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Introducing Quality of Access Continuity: The Positive and Negative Effects of a Technology Affordance

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Research-in-Progress

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Abstract

Mobile devices offer technology affordances that were not previously available. With the rapid acceptance of these technologies it is imperative to understand and investigate both their positive and negative effects on individuals. In this ongoing research we have conceptualized an affordance of mobile devices in order to examine these positive and negative effects. Quality of Access Continuity is a 1st-order reflective, 2nd-order formative construct which is defined as the degree to which an employee or individual perceives they have a secure, continuous, usable, and reliable connection to the Internet or an intranet using a mobile device thus affording them the opportunity to accomplish tasks. The four components of this construct are discussed and the construct is then placed within a conceptual model which we hypothesize will show the duality of this affordance in regard to its effects on an individual's strain.

Keywords: technology affordances, mobile device, access continuity, strain

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Introduction & Motivation

Information and Communication Technologies (ICTs) are increasingly encroaching into daily life and are becoming the standard form of communication among peers. Pew Research Center reports that in 2012, 55% of adult smart phone owners used their device to go online. This is a substantial increase from the 31% who reported doing so in 2009 (Smith 2012). The current literature (e.g., technostress) finds that ICTs, including mobile devices, tend to increase stress, leading to an increase in perceived strain (Ayyagari et al. 2011).

A recent Gallup poll found a dichotomy in the use of mobile devices; heavier users report increased stress yet they rate their lives as being better (Witters and Liu 2014). This is an interesting phenomenon that is worthy of further investigation. It provides compelling evidence that mobile devices not only increase stress levels, but also have the potential to positively enrich our lives. This duality may become increasingly salient with increased use. We believe this phenomenon requires exploration in order to develop an understanding of how mobile devices are effecting our stress levels and hence our overall health.

A full 64% of smart phone Internet users reported they primarily go online with their smart phone because of its "always available nature," 18% state it better fits their habits and 10% state they use it to fill "access gaps" (Smith 2012). In this study we begin the journey of exploring ways to approach what may be a growing problem–stress due to always being available. The current research develops a new affordance**,** Quality of Access Continuity (QAC)**,** and proposes that while it may increase personal stressors, it may also have a moderating effect that is believed to alleviate the cognitive load created by an individual's job demands. We study the effects of job knowledge characteristics specifically because it includes components that have been shown to vary with an individual's information processing ability (Hollands and Wickens 1999).

The rest of this paper will proceed as follows: first we discuss the two theoretical lenses through which we develop our conceptual model (information processing theory and affordances), we will then describe the affordance of QAC and the dimensions that form it. This will be followed by development of our conceptual model, hypotheses and proposed methodology. Our concluding discussion section will include implications for practice and research.

Literature Review

Information Processing Theory

Information processing in the context of Miller (1956) is grounded in psychology and cognitive theory. In its most simplistic form it views the human mind as a computer, as proposed years later by(Lachman et al. 1979). It brings to the forefront the concepts of sensory memory, short term memory, and long term memory. In brief, it traces a path of information processing through cognition and different load levels on each of the areas of the model. Sensory memory is a short lived buffer of information taken in by the senses (e.g., hearing an alert from a mobile device). This alert can be disregarded or moved forward to short term memory for further processing. The actual meaning of the alert (i.e., you need to tend to something on your mobile device) is stored in long term memory. Short and long term memories work together to process information and make decisions (Hollands and Wickens 1999).

Humans have only a finite capacity in terms of information processing. Miller (1956) shows this to be 7 plus or minus 2 items. In today's increasingly connected and complex world, we are required to process increasing amounts of information which may lead to information overload. This occurs when the information processing demands on time to perform interactions and internal calculations exceed the

supply or capacity of time available for such processing (Schick et al. 1990). When demand exceeds capacity, overload occurs. Information processing theory establishes the link from information overload to strain.

Technology Affordances

Gibson (1977) coined the term affordances for use in ecology to help us understand how an animal perceives what is afforded to it by its environment. For purposes of this research the "animal" is a person. The term affordance was first brought into the Human Computer Interaction (HCI) vocabulary when Norman (1988) defined affordances as "the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used. A chair affords ('is for') support and, therefore, affords sitting. A chair can also be carried."

