

Mobile Commerce Usage: Application of Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM)

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Mobile commerce (m-commerce) has witnessed significant growth in the last few years. As every business is aspiring to boost their online sales and get a bigger share of the mobile commerce market, the question that needs examination is “what are the factors influencing the usage of mobile commerce”? A literature review revealed that although there are numerous studies relating to various aspects of mobile services, there seems to be a lack of research on the usage of mobile commerce transaction services. This paper contributes to research through the development of a theoretical model that identifies the determinants of m-commerce transaction services usage. A theoretical model has been developed by drawing upon some of the constructs from the Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM). The “Determinants of M-Commerce Transaction Services Usage (MTSU) Model” developed in this paper seeks to identify the factors that influence the usage of mobile commerce transaction services specifically.

Field of Research: E-Commerce and Management Science

1. Introduction

M-commerce (Mobile Commerce) has been defined as “the use of mobile (handheld) devices to communicate and conduct transactions through public and private networks” (Balasubramanian, Peterson & Jarvenpaa 2002, p.349). Mobile devices include hand-phones, personal digital assistants (PDAs), hand-held or palm-sized computers, and laptops (Siau, Lim & Shen 2001; Lim & Siau 2001). A review of the literature shows that research on m-commerce from a behavioral perspective spans the spectrum from the application of theories of diffusion (Kauffman & Techatassanasoontorn 2005) and technology acceptance models (TAM) and theory of planned behavior (Pedersen 2005), to studying the impact of cultural elements such as collectivism, individualism, and power distance (Harris, Rettie & Kwan 2005), to trust building models (Siau & Shen 2003; Stewart, Spencer & Melby 2006).

But there seems to be a lack of research on the factors influencing the usage of m-commerce transaction services. Therefore, this study seeks to fill the gap in literature and thereby make a significant contribution by examining the research question, “what are the factors influencing the usage of mobile commerce”?

Guy Singh (2000) had estimated that the global mobile commerce market would be worth US\$200 billion by 2004 (Siau, Lim & Shen 2001). According to Informa, there were 1.8 billion cell phone users in the world in 2005 and countries like Italy, UK, Sweden and Hong Kong had already exceeded 100% market penetration. Forrester Research had estimated that by 2007, there would be an average of 2.2 wireless phones per U.S. household (Magura 2003).

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It should be noted that the research reported here from Forrester and Informa only mentions the statistics for mobile phones. If all other mobile devices are considered, then we could be looking at a humongous number of users of mobile devices, which would offer a huge potential for m-commerce. An example in this regard is the 1 million pounds donated via SMS in the U.K on January 17, 2005 to the relief fund for the December 2004 Asian tsunami (Harris, Rettie & Kwan 2005). Although, some people define m-commerce as any kind of mobile communication with the customer, there are others who associate m-commerce with some kind of monetary gain (Frolick & Chen 2004). In this research, only m-commerce “transaction” services would be studied. By “transaction”, it is implied that a business transaction with a monetary gain is involved. In other words, only the factors that influence the usage of transaction m-commerce services would be studied.

While earlier studies focused on the behavioral aspects of mobile services in general, this paper departs from the previous research by focusing specifically on determining the factors that influence m-commerce transaction services usage. The main contribution of this paper is the theoretical development of a model that identifies the determinants of m-commerce transaction services usage.

In the following literature review section, m-commerce is defined, behavioral-oriented research on m-commerce is discussed, and the theoretical foundation for the variables used in the research model is presented. In the methodology section, model development and propositions are presented. The findings section describes the model and also the salient conclusion drawn from the findings of the literature review. The summary and conclusion section reiterates the significance of this research, followed by a discussion of the study's limitations and direction of future research.

2. Literature Review

2.1 Mobile Commerce: Defined

M-commerce has been defined in different ways and there have been attempts to categorize the m-commerce services based on different criteria. Mobile commerce or m-commerce is defined as e-commerce activities conducted through mobile devices (Siau, Lim & Shen 2001; Lee & Benbasat 2003). In general, it is widely agreed upon that m-commerce is “the use of mobile (handheld) devices to communicate and conduct transactions through public and private networks” (Balasubramanian, Peterson & Jarvenpaa 2002, p.349). According to some however, m-commerce isn't just communication, but is associated with activities that lead to monetary gain (Frolick & Chen 2004). M-commerce has been defined by Muller-Veerse (1999) as “any monetary transaction conducted via a mobile telecommunications network” (Rask & Dholakia 2001).

