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The moderating role of prior experience in technological acceptance models for ubiquitous computing services in urban environments

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ABSTRACT

Ubiquitous computing services constitute a new information technology that can be used in thousands of potential applications and environments. Ubiquitous computing is also changing the classic paradigm of information technology as it is forcing social and cultural changes. Determining factors affecting the use of ubiquitous services is essential to correctly define the characteristics of new value added services. However, this study investigates not only these factors, but also the moderating effect of previous experience. Due to the technological nature of ubiquitous services, previous experience alters the way in which potential users face these services. Findings suggest that previous experience changes the way in which antecedent relates to basic TAM constructs. The derived research models and empirical results also provide valuable indicators for future research and managerial guidelines for the successful adoption of ubiquitous computing services.

1. Introduction

Ubiquitous computing is an emergent computing paradigm that improves quality of life and enriches human civilization by integrating computers, humans and objects [1,2]. It is a new vision in which computers will be embedded in our natural movements and interactions with our environments — both physical and social, helping to organize and mediate social interactions wherever and whenever these situations might occur [3]. Since ubiquitous computing was first conceptualized by Weiser of the Xerox Palo Alto Research Center [2], it has become a leading trend in information technologies and systems. The rapid diffusion of ubiquitous computing has been accelerated by the quick advances in smart technologies like wireless communication technologies, sensors for determining locations, automatic identification technologies, and flexible software architectures [4–6].

The emergence of ubiquitous computing provides a rich and exciting opportunity for future research [7]. First, ubiquitous computing is currently in an early stage of development. Therefore, it entails studying something that it is not completely developed. Researchers in this field are still "dreaming" and "creating problems" as much as they are solving problems and recording and theorizing about effects. Research in ubiquitous computing requires transcending the traditional barriers between social and technical as well as levels of analysis—individual, team, and organizational [7]. As technology becomes more embedded and integrated with mobility, the barriers between social and technical aspects become blurred. A paradoxical outcome of ubiquitous computing is that it is simultaneously very personal and extremely global. Thus, a complete understanding of its impacts cannot be gained at a single level of analysis [7,8].

The shift toward ubiquitous computing poses multiple novel technical, social, and organizational challenges. At the technology level, there are several unresolved technical issues concerning the design and implementation of computing architectures that enable dynamic configuration

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of ubiquitous services on a large scale. New challenges will also emerge in terms of how one should design and develop ubiquitous services. Unexplored challenges will also emerge at the border between the technical and the social: some issues are to be left outside the technical implementation to be addressed by social negotiation and due process; other issues should be addressed during technical design.

Despite its widespread use, there are few studies related to the use of ubiquitous computing. In [9], authors make use of extended technology acceptance model (TAM) introducing the concept of convenience. In this paper, TAM is extended considering several other constructs and measuring previous experience with wireless LAN, although it is not incorporated as a moderating variable. Kim et al. [10] have investigated the factors that influence the use of ubiquitous computing and U-business value, considering system, information and service qualities as the major factors affecting the use of ubiquitous computing. In general, most of the studies related to technology acceptance of ubiquitous computing applications are focused on incorporating additional variables and considering specific applications. For instance, acceptance of mobile commerce has been studied incorporating constructs like trust, cost, social influence and variety of services [11,12]. Mobile payment has been considered in [13], obtaining a strong support for the effects of compatibility, individual mobility, and subjective norm.

This study is mainly focused on studying the moderating role of experience on the intention of using ubiquitous technology. Although non-adopter do not have a prior experience using this kind of applications, they are known in the sense that they have seen how other people make use of ubiquitous computing applications like GPS or public transport information. Therefore, they do not have a direct experience using ubiquitous computing applications, but they know the possibilities they can provide. The paper tries to investigate about the differences of experienced and non-experienced users with respect to the intention of using an emergent technology.

The rest of the paper is organized as follows: Section 2 reviews previous literature on ubiquitous computing. Section 3 presents a research model and hypotheses. Research methods and data analysis are described in Section 4. Section 5 includes model testing and empirical results. The final section discusses research findings and implications.

2. Ubiquitous computing overview

Radical improvements in microprocessor cost-performance ratios have pushed computing process forward while drastically reducing computing-device form factors, enabling us to embed computers in many parts of our environments [14]. In 40 years this change has transformed the early large "computing machines" into compact devices that enable, mediate, support, and organize our daily activities [3]. Ubiquitous computing considers a vision of people and environments, augmented by computational resources, which could provide information and services anytime, anywhere, with any computer devices [15]. This evolution has recently been accelerated by improved wireless telecommunication capabilities, open networks, continued increases in computing power, improved battery technology, and the emergence of flexible software architectures [3].

One of the primary technologies in ubiquitous computing is context-aware computing, which consists of the automatic acquisition of sensible context surrounding users, providing information or services on users' behalf [15]. In the context-aware computing area, context is any data that can be sensed by computer devices and is deliverable by sensor networks [15,16]. Mobile and pervasive computing are terms that derive from context-aware computing. Although both terms are often used interchangeably, they are conceptually different. Mobile computing is fundamentally about increasing our capability to physically move computing services with us. As a result, the computer becomes an ever-present device that expands our capabilities to inscribe, remember, communicate, and reason independently of the device's location [3]. The main limitation of mobile computing is the availability of information as we move.

Pervasive computing is about making our lives simpler through digital environments that are sensitive, adaptive, and responsive to human needs. Far more than mobile computing, this technology will fundamentally change the nature of computing, allowing most objects we encounter in daily life to be "aware," interacting with users in both the physical and virtual worlds [8]. This concept implies that the computer has the capability to obtain the information from the environment in which it is embedded and utilize it to dynamically build models of computing of specific environments into dedicated computers or, more generally, by building generic capabilities into computers to inquire, detect, explore, and dynamically build models of their environments. The process is reciprocal: the environment can and should also become "intelligent" in that it also has a capability to detect other computing devices entering it. This mutual dependency and interaction result in a new capacity of computers to act "intelligently" upon and within the environments in which we move. This is the very idea of pervasive computing, an area populated with sensors, pads, badges, and virtual or physical models of the physical and social/cognitive environments.

Ubiquitous computing represents an ideal mixture of mobile and pervasive computing, including both the high mobility of mobile computing and the high level of embeddedness of

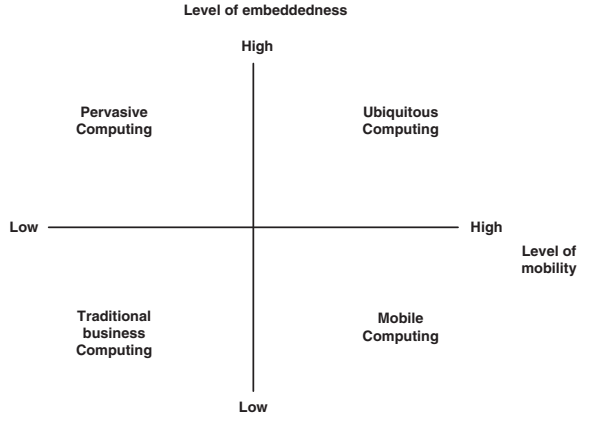

Fig. 1. Dimensions of ubiquitous computing.

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