For Gibson, the affordance exists independent of whether or not it is perceived; it is an inherent attribute of the "thing" itself (Kaptelinin and Nardi 2012; McGrenere and Ho 2000). For Gibson the affordance is also independent of the person's culture or experience, it either exists or it does not exist (McGrenere and Ho 2000). This view poses a limitation for its utility in technology related research (Kaptelinin and Nardi 2012) as our individual culture and experiences will influence our view of an affordance, how that affordance is utilized and even whether or not the affordance is perceived.

Norman recognizes that an affordance is not independent of an individual's culture and experience and states that "suggestions or clues as to how to use the properties" are an affordance(McGrenere and Ho 2000). In information systems, "clues" as to how to utilize the technology are exceptionally important (e.g., the diskette as a clue that clicking the icon will save your electronic work). We utilize Norman's view of affordances. While we adopt Norman's view it should be recognized that technology affordances are a special case in that they are changing and adaptable by interaction with a human (i.e., we can change the affordance of the technology by changing the functionality of our F7 key). Hence we take Norman's view one step further to apply it specifically to technology and incorporate the definition of affordances as defined by Majchrzak and Markus (2012) as "an action potential, that is, to what an individual or organization with a particular purpose can do with a technology or information system". For us, how the individual utilizes the affordance, their action potential with that affordance, may have an effect on the strain outcome. This definition fits nicely with the affordances terminology conceptualized by Hartson (2003) which we adopt for this research. Due to space limitation we refer you to the article for a detailed discussion on his terminology which breaks down affordances into cognitive, physical, functional, and sensory aspects.

Specifically for our conceptualization of the new construct QAC we classify it and each of the affordances that form it as per Hartson's terminology. This is a brief introduction to the affordances in our model with an in depth discussion to follow.

A functional affordance is a "higher level user enablement in the work domain." In other words what is actually being done. We believe QAC is a functional affordance as it affords continuous access via its component affordances. A physical affordance is defined as "a design feature that helps, aids, supports, facilitates, or enables doing something." We believe both perceived ubiquity and perceived usability to be physical affordances. Both of these affordances are highly dependent on design features that enable tasks to be performed regardless of geographic location. Is the mobile device designed to be lightweight and portable? Is the screen size appropriate for the tasks the individual wishes to perform? A cognitive affordance is defined as "a design feature that helps, aids, supports, facilitates, or enables thinking and/or knowing about something." We believe perceived security to be a cognitive affordance. As per the diskette example earlier seeing the "lock" when connected to an intranet via a virtual private network or on a web site affords knowing the connection is secure. A sensory affordance is defined as "a design feature that helps, aids, supports, facilitates, or enables the user in sensing something." Furthermore this type of affordance plays a "supporting role" for the other types. We believe perceived reliability to be a sensory affordance. If an individual does not perceive they have a reliable connection (i.e., the connection is regularly "dropped") they may not believe they have the ability to accomplish tasks or to even connect to the Internet or an intranet regardless of time or geographic location; all key elements of the QAC construct which will be discussed in the following section.

Access Continuity: A Multidimensional Affordance of Mobile Devices

To develop our construct of QAC, we identified four 1st-order reflective affordances which form the 2nd-order affordance QAC thus making QAC a 1st-order reflective, 2nd-order formative construct (Polites et al. 2012). The 1st-order affordances identified are Perceived Security, Perceived Ubiquity, Perceived Usability, and Perceived Reliability (Figure 1).