A review of the literature revealed two attempts to categorize m-commerce services. M-commerce applications have been categorized along the three dimensions of sensitivity to location, time, and extent of control by the user or the network (Balasubramanian et al 2002). In their cross-cultural study on the adoption and usage of m-commerce, Harris, Rettie, and Kwan (2005), have summarized the adoption rates of different m-commerce services into the following four categories.

- (1) Communication services: Voice, SMS, MMS, Video, and E-mail.
- (2) Transaction services: Ticket purchase, small payment, banking services, lotto/betting/gambling.

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- (3) Information services: Entertainment news, sports news, headline news, traffic news, weather forecast, local map, and local area information.
- (4) Entertainment services: Download game, download ringtone, download wallpaper/screensaver, and browse internet.

M-commerce services could be any or all of the above four categories of services or as suggested by Balasubramanian et al. (2002), they could be categorized along the dimensions of sensitivity to time, location, and extent of control by the user or the network. But for the purpose of this study, m-commerce will be considered strictly in the monetary transaction service sense, i.e., monetary transactions made over mobile devices. The ability to buy and sell goods/services over mobile devices (Maamar 2003), is the mantra of m-commerce and therefore, in this study the factors that influence the usage of only m-commerce “transaction” services will be studied.

2.2 Application of Theoretical Models to M-Commerce

Technology acceptance model (TAM) and its variants and diffusion of innovations are two of the major theoretical perspectives that have been applied to research on m-commerce. The differences in constructs and the relationships posited notwithstanding, all these models seem to agree that “individual’s beliefs about or perceptions of IT have a significant influence on usage behavior” (Agarwal & Karahanna 2000, p.666). Now these two theoretical perspectives will be briefly described, followed by a discussion of their application in m-commerce research.

The essence of innovation diffusion studies lies in the research question, “what determines the rate, pattern, and extent of diffusion of an innovation across a population of potential adopters?” (Fichman 2000, p.106). Rogers (1995) explained the adoption behavior using the characteristics of the technology that was introduced (Pedersen, 2005). According to Rogers (1995), the diffusion process consists of the following four elements: an innovation or new technology, a social system, communication channels of the social system and time (Pederson 2005). Kauffman and Techatassanasoontorn (2005) believe that one approach to understand m-commerce diffusion is to study the diffusion of digital mobile devices. In their study of international diffusion of digital mobile technology, Kauffman and Techatassanasoontorn (2005) empirically tested the effects of country characteristics, the digital and analog mobile phone industry characteristics, and the regulatory policies on the diffusion rates of digital mobile phones across 46 developed and developing countries. Since the number of mobile phone users around the world has reached a huge proportion and countries like U.S have already reached the 100% market penetration rate (Informa 2005), the diffusion of mobile phones or for that matter diffusion of mobile devices might not hold the key explanation to the diffusion or adoption of m-commerce. Having a mobile device, does not necessarily indicate the adoption or usage of m-commerce, owning an m-commerce service enabled device might. Therefore, now a brief review of the theoretical perspective that uses the adoption approach is presented.

In the technology adoption theoretical stream, there are three models which are very popular and are widely used for explaining user behavior in terms of technology acceptance and usage. The theory of reasoned action (TRA) by Ajzen and Fishbein (1980) and Fishbein and Ajzen (1975) is used to study consciously intended behaviors (Davis, Bagozzi & Warshaw 1989). The three variables used in this model are behavioral intention to perform the behavior (BI), which is determined by the person’s attitude (A) and subjective norm (SN) concerning the behavior in question (Davis, Bagozzi & Warshaw 1989). Fishbein and Ajzen (1975) have defined subjective norm as “the person’s perception that most people who are

