Experience and Facilitating Conditions as Impediments to Consumers' New Technology Adoption

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Abstract

The recent proliferation of new technologies and impediments to their adoption has made predicting new technology adoption/use complex and challenging. This paper aims to compare the predictive ability of behavioural expectation (BE) and behavioural intention (BI) given such impediments. BE predicts an attempt to perform a targeted behaviour, whereas BI predicts the likelihood of actually performing a targeted behaviour. An online longitudinal experiment was designed to examine the effects of two contrasting sources of impediments to new technology adoption: experience (internal) and facilitating conditions (external). The results confirm the tendency of subjects, who responded to BI measures, to make overestimations when they think they have more control over the (internal) impediments, and to make exaggerated underestimations when they think they have less control over the
(external) impediments. Moreover, it is found that subjects who responded to BE measures have a stronger Adoption-Use correlation compared to subjects who responded to BI measures regardless of the type of impediments encountered. This study offers a basis for marketers to increase the rate of consumers' adoption/use of new technology such as mobile applications. The research identifies boundary conditions to the predictive ability of behavioural expectations and behavioural intentions in the context of mobile applications adoption/use.

Keywords Impediments, Experience, Facilitating Conditions, Behavioural Expectations, Behavioural Intentions

Introduction

During the last three decades, marketing researchers have employed a widely popular construct: behavioural intention (BI; Fishbein and Ajzen, 1975), as an immediate predictor of consumers' adoption of new technology. Despite its popularity, prior research indicates that the measurement of BI demonstrated only a modest ability to predict the adoption/use of new technology (e.g. Mahardika et al., 2018; Bagozzi, 2007). In particular, BI has a limited predictive ability when the adoption/use of new technology is subject to impediments (Bagozzi et al., 1992). Inevitably, the identification of BI's boundary conditions in the prediction of new technology adoption remains a critical research gap, in particular when the adoption/use of the new technology is subject to various impediments.

In order to overcome the limitations of BI's predictive ability, another construct that qualifies as an immediate predictor of new technology adoption/use is needed. Venkatesh et al. (2008) contend that behavioural expectation (BE; Warshaw and Davis, 1985a) may be a better predictor of technology adoption/use than BI in certain conditions. BE itself has been overlooked in the marketing literature, even though it has showed a greater predictive ability than BI in various contexts, including in new technology adoption (e.g. Venkatesh et al. 2008). Unlike BI, BE takes into account foreseeable impediments that may challenge behavioural performance (Warshaw and Davis, 1985b). BE measures offer different conceptualisation from BI measures, and therefore may be able to better predict the adoption/use of new technology that is subject to impediments.

Against this backdrop, this paper aims to extend the aforementioned findings by examining the underlying process behind the predictive ability of BE versus BI, particularly in situations where the adoption/use of new technology is subject to impediments. We will focus on two such sources of impediments, namely experience (internal impediments) and facilitating conditions (external impediments). In a study, facilitating conditions is directly affecting usage behaviour for e-government service offered through intermediaries (Weerakkody et al., 2013). Subsequently, another study displays that user experience positively moderates the association between uncertainty costs and user resistance to change (Kim and Lee, 2016).

In doing so, this study adopts an experimental design to compare the predictive ability of BE versus BI in situations where a person encounters high experience versus low experience, or high facilitating conditions versus low facilitating conditions. The adoption of a mobile application (app) will be the context for this study, specifically, the adoption/use of

2D barcode reader apps, that enable rewarding interactions between marketers and consumers. Since the app is novel for some consumers, understanding the process of adopting/using 2D readers could help to explain the adoption process of mobile apps in general. Ultimately, this paper contributes to the marketing literature discourse by identifying the boundary conditions to the predictive ability of behavioural expectations and behavioural intentions in the context of mobile applications adoption/use.

Impediments to the Adoption/Use of New Technology

In the context of new technology adoption, the accuracy of a person's estimation of their likelihood to adopt/use the technology might also be influenced by their awareness of impediments (Venkatesh et al., 2008). Among the various types of impediments to the adoption/use of new technology, two are particularly relevant when comparing and contrasting the predictive ability of BE and BI: 'experience' and 'facilitating conditions'.