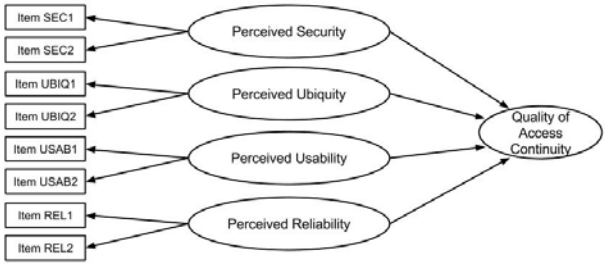

Figure 1: Quality of Access Continuity: 1st-order reflective, 2nd-order formative

Quality of Access Continuity

Quality of Access Continuity (QAC) is defined as the degree to which an employee or individual perceives they have a secure, continuous, usable, and reliable connection to the Internet or an intranet using a mobile device thus affording them the opportunity to accomplish tasks. With the statistics presented in the Introduction & Motivation section, we can see that understanding the nature of QAC and the constructs that form it allows us to analyze the effects this affordance will have (see Conceptual Model and Hypothesis Development below). After exploring these effects, we can determine how to adequately utilize the affordance. Specific for this study, we plan to define and develop measures for the four aspects that create QAC: perceived ubiquity, perceived security, perceived reliability, and perceived usability. Since these constructs collectively conceptualize QAC, it is a formative construct. Below is a brief description of each of these four aspects of QAC.

Perceived Ubiquity

Perceived Ubiquity is defined as the degree to which an employee or individual feels they can access the Internet or an intranet regardless of time, geographic location, or context using a mobile device. This definition was modified from the definition of mobility provided byRoggenkamp (2004). By their very nature, mobile devices afford the ability to access the Internet or an intranet while changing geographic locations. This is done through wireless communication technologies that are not restricted by the physical limitations of wires. Mobile devices are built to be lightweight and less of a burden to carry while moving. As a result of the ability to move and maintain access mobile devices are not constrained by time restrictions that other devices may impose (i.e., access can be obtained without regard to time of day). This availability strengthens the continuous connection of the QAC construct.

Perceived Security

Perceived Security is defined as the degree to which an employee or individual perceives their access to the Internet or an intranet on a mobile device is free from risk and danger. In the context of QAC this is critical to its formation. Given a job and workplace, security is required to communicate both at the workplace and in a mobile setting. Without security, it is unlikely that an individual would be authorized to utilize a mobile device for work related tasks other than those dealing with publicly available information and published items.

Perceived Usability

Perceived Usability is defined as the degree to which an employee or individual perceives their mobile device is attractive to complete a job-related task with regard to screen size, speed, functionality, and ease

of access (adapted from Bevan (1995) and Hornbæk and Law (2007)). Many aspects of a device can be used when an individual makes the decision to use it for work related functions. For example, if a task requires the processing of lots of visual elements, the screen size of mobile device may not be adequate; conversely, for a simple scanning and reacting task, the screen size limitations may not cause an issue. If the mobile device does not contain what the user believes to be adequate usability, he or she may refrain from utilizing it. On the other hand, if the device can be used for more tasks, QAC would be strengthened.

Perceived Reliability

Perceived reliability is defined as the degree to which an employee or individual perceives their access to the Internet or an intranet to be available without interruption using a mobile device. If an individual does not believe their device will allow reliable access, they will have a reduced perception of the quality of access continuity. QAC not only deals with the continuous connection (i.e., perceived ubiquity), but also with the reliability and consistency of that connection. Perceived reliability captures this aspect of QAC.

Conceptual Model and Hypothesis Development

The conceptual model is shown in Figure 2. In brief, Job Knowledge Characteristics (JKCs) will place differing cognitive demands on individuals. The higher the cognitive demands, the more likelihood that information overload will occur; however, the affordance of QAC may moderate this relationship and reduce the expected information overload. The link from information overload to strain is well established (Bawden and Robinson 2009), as is the link between stressors and strain (Ayyagari et al. 2011) and are included in our model for illustrative purposes. While QAC may moderate the relationship between JKCs to decrease information overload it may increase stress through a variety of existing stressors (e.g., work-home conflict). This increase in stressors would lead to an increase in strain.