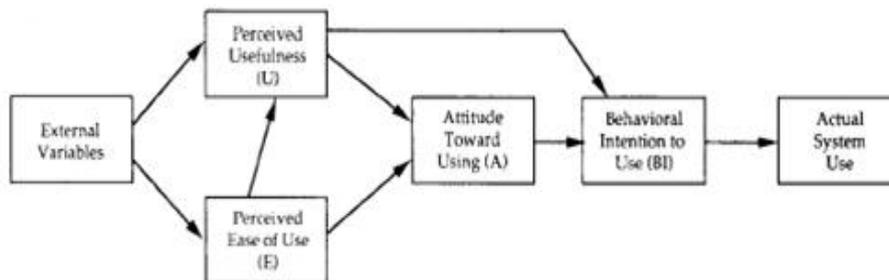
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important to him think he should or should not perform the behavior in question” (Venkatesh et al 2003, p.428). Ajzen’s (1985, 1991) theory of planned behavior (TPB) has been applied in various disciplines (Morris & Venkatesh 2000). Organizational psychologists have applied TPB to study adoption of new technologies (Morris & Venkatesh 2000; Mathieson 1991; Taylor & Todd 1995). The TPB is an extension of the theory of reasoned action (TRA) (Pedersen 2005). The additional variable in TPB is perceived behavioral control (PBC), which has been defined by Ajzen (1991) as “people’s perception of the ease or difficulty of performing the behavior of interest” (Morris & Venkatesh 2000, p. 377). Perceived behavioral control (PBC) refers to the constraints to technology usage (Taylor & Todd 1995), particularly the ease or difficulty of using the new technology (Morris & Venkatesh 2000).

Davis (1986) introduced TAM to model user acceptance of information systems (Davis, Bagozzi & Warshaw 1989). The main constructs of TAM will now be discussed, followed by a discussion of some research on m-commerce that has borrowed constructs from TAM. According to TAM, the two particular beliefs – perceived usefulness and perceived ease of use, are of the main relevance for computer acceptance behaviors (Davis, Bagozzi & Warshaw 1989). Perceived usefulness (U) is the prospective user’s subjective probability that using a specific application system will increase his or her job performance within an organizational context (Davis, Bagozzi & Warshaw, 1989). Perceived ease of use (EOU) is the “degree to which the prospective user expects the target system to be free of effort” (Davis, Bagozzi & Warshaw 1989, p.985). According to Davis, Bagozzi, and Warshaw (1989), TAM is represented by the following equations.

$$BI = A + U$$
$$A = U + EOU$$

Figure 1: Technology Acceptance Model (TAM)



Source: Davis, Bagozzi, and Warshaw (1989), p.985

According to TAM, computer usage is determined by behavioral intention (BI); and BI is viewed as being jointly determined by the person’s attitude toward using the system (A) and perceived usefulness (U), with relative weights estimated by regression (Davis, Bagozzi, & Warshaw, 1989). It is further postulated that attitude (A) is determined by perceived usefulness (U) and perceived ease of use (EOU), with relative weights statistically estimated by linear regression (Davis, Bagozzi & Warshaw 1989):

$$A = U + EOU.$$

Venkatesh and Davis (2000) included subjective norm as an additional predictor of intention under mandatory settings and thus, extended TAM into a model called TAM2 (Venkatesh et al 2003).

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Taylor and Todd (1995) proposed the decomposed theory of planned behavior (DTPB) (Agarwal 2000). In DTPB the attitudinal, normative, and control beliefs from TPB are decomposed into “multidimensional belief constructs that are generalizable across situations and not specialized to each context” (Agarwal 2000, p.89). The applications of some of these adoption models to the m-commerce research context will now be discussed.

Pedersen (2005) applied a modified version of the decomposed theory of planned behavior to the “adoption behavior of early adopters of mobile commerce services” (p.203). It was found that simple services such as direct downloads, search, and alert services were most commonly used and respondents indicated that payment and location based services could be interesting for the future (Pedersen 2005). Since this study was published a few years ago, a lot of changes could be expected regarding people’s perceptions and usage of ‘payment’ services, which can be termed as m-commerce transaction services. This indicates a need for research in this area, which hopefully will be fulfilled by this research.