Experience often describes certain feelings or emotions after an encounter with technology-related stimuli (Smith et al., 1999). Smith et al. (1999) contend that experience can be a source of impediment when interactions with computer-related stimuli are unable to provide satisfactory information that reduces a person's anxiety toward adoption/use of the targeted new technology. Although experience can be a result of marketing-designed, technology-related interaction, consumers could also actively seek stimuli or information that can increase their experience with the new technology. Hence, experience is an internal mental process which is largely determined by the effort expended. In this sense, a person might perceive that s/he has more control over the experience with new technology regardless of marketers' efforts to design the consumers' new technology interaction. For example, mobile applications offer various options to consumers who would like to have a trial (experience) before adopting/purchasing the application. Consumers have full control over the type of trial/experience that they would like to have, from reading reviews to downloading the trial version of the application. This perception of control is important in explaining the accuracy of consumers' BE versus BI predictions of new technology adoption/use.

Meanwhile, in the context of new technology adoption/use, facilitating conditions refer to consumers' beliefs about whether or not the necessary computer-related resources can be easily accessed to facilitate adoption/use (Venkatesh et al., 2008). Facilitating conditions become a source of impediments when access to the necessary resources is limited or scarce. For example, computer-related resources may include operators' resources (i.e. network

coverage), manufacturers' resources (i.e. platform and operating systems), developers' resources (i.e. applications) and users' resources (mobile device). The accessibility of most of these resources are generally not under consumers' control. For example, consumers may not have control over the quality of network reception in certain areas since it depends on the services provided by their mobile operator. In that particular situation, facilitating conditions become external impediments, over which consumers perceive that they have less control. When consumers perceive that they have less or no control at all over the impediments, this could influence the accuracy of their BE versus BI estimations toward new technology adoption/use.

From the above discussion, experience (internal impediments) and facilitating conditions (external impediments) play an important role in the predictive ability of BE versus BI. Prior research has identified that BE has a greater predictive ability than BI when the behaviour is subject to impediments (e.g. Warshaw and Davis, 1985b; Venkatesh et al., 2008). However, it remains unclear how perceived control over the impediments affects the predictive ability of BE versus BI. Does a person's degree of control over the impediments determine the accuracy of her/his BE (versus BI) estimations of new technology adoption/use? It is the aim of this paper to address these questions.

Internal Impediments: Experience

A person's likelihood of adopting/using new technology can be influenced by the results of an interaction between her/him and the said new technology, i.e. experience. Experience, in the adoption of technology context, is often described as "specific feelings or emotions that are engendered by technology-related stimuli" (Smith et al., 1999; p. 241). For example, interaction with new technology may take place through trial, reading reviews and experience with similar or related technology (Mao and Palvia, 2008). The interaction between a person and technology-related stimuli then determines her/his attitude toward adopting/using the new technology. However, the effects of interaction with technology-related stimuli on a person's feelings/emotions may vary in different situations. It may depend on the amount of usage, opportunities to use the technology, and the diversity of experience when using it (Jones and Clarke, 1995).

Venkatesh et al. (2006; 2008) investigated the role of experience in the formation of BE and BI by measuring the amount of computer use or accumulation of experience with the targeted technology. The authors found that the effects of BE and BI on technology adoption

are fully moderated by experience (Venkatesh et al. 2006), in that increasing experience strengthens the relationship between BI and actual adoption but weakens the relationship between BE and actual adoption. According to Venkatesh et al. (2008), the amount of computer-use provides information that allows subjects to estimate their perceived control over performing the behaviour. Moreover, the authors contend that an increase in experience significantly improves the sense of control in relation to BI judgments to adopt new technology, but it is insignificant for BE. This may be due to the fact that increasing experience with new technology reduces perceived uncertainty and thus increases anticipation of impediments to actual adoption. In an effort to extend these findings, we seek to further explain the effects of experience as an internal impediment (in which consumers tend to perceive that they have more control over technology adoption), on the accuracy of BE versus BI estimations. The degree of experience (high/low) may motivate consumers to understate or overstate their BE or BI estimations, and thus increase or reduce the consistency between BE (versus BI) and adoption/use.

