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Response to potential information technology risk: Users' valuation of electromagnetic field from mobile phones

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ABSTRACT

As information technologies have become embedded in daily life, end-users encounter unexpected dangers from using IT. Electromagnetic field (EMF) risk from mobile phones is an example of those dangers. In this paper, we explore how much users value their tolerance of EMF risk by scrutinizing their preference structure of mobile phone devices. The preference structure was generated from conjoint analysis including three attributes of mobile phone devices: brand, price, and electromagnetic emission. In addition, we examined four groups which were clustered based upon their preference structure. Results show that the risk is differently perceived by user clusters and approximately 80% of respondents are likely to change their mobile phone brands for better protection from EMF risk.

1. Introduction

Despite tremendous benefits from the use of information technology (IT), it has been reported that IT may lead to various types of unexpected negative outcomes. Online privacy has been extensively studied as a main topic related to IT risk (Debatin et al., 2009; Dinev and Hart, 2006; Dritsas et al., 2006; Hui et al., 2006). Given that IT designates a technology for information production and management, it is certain that online privacy associated with unintended disclosure of digital personal information is a primary risk from IT use. Personal risks derived from IT use, however, are not limited to online privacy threats, and can be extended to other kinds of risks: for example, addiction to Internet use (Kim and Haridakis, 2009), mobile phone addiction (Balakrishnan and Raj, 2012), technostress (Ayyagari et al., 2011), and computer eye strain (Blehm et al., 2005). A recent example is that mobile phones intrude into private lives, blurring the border between the work and the private spheres (Prasopoulou et al., 2006). Considering that risk is defined as the extent of uncertainty of disappointing outcomes (Sitkin and Pablo, 1992), the range of IT risk can be widened. The cases described above are undesirable consequences in using IT, and thus, we assume that they can be a kind of IT risk.

In this paper, from the individual user's view, we explore the electromagnetic field (EMF) of mobile phone devices, which can be considered an emerging IT risk. Even though mobile phones can be regarded as a celebrated contemporary IT, there has been a continuous debate on whether the EMF emitted from mobile phone devices is harmful to human health. If the damaging effects of EMF really exist, it could be extremely hazardous, because mobile phones have become embedded in everyday life. To reduce the potential risk, regulations for protecting mobile phone users from the threat have been established in some countries (McKinley, 2010). The issue of EMF risk, however, is not publicized or institutionalized in other

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countries. In the controversial situation, it is valuable to explore how users understand and respond to the threat. According to the social construction of risk (Douglas and Wildavsky, 1982), the decision on whether risk is real reflects stakeholders' opinions or values, rather than objective facts depending on scientific proof. Users' understanding of the risk of mobile phone electromagnetic radiation, therefore, is fundamental information on social acceptance of the risk, and further provides mobile phone vendors and service providers with a direction for coping with the issue of EMF risk.

For a better understanding of users' response to the potential threat from mobile phones, this study examines how much users valuate electromagnetic field risk from mobile phone devices. More specifically, the influence of the risk on the choice of mobile phone devices is explored in comparison with the impact of brand and price, which are regarded as the most significant factors in consumers' decision making (Brucks et al., 2000; Dodds et al., 1991). Users might tolerate online privacy risk for gains from using the Internet (Dinev and Hart, 2006), and consumers might accept product risks in order to reap benefits from using the product (Dowling and Staelin, 1994). In the same vein, mobile phone users might also bear EMF risk from mobile phones for some benefits. In this paper, we explore user' valuation of EMF risk by using conjoint analysis, which is a prevalent approach to measuring consumer trade-offs in using products or services (Green and Srinivasan, 1990). The analysis assumes that by analyzing respondents' ranking or rating of choices combining product attributes, we can understand their preferences for the product. In the context of the current paper, we develop a set of alternatives, including electromagnetic emission rate, and two attributes of mobile phone devices (mobile phone price and brand), which are regarded as critical factors when consumers choose a mobile phone device (Karjaluoto et al., 2005; Liu, 2002). By providing information about the relative importance of these attributes, the analysis enables us to understand users' assessment of the EMF risk of mobile phones in comparison to the other attributes. We then classify users into clusters based on the structure of their preferences of alternatives, and compare them for a richer analysis on users' understandings of mobile phones' EMF.

2. Theoretical background

2.1. Personal acceptability of risk

Individuals' tolerance of risk in exchange for merits has been widely used to investigate individual risk perception. Starr (1969) empirically examined that personal acceptability of risk of a technology is proportional to the degree of benefits generated by the technology, and Lowrance (1976) revealed that the benefit/risk ratio is one of the factors influencing the acceptability of risk. Online privacy has been a dominant topic in research regarding individual-level IT risk, and cost-benefit models are commonly used to explicate users' coping with online privacy risk. Despite recognizing the possibility of unintentional disclosure of their personal information, users may willingly reveal it in online stores or social network sites. The online disclosure of personal information has been widely explained from the perspective of rational behavior driven by cost-benefit evaluations (Dinev and Hart, 2006; Hui et al., 2006). Users may think of monetary rewards or convenience as the return for the exposure of personal information on the Internet (Hann et al., 2007). They may also regard intrinsic rewards, such as cognitive attraction to Internet interactions, as a benefit in return for the exposure (Dinev and Hart, 2006).

Individuals' tolerance of risk has been applied to explain consumer behavior towards product or service risks. By stating that a product could not be absolutely free of risk, Bauer (1960) posited the risk-taking aspect of consuming behavior. Since his work, the influence of perceived risk on consumer decisions has been extensively examined in empirical consumer research (Morris et al., 1994). Those studies assume that a consumer has a certain acceptable level of risk in choosing and using a product, and their choice of a product, thus, is affected by the level of perceived risk (Dowling, 1986). Many studies focus on dimensions of risk perception, its measurement, or an effect of risk perception on consumer choice (e.g., Dowling and Staelin, 1994; Morris et al., 1994); some studies explicitly examine consumers' perception of risk in comparison with their perception of product benefits. For example, Rethans and Albaum (1981) demonstrated that perceived necessity of product has the highest correlation with risk acceptability, implying that the more necessary the product is perceived to be, the more likely the consumer is to accept the product risk.

Similarly with prior research on IT risk and consumer risk, it is expected that users' perception of EMF risk from mobile phone devices has an influence on their choice of devices, and further, its influence might be changed according to the rewards for accepting the risk.

2.2. Debate on threat of electromagnetic field from mobile phones

Even though scientific experiments on the harmfulness of EMF from mobile phones have been actively conducted in the 2000s, consistent results have not been obtained. Results of early studies showed that use of mobile phones is not associated with an increased risk of brain cancer or central nervous system symptoms (Muscat et al., 2000; Chia et al., 2000). The American Food and Drug Administration (FDA) also announced that the negative effects of EMF were not found in an experiment with individuals who had used mobile phones over three years (FDA, 2003). Some scientists, however, posited that the FDA's experiment had limitations, because the effect of mobile-phone EMF on users' health could occur over a longer period (Environmental Working Group, 2009). For instance, it was reported that use of mobile phones for more than 10 years could increase risk for acoustic neuroma and glioma (Hardell et al., 2007). Although recent research with long-term users, which was led by the World Health Organization (WHO), did not find any evidence to prove that EMF from mobile phones causes