Based on the type of interactivity (person/machine) and process characteristics (goal-directed/experiential), Nysveen, Pedersen, and Thorbjornsen (2005) classified mobile services into four categories: text messaging, contact, payment, and gaming. The TAM constructs of perceived usefulness, perceived ease of use, and attitude toward use explained mobile services usage directly or indirectly (Nysveen, Pedersen & Thorbjornsen 2005). The results from the study by Nysveen et al. (2005) supported the effects of motivational influences, attitudinal influences, normative pressure (norms that are developed through external and interpersonal influence), and perceived control on the intentions of the consumers to use mobile services. The findings of the study by Nysveen et al. (2005) are about the intentions of the consumers to use mobile services, and not the actual usage of mobile services. The purpose of this research on the other hand is to understand the factors that influence the actual usage of m-commerce transaction services.

2.3 Research Question

A review of the literature within the context of m-commerce research and adoption theories reveals the need for research on actual m-commerce transaction services usage and the factors that influence the usage from the perspective of the user. This study therefore, seeks to fill the gap in research by examining the research question, “what are the factors influencing the usage of mobile commerce”?

While the earlier research focused on the behavioral perspectives associated with the use of mobile services in general, this study attempts to overcome such a limitation and focus specifically not on the intention, but the actual usage of m-commerce transaction services.

The idea behind TAM is that a model should not only help predict, but also explain so that researchers and practitioners can identify why a particular system may be unacceptable, and pursue appropriate corrective steps (Davis, Bagozzi & Warshaw 1989). Therefore, the goal of this research study is to not only identify why people are using m-commerce transaction services, but also identify and understand why they might not be using the transaction services. In this way, this research study has the potential of not only making a contribution to the literature, but also of providing practitioners with guidelines on the business of m-commerce. In the following section, the research model on m-commerce transaction services usage will be presented.

3. The Methodology and Model

3.1 Determinants of M-Commerce Transaction Services Usage (MTSU): Model Development

The characteristics of an individual such as age, gender, income level, and cultural origin have an impact on usage of m-commerce transaction services. Harris, Rettie, and Kwan (2005) have found that usage and attitudes to m-commerce services differed in the U.K and Hong Kong because of the cultural differences. Morris and Venkatesh (2000) found that age mattered in adoption and usage of technology. Venkatesh and Morris (2000) investigated gender differences in the adoption and usage of technology in the work place and found that men's technology usage decisions were more strongly determined by perceptions of usefulness, whereas women's technology usage decisions were more strongly determined by perceptions of ease of use and subjective norm. Income was one of the confounding variables controlled for by Venkatesh and Morris (2000). Therefore, age and gender, which have been proven to influence technology usage, would also influence m-commerce transaction services usage. Income level also influences the usage of m-commerce transaction services. From the earlier discussion on TAM, it can be seen that perceived usefulness and perceived ease of use are of the main relevance for computer acceptance behaviors (Davis, Bagozzi & Warshaw 1989). In this study, it is believed that these two factors could have a mediating role in the relationship between the users' individual characteristics and their usage of m-commerce transaction services. This discussion leads to the following propositions.

Proposition 1: The relationship between individual characteristics and usage of m-commerce transaction services is mediated by perceived ease of use.

Proposition 2: The relationship between individual characteristics and usage of m-commerce transaction services is mediated by perceived usefulness.

Proposition 3: There is a direct positive relationship between perceived ease of use and perceived usefulness

It should be noted that in this study, the TAM definitions of perceived usefulness and ease of use are adapted to the specific research context. In this study, perceived usefulness is the degree to which a person believes that using m-commerce transaction services would enhance his/her convenience. Ease of use is the degree to which a person believes that using m-commerce transaction services would be free of effort.

Venkatesh and Davis (1996) found that general computer self-efficacy is a strong determinant of perceived ease of use before the users gain a hands-on experience (Venkatesh 2000). This could be applied to an m-commerce context; where in the users' technological self-efficacy could moderate the relationship between the users' individual characteristics and ease of use of the m-commerce transaction services. This leads to the following proposition.

Proposition 4: The relationship between individual characteristics and ease of use is moderated by the technological self-efficacy of the users.