As experience with new technology is internally processed in consumers' minds, they tend to perceive that they can make accurate estimations based on any information that has been acquired from the interaction with technology-related stimuli, even when the information is incomplete or abstract. This leads to an overestimation of their likelihood to adopt/use the new technology, particularly for those who respond to BI measures. The consistency between BI and actual behaviour is greater for high (i.e. a direct experience) consumers than for low (indirect) experience consumers (Fazio and Zanna, 1981). This is because direct (high) experience offers more complete information than indirect (low) experience that is required in the formation of a cognitive judgment (Hamilton and Thompson, 2007). This notion is supported by the Smith and Swinyard (1983) study which reported that product trial produces a stronger effect on attitude compared to a description presented by an advertisement. According to the authors, a product trial generates non-verbal information that stimulates cognitive judgment more comprehensively than verbal information generated by advertisement exposure. In the context of new technology adoption/use, consumers who have direct experience (i.e. trying all the features of a mobile app or playing a mobile app game) formed different mental judgments from those consumers whose experience is indirectly derived (i.e. watching video tutorials of a mobile app or a mobile app game). A direct encounter with the application provides more concrete information and more diverse experience from different types of stimuli (Jones and Clarke,

1995). Consequently, a high experience with the application strengthens the consumers' ability to identify, and thus anticipate, foreseeable impediments to adopting/using it. On the other hand, a low experience provides more abstract information and a homogenous experience, which is less likely to improve consumers' ability to identify and anticipate foreseeable impediments to adoption/use.

Warshaw and Davis (1985b) contend that BE has a greater predictive ability than BI when the behaviour is subject to uncertainty and when information about the behaviour is limited. According to the authors, subjects who respond to BE measures tend to have greater awareness of impediments than those who respond to BI measures. Such awareness was activated regardless of the types of experience (i.e. low or high experience), since different information from the experience has little effect on BE estimations (Venkatesh et al., 2008). As a result, a person will have more moderate BE estimations about intention to adopt/use new technology regardless of the types of experience encountered, and thus s/he has a more consistent BE – adoption-use relationship. On the other hand, low experience is less likely to activate anticipation of impediments in a person who responds to BI measures. Such awareness is more likely to be triggered when a person who responds to BI measures encounters a high experience. As a result, a person who has a low experience with new technology tends to overestimate their BI, and therefore the consistency between BI and actual adoption/use is decreased. Based on the aforementioned discussion, this paper therefore proposes the following hypotheses:

Hypothesis 1: *When experience is low, behavioural expectation of new technology adoption/use will be more predictive than behavioural intention.*

Hypothesis 2: *When experience is high, behavioural expectation and behavioural intention will be equally predictive of new technology adoption/use.*

External Impediments: Facilitating Conditions

In the context of new technology adoption/use, facilitating conditions refer to consumers' beliefs about whether necessary resources can be easily accessed to facilitate adoption/use (Venkatesh et al., 2008). Taylor and Todd (1995) reported that facilitating conditions constitute a key determinant in the formation/assessment of subjects' BI to perform certain behaviour. Venkatesh and Morris (2003) contend that facilitating conditions should be measured by various factors including users' knowledge, resources and availability of advice from marketers or peers. This paper focuses in particular on the resources since here users

have a more concrete mental representation of whether or not they have control. For example, the level of facilitating conditions can be based on resources such as network coverage or mobile devices operating system, where consumers may perceive that they have less control over them.

Warshaw and Davis (1985b) reported that BE has a greater predictive ability than BI when subjects have low perceived control over the behaviour. Specifically, in the context of new technology adoption/use, facilitating conditions influence the formation of a person's BE and BI estimations (Venkatesh et al., 2008). Since facilitating conditions are external factors that are generally not under a person's control, high facilitating conditions tend to increase both BE and BI estimations; while low facilitating conditions lead to lower BE and BI estimations. However, low perceived control over the behaviour has a different effect on BE and BI estimations (Warshaw and Davis, 1985b). For someone who responds to BE measures with low perceived control over the behaviour, s/he tends to have more moderate estimations of her/his BE (Mahardika et al., 2011). For example, in the situation where facilitating conditions are low, those who respond to BE measures see it as part of foreseeable challenges of adopting/using new technology. Hence, their BE estimations reflect their careful prediction of whether they can improve the facilitating conditions (i.e. by getting technical support) to adopt/use the technology. On the other hand, as BI measures have a limited ability to capture foreseeable impediments, *a person will make exaggerated underestimations* of her/his BI when the behaviour is not fully under their control (Mahardika et al., 2011). If the reasons for the resources not facilitating adoption/use are not clearly explained (e.g. why an application is not compatible with certain operating systems), a person tends to rely on her/his preconceived desire for the targeted application to form her/his BI estimations. As BI measures reflect desirability for the behaviour, it will be less likely to activate a careful prediction of whether or not the facilitating conditions can be improved. This overstated underestimation leads to a lower consistency between BI and actual behaviour. From aforementioned discussion, this study hypothesises:

