UNDERSTANDING THE LINKAGE BETWEEN TECHNOLOGY FEATURES AND TECHNOSTRESS IN TELEMEDICINE COMMUNICATION

Ziyu Yan, City University of Hong Kong, Tat Chee Avenue, HK, ziyuyan2@student.cityu.edu.hk
Xitong Guo, Harbin Institute of Technology, 13 Fayuan Street, P.R. China, xitongguo@gmail.com
Matthew K. O. Lee, City University of Hong Kong, Tat Chee Avenue, HK, ismatlee@cityu.edu.hk
Douglas R. Vogel, City University of Hong Kong, Tat Chee Avenue, HK, isdoug@cityu.edu.hk

Abstract

Information and communication technologies (ICTs) have penetrated all walks of life and brought about new ways of working. Network and communication technology brings organizations financial and managerial benefit by connecting virtually separated participants to work together, however, it also increases stress level of individual users. Technostress, one particular stress due to ICT, has not been well studied, especially with IT artifact examined together with. The objective of this research is to explain the relationship between telemedicine communication technology characteristic and technostress. Based on previous literatures, we propose a model that articulates the technology characteristic to telemedicine communication and assess the relationship with stressors of users. The authors believe that the current study will enrich the knowledge by extending the theoretical framework from general ICT to CMC features specifically and revealing the underlying logic in between. The study is also potentially useful to provide practical implications for healthcare practitioners.
1. Introduction

“The World is Flat”, the New York Time Bestseller, conveys the trend that Information and communication technology (ICT) brings the world closer (Friedman 2005). Telecommunication technology makes the world more interconnected, creates new ways of working which lets geographically separated people work together. Numerous of new ways of clinical practice emerged with the advent of new technologies in health care industry. Telemedicine, "the use of electronic information and communication technologies to provide and support healthcare when distance separates the participants" (Ekeland et al. 1996), breaks the restriction of locations and provides virtual collaboration. Particularly in this study, the telemedicine communication refers to the real-time teleconsultation between general and specialized doctors through video-conferenced based platform.

Although the telemedicine has brought financial and managerial benefit as well as better healthcare delivery in clinical practice, there is also failure adoption or resistant endeavors coming along (Ekeland et al. 2010; Obstfelder et al. 2007). The attitude towards technology innovation varies among different industries, but the negative feelings towards technology innovation are both reported in academic literatures and anecdote articles (Ilie et al. 2007a; Miller and Sim 2004). Technostress is one kind of stress that “caused by an inability to cope with the new Computerworld technologies in a healthy manner” (Brod 1984). Although attention from both popular press and academic literature has been drawn on this emerging stress, the dearth of the relationship between technology characteristics and technostress still exists.

Our paper propose a specific technostress model in telemedicine context in response to the call from IS field which encourage researchers not treating IT as a black box but to explore the unintended consequence from the IT artifact (Orlikowski and Iacono 2001). In addition, instead of treating ICT as a general concept, we focus on the network and communication technology that the main function is to connect virtually separated participants to work together. Therefore, the focus of this paper is to articulate the technology characteristic to telecommunication and empirically test the relationship with stressors of users.

2. Literature review

2.1. Stress-related literature

Stress research is a big stream which rooted in various research domains such as psychology, organizational management, and ergonomics, etc. The term technostress is brought by the leading clinical psychologist Craig Brod, and be defined as “a modern disease of adaptation caused by an inability to cope with the new Computerworld technologies in an unhealthy manner” (Brod 1984). Unlike richness of stress research, technostress has not been extensively studied yet (Moore 2000; Tarafdar et al., 2007; Tu et al. 2008). In prior research, technostress was consistently treated as a multidimensional construct (Riedl et al. 2012). A group of research investigated the influence of technostress on the job satisfaction, commitment to organization, employees’ productivity and so on (Ragu-Nathan et al. 2008; Tarafdar et al. 2010; Tarafdar et al. 2007; Tu et al. 2005; Tu et al. 2008). Their studies tested in different industrial and culture background, so that the accumulated results add values on the potential consequence of technostress. Compared with the consequence, the antecedents of technostress have not been fully investigated. Until recently, the new theoretical angle that investigates technology characteristic as antecedence of technostress stressors has been studied. As a result, the Personal-Technology model (P-T model) was proposed (Ayyagari et al. 2011). The model identify technology characteristic for general use of ICT and explain the relationship with stressors accordingly.