Compeau and Higgins (1995b) have defined self-efficacy as the "judgment of one's ability to use a technology (e.g., computer) to accomplish a particular job or task" (Venkatesh et al 2003, p.432). Marakas, Yi, and Johnson (1998) have defined computer self-efficacy as "an individual's perception of efficacy in performing specific computer-related tasks within the

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domain of general computing” (p.128). In this study the technology used would be mobile devices.

According to Gefen and Straub (1997), social influence and gender are two important constructs that have not received much attention in the context of TAM (Venkatesh & Morris 2000). They could be important determinants of new technology usage (Venkatesh & Morris 2000). Gender has already been included in the research model, and now social influence will be included. This leads to the next proposition.

Proposition 5: The relationship between individual characteristics and usage of m-commerce transaction services is mediated by social influence.

Social influence was included in the form of the construct ‘subjective norm’ in TRA, the referent theory of TAM (Venkatesh & Morris 2000). As has been noted earlier in this paper, Fishbein and Ajzen (1975) had defined subjective norm as “the person’s perception that most people who are important to him think he should or should not perform the behavior in question” (Venkatesh, et al 2003, p.428).

In the usage of m-commerce services, it can be said that a user’s mobility plays a major role. Nohria and Leestma (2001) believe that opportunities and potential provided by m-commerce can be fully unleashed only when companies understand the role of mobility in the lives of people today. This leads to the following proposition.

Proposition 6: The relationship between individual characteristics and usage of m-commerce transaction services is mediated by the mobility of the individual.

Kristoffersen and Ljungberg (2000) defined the three aspects of mobility (traveling, wandering, and visiting) as follows:

Traveling-“the process of going from one place to another in a vehicle”

Wandering-“form of extensive local mobility” where an individual may spend considerable time walking around

Visiting-“stopping by at some location and spending time there, before moving to another location” (Sarker & Wells 2003, p.38)

The above three constructs on mobility will be borrowed in this study, but they will be redefined in a communications networking context as follows:

Traveling - The movement or mobility of the user beyond the local cell tower area.

Wandering - The movement or mobility of the user within the local cell tower area.

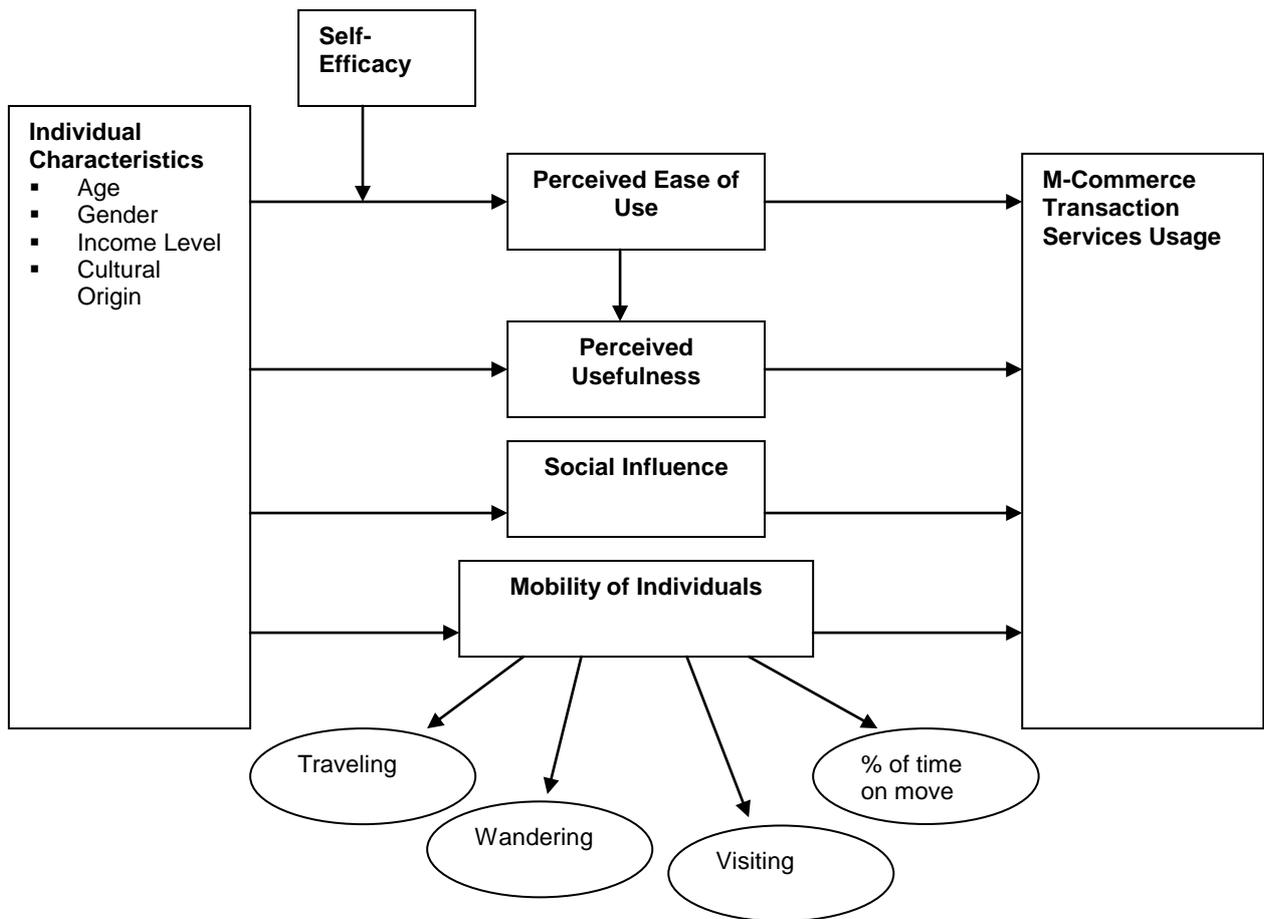
Visiting - The movement or mobility of the user beyond the geographical location.