> Hypothesis 3: *In low facilitating conditions, behavioural expectation will be more predictive of new technology adoption/use than will behavioural intention.*
>
> Hypothesis 4: I*n high facilitating conditions, behavioural expectation and behavioural intention will be equally predictive of new technology adoption/use.*

It is known from prior research (e.g. Warshaw and Davis, 1984) that BE should have a greater predictive ability than BI when the behaviour is subject to impediments. However, when the impediments are further categorised as internal and external impediments, the effect on the predictive ability of BE compared with BI remains unexplained. This paper hypothesises that BE will have a greater predictive ability than BI when internal impediments (experience) are few (H1), as well as when the external impediments (facilitating conditions) are few (H3). Although it was hypothesised that the effects of internal versus external impediments on BE/BI will be similar, the underlying processes are different for each type of impediment. In the situation where experience is low, a person may intend (or expect) to overcome the impediments by seeking additional technology-related stimuli before actual adoption/use. A person who responds to BI measures is likely to overstate the intention (BI) since s/he perceives to have greater control over seeking additional technology-related stimuli to increase the experience, even when in reality s/he has limited control over it. Meanwhile, in the situation where facilitating conditions are low, a person may not intend (or expect) to overcome the impediments since they are greatly determined by resources beyond her/his control (i.e. company resources). Hence, BI measures are likely to produce an underestimation of intention (BI) to adopt/use, because the potential consumer perceives that s/he has limited control over company resources, even when company resources may be accessible (i.e. call to customer service for troubleshooting). In sum, BI measures perform differently in the presence of internal impediments as opposed to external impediments, and therefore this paper hypothesises:

> Hypothesis 5*: Behavioural intention under low experience condition is greater than behavioural intention under low facilitating condition since people who have little experience with new technology tend to overestimate their behavioural intentions, whereas they tend to underestimate their behavioural intention when facilitating conditions are low.*

Experiment 1 (pre-test)

Participants, Design and Procedure

One hundred and sixty-one undergraduate students (103 female) from an Australian university agreed to voluntarily participate in a lab experiment. They were randomly assigned to conditions of a 2 (high, low) experience x 2 (high, low) facilitating conditions in the context of 2D barcode reader adoption. The participants in the high experience group were

instructed to try to scan 2D barcodes using mobile phones pre-installed with a 2D barcode reader application supplied by the researcher. In addition, participants from this group were instructed to generate their own 2D barcodes using an online 2D barcode generator, and scan the generated code with the researcher's mobile phone where the app had been pre-installed. Conversely, the low experience group was instructed to watch an instructional video on how to generate a 2D barcode reader and how to use a 2D barcode reader application. The participants in this group did not engage in an actual trial with the application. Meanwhile, in order to manipulate the facilitating conditions, participants were asked to self-report their mobile phone model and brand or manufacturer to check its compatibility with the 2D barcode reader application being offered. Participants in the low facilitating conditions group found that their mobile devices were not compatible with the application. Then they were informed that since their mobile devices were not compatible with the application, they would need to install the application through a long and complex process. On the other hand, participants in high facilitating conditions found that their mobile devices were compatible with the application, and therefore they were informed that the installation of the application on their mobile device would be easy and quick.

The study was conducted in a laboratory setting. The product trial (high experience) and video instructions (low experience) were given to the participants at the beginning of the study. This was then followed by the manipulation of facilitating conditions. Accordingly, participants responded to a questionnaire containing BI or BE measures. Participants were asked to indicate their expectations or intentions to adopt the 2D barcode reader application.