Stress has a broad definition that can refer to the stimuli, process as well as outcomes. As outcome variable, stress is divided into sub-scales such as state of mind (measuring anxiety-depression),
confidence-level (measuring worry), energy-level (measuring exhaustion), and etc. As stimuli, it is measured from different sub-scales such as workload, relationship, recognition, personal responsibility and etc (Cooper et al. 2001). For clarity, we use stress-strain relationship, which is stressors, moderating factors, and stress outcomes, to theoretically decompose the overall concept. In this study, we focus on stimuli of stress and use term stressors to particularly refer to” the events or properties of events (stimuli) encountered by individuals (Ayyagari et al. 2011). Particularly in current study, the scope of this construct is constrained to only the stressors that due to telecommunication. Previous literatures from different region show that physicians as a special professional group who may evaluate technology at work differ from those working in business or IT industry (Chismar and Wiley-Patton 2003; Ilie et al. 2007b). In this paper, we investigate specific telemedicine technology and adapt the model towards our research context in terms of theoretical extension and practical meaning.

2.2. Theoretical lens

The underlying theoretical lens is based on the original personal-environment model (P-E fit model) from stress research (Cooper et al. 2001). The P-E fit model is central in stress research and from which we can infer that the misfit between characteristic of the person, either their value or ability, and the environment could lead to stress as an outcome. Later on, the refined P-T model (Ayyagari et al. 2011) has built the bridge between technologies to stressors. However, technologies are various in functionalities and of which the features should be captured into different dimensions. Therefore, the one-size-fit-all model needs to be further articulated to reflect the appropriate features on specific situation. For instance, the connectivity supported by technology could be used as a surveillance tool by organizations that in turn triggers stress emotion to employees, or it can be a prerequisite feature that assists virtual collaboration such as telemedicine system. In other words, telemedicine users won’t blame the real-time connection for instructiveness, but ask for a well connect network to accomplish the work. Therefore, considering the goal of the collaboration, the misfit may occur due to users’ perceived experience or abilities cannot match the technology on hand.

In current study, our focus is to examine the distinguished computer mediated communication (CMC) feature and its impact on technostressors. In the meantime, we also test the established links between other features and stressors in the newly identified model in our research context.

3. Models and Hypothesis

3.1. Technostressors

The technostressors are carefully identified and selected into the model: firstly, we review stress literature from different streams including psychology, organizational behavioral and information systems research (Ayyagari et al. 2011; Cavanaugh et al. 2000; Hurrell et al. 1998; Patterson et al. 2005; Tarafdar et al. 2007; Webster et al. 2011; Williams and Cooper 1998). The major stressors that been generally investigated are: work overload, role ambiguity, work/home balance, organizational climate, personal responsibility, job insecurity, interpersonal relationship, daily hassles, etc. Secondly, we narrow the list to stressors that due to the use of ICT and also consider the occupational characteristic in our research context (Admi and Moshe-Eilon 2010; Denton M et al. 2002). To focus on the technostressors related to the telemedicine communication technology characteristics, we adopt the theoretical lens of challenge-hindrance occupational stress model (Cavanaugh et al. 2000) to select the appropriate stressors represent challenge stressors and hindrance stressors respectively. The challenge stressors are factors reflecting demands, workload, and responsibility. The hindrance stressors, such as role ambiguity and role conflict, are factors that more likely to interfere the accomplishment of work. Therefore, work overload and role ambiguity represent major technostressors in the proposed model.
Work overload refers to perception that “assigned work exceeds an individual’s capability or skill level” (Ayyagari et al. 2011). Previous studies show that adapting to new technologies is time-consuming for physicians and lead to negative views towards technology innovations (Johnston et al. 2001; Miller and Sim 2004). Unintended outcomes from usability and collaboration features brought by telecommunication technology can lead to over workload, and thus work overload is selected to refer to the perception that assigned work exceeds an individual’s capability or skill level.

Role ambiguity means “unpredictability of the consequences of one’s role performance and lack of information needed to perform the role.” Adaptation to new communication ways takes time which can confuse users whether they are dealing with work itself or computers. Role ambiguity is to capture this negative cognition that cause by intervention of technology in routine work.

3.2. Technology Characteristic

3.2.1. Computer mediated communication (CMC) Feature

The distinguished characteristic of telemedicine is to use computer mediated communication (CMC) to support geographically remote group members. Network and communications is one of primary tangible technology infrastructures and the features of which should be investigated (Duncan & Nancy, 1995). More specifically, the collaboration technology refers to telecommunication media. We identify the media characteristics from seminal theories in media stream: media synchrony theory (MST) (Dennis et al., 2008) and social presence theory (Fulk & Boyd, 1991). Three relevant characteristics are included: transmission, symbol set, and social presence.

Transmission support means the degree to which transmission speed can support telemedicine communication. Transmission velocity refers to “the speed at which a medium can deliver a message to intended recipients.” MST predicts that high transmission velocity supports real-time communication (Dennis et al., 2008). In converse, communication can be hindered due to the low pixel of the video camera, in-consistent voice delivery, or inability to capture the physical gestures, etc. Therefore, inadequate speed of transmission can lead to users’ inability to fulfill the work and ultimately cause work overload.