In addition to the above three variables, ‘percentage of time (the user is) on the move’ will also be included as part of the mobility construct.

The usage of m-commerce transaction services will be the actual usage of m-commerce transaction services by the users.

The model thus developed is shown in Figure 2.

Figure 2: Determinants of M-Commerce Transaction Services Usage (MTSU) Model



4. The Findings

4.1 MTSU Model: Explanation and Significance

The MTSU model depicts that individual characteristics determine m-commerce transaction services usage, while at the same time this relationship is mediated by factors such as perceived ease of use, perceived usefulness, social influence, and mobility of individuals. It also shows that the relationship between individual characteristics and perceived ease of use is moderated by self-efficacy. Furthermore, it also proposes that there is a direct positive relationship between perceived ease of use and perceived usefulness.

While the earlier studies covered in the literature review focused on the behavioral aspects of mobile services in general or intention to use m-commerce, this study adds to literature by focusing specifically on determinants of actual m-commerce transaction services usage. It also extends the application of Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM) to the context of m-commerce transaction services, a topic that warrants research due to the phenomenal growth in the use of mobile devices and the associated use of transaction services.

5. Summary and Conclusions

The market penetration rate of mobile phones has almost exceeded the 100% rate in U.S. and some other developed countries (Informa 2005). The usage of mobile devices is growing across the world and huge estimates of m-commerce growth and potential are being made (Siau, Lim & Shen 2001). Yet, based on a review of the literature, there seems to be a dearth of research specifically on the usage of m-commerce transaction services. Some of the existing research has tried to study m-commerce usage from the diffusion of mobile devices (Kauffman & Techatassanasoontorn 2005) or from the intent to use m-commerce (Nysveen et al 2005), but there does not seem to be any literature on the actual usage of m-commerce transaction services.

This paper contributes to research through the development of a theoretical model that identifies the determinants of m-commerce transaction services usage.

The proposed research model in this paper is based on some constructs from well-known, highly accepted, and repeatedly validated theoretical models such as Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM). This paper extends literature by presenting a theoretically well grounded model that is capable of being empirically tested.

The limiting factor of this study is that the theoretical model has not yet been empirically tested. This presents an opportunity to further extend this research by doing an empirical study to test the presented theoretical model. Thus, this study not only makes a contribution to the literature, but also through further empirical testing has the potential to provide practitioners with guidelines on factors influencing m-commerce usage.

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