Measures

Both BI (α = .90) and BE (α = .96) items were operationalised based on the guidelines of Warshaw and Davis (1985a), Gordon (1989; 1990), and Venkatesh et al. (2008). BI and BE were measured on a 9-point Likert scale, where -4 = "strongly disagree" and 4 = "strongly agree". The BI and BE measures were adapted to fit the context of new technology adoption. The 3-item intention (BI) scales were: "I intent to adopt 2D barcodes reader", "I predict I will adopt 2D barcodes reader", and "I plan to adopt 2D barcodes reader". The 4-item expectation (BE) scales were: "I expect to adopt 2D barcodes reader", "I will adopt 2D barcodes reader", "I am likely to adopt 2D barcodes reader", and "I am going to adopt 2D barcodes reader".

Results and Discussion

As a pre-test, the objective of Experiment 1 was to examine the effectiveness of the manipulation design for experience and facilitating conditions and whether this was working. The results were used to refine the manipulation design for Experiment 2.

Findings from Experiment 1 indicate that subjects' BE estimations to adopt/use a 2D barcode reader application were indeed similar regardless of the type of condition they have encountered. The means of BE for high experience group ($M_{BE.HE} = 5.10$) is not significantly different to BE for low experience group ($M_{BE.LE} = 4.69$). On the other hand, subjects' BI estimations to adopt/use the application shows a significant means difference between the high experience group and the low experience group ($M_{BI.HE} = 5.36 > M_{BI.LE} = 4.48$, $p<.10$, two-tailed). Results from the manipulation check are in line with our expectations. It is also reflected in the BE and BI estimations, where high experience manipulation produces higher BE/BI estimations, whereas low experience manipulation produces lower BE/BI estimations. Additionally, as predicted in the discussion, the effects of high versus low experience on subjects' BE estimation were insignificant. An actual experience will not significantly change subjects' estimation of their 'expectations' to adopt the application since they have taken into account foreseeable impediments to behavioural performance (e.g. unable to actually try the app). Conversely, the type of experience matters for subjects who respond to BI measures. As predicted, subjects who have little experience with the application will have a significantly lower estimation of their 'intention' to adopt it—compared to subjects who have had more experience with the application.

However, the manipulation design for facilitating conditions did not perform according to our expectations. The results show that subjects should have lower BE estimations when facilitating conditions are low compared to BE estimations when facilitating conditions are high; yet the results show the mean differences are not significant ($M_{BE.HFC} = 4.88 > M_{BE.LFC} = 4.87$). Furthermore, the means difference between the two groups of facilitating conditions are also found to be not significant for subjects who responded to BI measures, and the effects were reversed ($M_{BI.HFC} = 4.61 < M_{BI.LFC} = 5.31$). These results indicate a limitation in the design of manipulation for facilitating conditions. In manipulating subjects' perception of facilitating conditions, they were instructed to check a list of mobile device brands and models that are compatible with the application being offered. This list is quite long, containing over 30 mobile device brands and models. Some subjects may pay scant attention and fail to locate their mobile device on the list. Another possibility is that they

were not conscientiously following the instruction and proceeded to the next section of the questionnaire without checking the list, or checking it thoroughly. The results from the manipulation check also confirm this. Overall, results from Experiment 1 provide an initial examination of the manipulation design for experience and facilitating conditions.

Experiment 2

Participants, Design and Procedure

Two hundred and fifty-five participants (92 female) from a US online panel participated in an online longitudinal experiment and were randomly assigned to one of a 2 (high, low) experience x 2 (high, low) facilitating conditions in the context of the adoption and usage of a 2D barcode reader. Specifically, 120 participants received BI questions and 135 participants received BE questions. This study employed screening questions to check whether participants were familiar with 2D barcode technology and whether they had installed a 2D barcode reader in their mobile device. Only those who were not familiar with the technology and those who had not installed a 2D barcode reader in their mobile device were selected as participants for this experiment.

The longitudinal experiment recorded subjects' responses and/or actual behaviour at four points of observation (Time 1 – 4). At Time 1, participants were asked to indicate their BI and BE to adopt a 2D barcode reader application. There was no manipulation and no conditions given to participants at Time 1. On the other hand, at Time 2, participants were randomly given one of a 2 (high, low) experience x 2 (high, low) facilitating conditions manipulation before responding to the BE or BI questions. At Time 3, participants' actual adoption of the application was observed. Finally, at Time 4, the actual use of the application was observed.