**H1: Individual perception of transmission support will be negatively related to perceived work overload.**

Symbol Set Support refers to the degree to which individual perceived the symbol sets can be used in telemedicine. In MST, Symbols sets mean the “number of ways in which a medium allows information to be encoded for communication” (Dennis et al., 2008). In face-to-face communication, natural symbol sets such as physical, verbal and visual means can be used. Richer in nature symbol sets (physical, verbal and visual) can facilitate synchrony communication. Otherwise, users have to spend extra effort in real-time communication which leads to work overload.

**H2: Individual perception of symbol set support will be negatively related to perceived work overload.**

Social Presence refers to the degree to which telemedicine system allows participants to feel psychologically close or present. According to social presence theory, the appropriate social presence that matches inter-personal communication requirement has positive affect on communication outcome (Fulk and Boyd 1991; Short et al. 1976). It captures the variances among individual user’s perception of the extent to which features and functions provided by media allowing participants being psychological close. Telemedicine work is contingent on group collaboration and the outcome is constrained if participants feel the video conference system is not personnel or sociable. In telemedicine communication, the lack of social presence will lead to uncertainty of whether the efforts being made on adapting technology issues or the consultation work itself.

**H3: Individual perception of social presence will be negatively related to perceived role ambiguity.**
3.2.2. Usability Feature

Usability characteristics are derived from the well-established ICT adoption and use literature (Moore & Benbasat, 1991; DeLone & McLean, 1992). We keep consistent with the constructs which related to techno stressors: usefulness, complexity and reliability. Usefulness means “the degree to which characteristics of technology enhance job performance”; Complexity means “the degree to which use of technology is free of effort”; Reliability means “the degree to which features and capabilities provided the technology are dependable.” Similarly as other technology innovations, users will be likely to adopt the new method if they find telemedicine system useful, less complex, and reliable. On the other hand, problems occurs if telemedicine system cannot achieve good results, the design of which is complicated and not user-friendly, or often loose signals during connection or even crush down. All of these factors can trigger negative feelings which in turn become techno stressors.

**H4:** Individual perception of technology usefulness will be negatively related to perceived work overload.

**H5a:** Individual perception of technology complexity will be positively related to perceived role ambiguity.

**H5b:** Individual perception of technology complexity will be positively related to perceived work overload.

**H6:** Individual perception of technology reliability will be negatively related to perceived work overload.

3.3. Control Variables

To capture the individual characteristic variance, we collect relevant information: age, gender, and educational level for control. In addition to capture cognitive tendency within personal characteristic, we adopt the construct of negative affectivity (NA) from (Ayyagari et al., 2011). The original definition of NA is the “tendency to experience negative emotional states and low self-esteem” (Watson and Clark 1984).

To capture the different degree of usage, we choose use frequency. Heavily users and occasional users can experience difference in terms of both advantage and disadvantage outcomes of technology, so it is necessary to measure to what extend telemedicine function is being used.
4. Research Method

In the current research, the proposed model aims to reveal the antecedents of technostress by explaining the relationship between telecommunication technology characteristic and technostressors. Surveys will be designed and distributed to healthcare workers who have real-time telemedicine consultation experience. Based on the theoretical lens of P-T model, the survey questionnaires are self-reported to reflect participants’ perception of misfit between technology features and their work requirement. We adapt as much as the existing instruments being verified and develop two constructs, “transmission support” and “symbol set support” based on the original theory and concept of MST (Dennis et al., 2008).

All measures used a seven-point Likert scale on the degree of agreement. Three constructs under usability feature are measured by classic instruments of usability, complexity and reliability (Moore & Benbasat, 1991; DeLone & McLean, 1992). The measurements of transmission support and symbol set support are derived from MST and modified in our research context (Dennis et al., 2008). Three items are selected to measure social presence from (Kettinger & Grover, 1997) and measurement of work load and role ambiguity are adapted from (Moore, 2000). The constructs and items are listed in Table 3.

We plan to distribute our surveys to hospitals in different levels from different regions in China. The paper-based surveys will be distributed in their working institutions. The participation is voluntary. The structural equation modeling (SEM) technique, AMOS, will be used for both structure and measurement model analysis. Reliability, which refers to consistency of measurement, will be examined by composite
reliability (CR) and average variance extracted (AVE) (Fornell & Larcker, 1981). Convergent validity will be confirmed through factor loadings and discriminant validity will be assessed by the square root of average variance extracted (AVE). The model fit indices will be also checked (Gefen et al., October 2000).

5. Conclusion

In the current study, we propose the specific technostress model to explain the relationship between telemedicine communication technology characteristics and corresponding technostressors. Instead of treating IT artifact as a black box, we examine its features and impacts. Theoretically, our study is expected to enrich the knowledge by extending the framework from general ICT and to specific category of technology and revealing the underlying logic in between. The study is also potentially useful to provide practical implications for healthcare practitioners in terms reducing occupational stress.

Reference