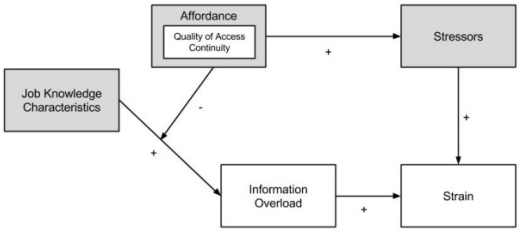

Figure 2: Conceptual Model

Job Knowledge Characteristics

JKCs include the types of knowledge, skills, and ability demands that an individual faces as a result of their job (Morgeson and Humphrey 2006). Directly included as a characteristic is information processing. If JKCs increase information processing, then information overload will also increase. The more knowledge required to carry out the duties of a job, the more items a person is likely required to store in their limited short term memory (see Information Processing Theory).

H1: Increasing levels of Job Knowledge Characteristics will increase Information Overload.

Quality of Access Continuity

Current literature indicates our vastly increasing mobility, with easy access to information, may lead to differing effects on information overload (Allen and Shoard 2005; Edmunds and Morris 2000). Allen and Shoard (2005) did a study on senior managers who were provided with Blackberry's which were "always on" (QAC). They found mixed results regarding "QAC" and its effect on information overload; some participants felt they could handle the vast amount of information while most participants felt overloaded. E-mail was the most cited source of overload. Interestingly, for those reporting not feeling overloaded, a common theme was the ability to determine when to respond to messages; the ability to answer some immediately and to "think on" others. It is commonly known that temporal distance has a central role in

information overload and hence stress (Keinan 1987; Perlow et al. 2002), so the ability to be able to respond to some emails immediately and to "think on" others may be an additional mechanism by which QAC may alleviate the existing effects of JKCs on information overload.

H2: Quality of Access Continuity will negatively moderate the existing positive relationship between Job Knowledge Characteristics and Information Overload.

While H2 shows how QAC can alleviate some pressures caused by JKCs, it's also possible that mobile devices themselves may cause stress in an individual. For purposes of this paper we define perceived stress as an imbalance arising from an individual's perception that an environmental demand exceeds his or her available capabilities and resources (Shirom 1982). Note that the definition specifically states "an individual's perception" thus it is not any specific event, or objective number of events that cause stress, but rather the individuals perception of that event and their ability to cope with it.

Ayyagari et al. (2011) specifically studied the stress and strain that are caused by the utilization of ICTs. This advancement brought stress into the 21st century by examining the antecedents and implications of the constant need to utilize ICTs in order to accomplish work. So whereas ICTs have allowed for an ever increasing amount of productivity due to increased capabilities, there are downsides to constant connectivity which they discuss and speak of as technostress.

H3: Quality of Access Continuity will positively affect existing stressors.

With mobile devices becoming an almost unavoidable omnipresent reality, technostress poses a problem that arguably won't go away. In this study, we hope to show that although certain omnipresent characteristics of these devices can cause stress, there exists an attainable balance that can be used to offset the negative impact of ICTs. We propose that the technology affordances of mobile devices can help in identifying and creating this type of balance.

Methodology

This research will be conducted via standard survey methodology. When available, previously validated measures will be utilized. For the original constructs being developed (i.e., QAC and its related constructs) in this research, we will closely follow the methodology for instrument development recently published by MacKenzie et al. (2011). Once a fully validated instrument is created we will utilize a panel survey of full time working professionals who are required to utilize a mobile device to accomplish work related tasks. The SmartPLS software package will be utilized for data analysis due to its recognized ability to better handle formative constructs (Hair Jr et al. 2013).

Discussion

Current research (i.e., technostress) tends to focus on the negative aspects of a technology saturated environment, the so called "dark side." We hope to show that by the use of affordances there may also be positive aspects–a bright side so to speak. Should this research show that ICTs can reduce information overload and stress, future research can focus on conceptualizing, developing, and understanding additional affordances and how they can best be used to reduce stress. With a fuller understanding of the mechanisms by which mobile technology may induce information overload, and hence stress, in combination with understanding potential remedies to reduce stress this research will allow the research community to make recommendations to practice in regard to mobile technology usage.

This research also contributes the theoretical development of a new construct, QAC, which is playing an ever increasing role in modern society via the use of mobile devices. This, coupled with the speed at which technology advances, make this study particularly relevant now and for the foreseeable future. Using QAC as a lens through which to study both technology affordances and stress provides a useful framework for studying both the technology artifact and human interaction with the artifact.

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