At Time 2 observation, participants in two 'experience' conditions (high/low) received written and visual information about 2D barcodes, including benefits and operation. 'High experience' participants were given an interactive questionnaire, in which they could create their own 2D barcodes using an online 2D barcodes generator. Meanwhile, 'low experience' participants were given a static questionnaire with no access to a 2D barcodes generator to create their own barcodes. In order to manipulate facilitating conditions, participants were asked to report the brand and model of their mobile devices. The system randomly indicated whether their mobile devices were compatible with the 2D barcode reader application being offered. Participants encountered 'high facilitating conditions' when the system indicated that

their mobile devices were compatible with 2D barcodes reader application. On the other hand, participants encountered 'low facilitating conditions' when the system indicated that their mobile devices were not compatible with the application.

Actual adoption was observed in Time 3. Participants were asked to confirm whether they would like to install a 2D barcode reader application in their mobile devices. Those who agreed to install the application were given a URL that led to installation instructions, and their selections were recorded. Having installed the application, they were then offered an online coupon (bonus) in the form of a 2D barcode. If the participants accepted the offer, they were asked to scan the coupon and copy paste the unique number inside the coupon to the system to validate their usage.

Measures

Measures of BE (α = .996) and BI (α = .987) items followed the guidelines of Warshaw and Davis (1985b) and Venkatesh et al. (2008). BI was measured using three items, each on a 9-point bipolar (+4 to -4) scale as follows: "I intend to adopt 2D Barcodes Reader Application", "I plan to adopt 2D Barcodes Reader Application", and "I predict I will adopt 2D Barcodes Reader Application". In contrast, the four BE items were: "I expect to adopt 2D Barcodes Reader Application", "I will adopt 2D Barcodes Reader Application", "I am going to adopt 2D Barcodes Reader Application" and "I am likely to adopt 2D Barcodes Reader Application". Adoption and use were observed from actual participant behaviour. In addition, the predictive ability of BE and BI toward adoption and usage were measured based on the within-participants Pearson correlation based on the guidelines advanced by Sheeran et al. (1999).

Results and Discussion

Findings from Experiment 2 provide a more accurate explanation than do the results from Experiment 1 (pre-test), specifically in regard to the role of 'experience' and 'facilitating conditions' in the formation of BE versus BI estimations. Experiment 2 measured subjects' BE and BI estimations at two time points: Time 1 (before manipulation) and Time 2 (after 'experience' manipulation). The longitudinal design of Experiment 2 allowed a comparison between subjects' BE/BI estimations before and after manipulation. Table 1 indicates that subjects' BE estimations are stable over time, regardless of the type of experience.

Meanwhile, Table 2 shows that BI estimation is stable only when subjects encounter a high experience. When experience is low, BI estimations are significantly lower on Time 2 ($M_{\text{BI-Time1}} = 6.03 > M_{\text{BI-Time2}} = 5.53$, $p<.10$, two-tailed). Indeed, the results confirm that internal impediments (low experience) have little effect on subjects' BE estimations. When responding to BE measures at Time 1, subjects took into account foreseeable internal impediments, including the possibility that they might not be able to obtain adequate information (i.e. not be able to try the application). Then, whatever conditions the subjects encountered in Time 2, these would have only limited effects on BE estimations. On the other hand, when responding to BI questions, subjects might not take into account the possibility that they may or may not be able to try the application before making an adoption decision. Hence, BI estimations at Time 2 became significantly lower as subjects did not realise that such impediments could arise (i.e. inadequate interaction/information with the application).

Table 1 also shows that subjects' BE estimations were greatly influenced by facilitating conditions. It was found that BE estimations were not stable between Time 1 and Time 2 regardless of the level of facilitating conditions. BE estimations became higher at Time 2 for those who encountered high facilitating conditions ($M_{\text{BE-Time1}} = 5.98 > M_{\text{BE-Time2}} = 6.65$, $p<.01$, two-tailed), while lower for those who encountered low facilitating conditions ($M_{\text{BE-Time1}} = 6.04 < M_{\text{BE-Time2}} = 5.29$, $p<.01$, two-tailed). A similar result is also indicated by Table 2, where subjects' BI estimations were strongly influenced by facilitating conditions. BI estimations became higher at Time 2 for those who encountered high facilitating conditions ($M_{\text{BI-Time1}} = 5.80 > M_{\text{BI-Time2}} = 6.39$, $p<.01$, two-tailed), while lower for those who encountered low facilitating conditions ($M_{\text{BI-Time1}} = 6.29 < M_{\text{BI-Time2}} = 4.87$, $p<.01$, two-tailed). This result is in line with Venkatesh et al.'s (2008) findings in which BE negates the effects of facilitating conditions once it is introduced into the predictive model.

