use the system longer when interacting with the system would generate positive intentions to use it continuously in the future.

Our findings also imply that the design of mobile information systems has to take individual temporal and spatial differences into consideration, especially the implications of space. Potential mobile systems should be sensitive to changing “spatial” environments and help a potential adopter to configure the environments effectively (Dix et al., 2000). They should also provide functions so that a potential user could personalize the system according to his/her own temporal or spatial dimensions.

To conclude, this research has highlighted the importance of studying user’s behaviour regarding mobile technology. We have to be aware that it is the users and their use, not advanced mobile technology that will drive its growth to a new level (Jarvenpää et al., 2003). The contribution of our study includes theory extension and testing, as well as some insights into advice practice, especially the introduction of the concepts: individual FWT and FWS. We have noted that individual FWT and FWS play a role in mobile technology acceptance through moderation with and mediation by the constructs proposed in the research model, which was underlined by TAM. We have demonstrated that individual temporal and spatial working behaviour affect an adopter’s beliefs and behaviour regarding mobile technology. We have tested our proposed hypotheses with data collected from real users of the mobile system and adopted an HC3 estimator in the regression analysis. Finally, we discussed some suggestions for how our findings may be adapted by management to implement new mobile technology in an organization, more specifically a healthcare organization.

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Appendix: Items Used in the Study

Temporal behaviour of working

FWT1: My work schedule is often influenced by unexpected events during my working day.

FWT2: I do work in my free time (non-office time).

FWT3: I usually do many things at the same time.

FWT4: I usually achieve what is planned in my typical working day.

FWT5: I usually try to keep to a specific schedule at work.

FWT6: My working day is built of routines.

FWT7: My work schedule often depends on other peoples' schedule.

Spatial behaviour of working

FWS1: I usually do work in my own office.

FWS2: For different reasons, I visit other places (e.g., reception, wards) near my office during my working day.

FWS3: I do work at home sometime.

FWS4: I regularly visit other healthcare locations (other hospitals or healthcare centres) within or outside the same municipality.

FWS5: I do work on a transportation vehicle (e.g. bus, train, plane, or ferry etc.).

FWS6: I take "house call" visits frequently.

Perceived usefulness

PU1: I find the mobile package useful in my practice/patient care.

PU2: Using the mobile package enables me to accomplish tasks more quickly.

PU3: Using the mobile package in my job increases my productivity.

PU4: Using the mobile system makes it easier to do my job.

Ease of use

EU1: Learning to operate the mobile package is easy for me.

EU2: I find the mobile package easy to use.

EU3: It is easy for me to become a skilful user of the mobile package.

EU4: I find the mobile package inflexible to interact with. (Dropped)

Compatibility

COMP1: Using the mobile package fits into my work style.

COMP2: I think that using the mobile package fits well with my life style.

COMP3: Using the mobile package helps me in my working routines.

System current usage

Usage frequency: On the average, I use the mobile package:

1. I don't use it at all. 2. About once a month. 3. About once a week. 4. Several times a week. 5. About once a day. 6. Several times a day.

Usage Volume

Please specify (estimate) how many hours each week you normally spend using the mobile package?

1. <0, 5 hours. 2. 0, 5-0, 9 hours. 3. 1, 0-1, 9 hours. 4. 2, 0-2, 9 hours. 5. 3, 0 or more hours.

Behavioural intention to use the mobile package

BI1: I intend to use the mobile package for my patient care as often as needed.

BI2: I predict I will use the mobile package.

BI3: I intend NOT to use the mobile package in my work routinely.

BI4: I intend to use the mobile package also for checking up new medical knowledge.

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