Table 3 compares the predictive ability of BE and BI under four conditions using within-participants correlations. The difference between BE and BI correlations were examined using the Fisher z transformation test. Hypotheses 1 and 3 expect BE to be more predictive than BI when the behaviour is subject to impediments, such as when experience

Table 1. The Stability of BE Estimations

No	Conditions	BE Mean score		Time 1 > Time 2[a]	*t*
		Time 1 (before manipulation)	Time 2 (after manipulation)		
1	High Experience (N=68)	5.76	5.89	No	.62
2	Low Experience (N=67)	6.26	6.10	Yes	.46
3	High Facilitating Conditions (N=69)	5.98	6.65	No**	.001
4	Low Facilitating Conditions (N=66)	6.04	5.29	Yes**	.007
5	ALL (N=135)	6.01	5.98	Yes	.88

[a] Significant differences between BI and BE mean scores are based on independent sample t-test; ** $p<.05$; * $p<.10$

Table 2. The Stability of BI Estimations

No	Conditions	BI Mean score		Time 1 > Time 2[a]	*t*
		Time 1 (before manipulation)	Time 2 (after manipulation)		
1	High Experience (N=58)	6.04	5.79	Yes	.45
2	Low Experience (N=62)	6.03	5.53	Yes	.08
3	High Facilitating Conditions (N=62)	5.80	6.39	No**	.007
4	Low Facilitating Conditions (N=58)	6.29	4.87	Yes**	.000
5	ALL (N=120)	6.03	5.66	Yes*	.08

[a] Significant differences between BI and BE mean scores are based on independent sample t-test; ** $p<.05$; * $p<.10$

with the applications is low (H1) and facilitating conditions are low (H3). On the other hand, Hypothesis 2 and 4 expect that BE and BI will be equally predictive when subjects perceive that impediments to performing the behaviour are limited by having more experience with the applications (H2) and/or by getting high facilitating conditions (H4).

Results presented in Table 3 indeed support the notion that BE is more predictive than BI when the behaviour is subject to impediments. In low experience conditions, the correlation between BE and actual use is significantly higher than BI and actual use correlations ($r_{BE\text{-}Use}$= .71 > $r_{BI\text{-}Use}$ = .53, p < .10, z = 1.62, one-tailed). In line with this result, BE-Use correlation is higher than BI-Use correlation when subjects encounter low facilitating conditions ($r_{BE\text{-}Use}$= .68 > $r_{BI\text{-}Use}$ = .56, p < .15, z = 1.1, one-tailed). Meanwhile, Table 3 also confirms that there is no significant difference between the predictive ability of BE and BI when behaviour is not subject to impediment. For subjects with high experience, the BE-Use correlation is not significantly different from BI-Use correlation ($r_{BE\text{-}Use}$= .76 > $r_{BI\text{-}Use}$ = .68, z = 0.25, one-tailed). In high facilitating conditions, the BE-Use correlation and BI-Use correlation are not significantly different ($r_{BE\text{-}Use}$= .76 > $r_{BI\text{-}Use}$ = .68, z = 0.95, one-tailed).

These results support the notion that subjects who responded to BE measures with low perceived control over the behaviour tend to have more accurate estimations toward adopting/using new technology. Their BE estimations reflect their careful prediction whether they can improve the facilitating conditions (i.e. by getting technical support) to adopt/use the technology. On the other hand, as BI measures have a limited ability to capture foreseeable impediments, people will make exaggerated underestimations of their BI when the behaviour is not fully under their control (Mahardika et al., 2011). Results presented in Table 4 confirm Hypothesis 5 that a person who has a low experience with new *technology tends to overestimate her/his BI*, whereas *s/he tend to underestimate* her/his BI when facilitating conditions are low. Table 4 compares BI estimations between Time 1 and Time 2 correlations in each of 2 (high, low) experience x 2 (high, low) facilitating conditions. BI Time 1 – Time 2 correlations is higher for low experience than high experience ($r_{BI\text{-}T1T2\text{-}HE}$= .65 > *r* $r_{BI\text{-}T1T2\text{-}LE}$ = .76, p < .15, z = 1.19, one-tailed), while it is lower for low facilitating conditions than high facilitating conditions ($r_{BI\text{-}T1T2\text{-}HFC}$= .84 > *r* $r_{BI\text{-}T1T2\text{-}LFC}$ = .68, p < .05, z = 2.11, one-tailed).

Table 3. Correlations of BE versus BI: Predictive Accuracy toward Actual Use

No	Conditions	Correlations (Spearman)		z	P (one-tailed)[a]	Correlations (Spearman)		z	P (one-tailed)[a]	Supported Hypothesis
		BE Adopt-Use	BI Adopt-Use			BE-Use	BI-Use			
1	High Experience	.94 (N=68)	.66 (N=58)	5.16	0.00	.75 (N=68)	.73 (N=67)	0.25	0.40	H2
2	Low Experience	.82 (N=67)	.62 (N=62)	2.39	0.01	.71 (N=67)	.53 (N=62)	1.58	0.06	H1
3	High Facilitating Conditions	.91 (N=69)	.67 (N=62)	4.00	0.00	.76 (N=69)	.68 (N=62)	0.93	0.18	H4
4	Low Facilitating Conditions	.85 (N=66)	.58 (N=58)	3.22	0.01	.68 (N=66)	.56 (N=58)	1.06	0.14	H3
5	ALL	.88 (N=135)	.62 (N=120)	5.13	0.00	.73 (N=135)	.62 (N=120)	1.60	0.05	

[a] Significant differences between BI and BE correlations are based on Fisher z transformation test.

Table 4. Correlations between Time 1 and Time 2 Estimations: Overestimations and Underestimations on BI

No	Conditions	Time1 – Time 2 Correlations (Spearman)		z	P (one-tailed)[a]	Time1 – Time 2 Correlations (Spearman)		z	P (one-tailed)[a]	Supported Hypothesis
		High Experience	Low Experience			High Facilitating Conditions	Low Facilitating Conditions			
1	Behavioural Intentions (BI)	.65 (N=61)	.76 (N=62)	1.19	0.12	.84 (N=62)	.68 (N=60)	2.11	0.02	H5
2	Behavioural Expectations (BE)	.77 (N=69)	.79 (N=68)	0.29	0.39	.84 (N=69)	.76 (N=66)	1.28	0.11	

[a] Significant differences between BI and BE correlations are based on Fisher z transformation test.

This overstated (or understated) estimation leads to a lower consistency between BI and actual behaviour (use), as indicated in Table 3.

Warshaw and Davis (1985b) contend that BE has a greater predictive ability than BI when the behaviour is subject to uncertainty and when information about the behaviour is limited. According to the authors, subjects who respond to BE measures tend to have greater awareness of impediments than those who respond to BI measures. Such awareness is activated regardless of the type of experience (i.e. low or high experience), since different information from the experience has little effect on BE estimations (Venkatesh et al., 2008). Hence, a person will have more moderate BE estimations about adopting/using new technology regardless of the types of experience being encountered, and thus s/he has a more consistent BE – adoption/use relationship. On the other hand, low experience is less likely to activate anticipation of impediments in a person who responds to BI measures. Such awareness is more likely to be triggered when a person who responds to BI measures encounters a high experience. As a result, a person who has little experience with new technology tends to overestimate their BI, and thus reduces the consistency between BI and actual adoption/use.

Ultimately, Table 3 also shows that the subjects who responded to BE measures have a more consistent adoption-use relationship than subjects who responded to BI measures under all conditions. In a high experience condition, the adoption-use correlation for BE is higher than adoption-use correlation for BI ($r_{\text{BE.Adopt-Use}} = .94 > r_{\text{BI.Adopt-Use}} = .66$, $p < .00$, $z = 5.16$, one-tailed). Similarly, BE correlations are higher than BI correlations for: low experience ($r_{\text{BE.Adopt-Use}} = .82 > r_{\text{BI.Adopt-Use}} = .62$, $p < .01$, $z = 2.39$, one-tailed), high facilitating conditions ($r_{\text{BE.Adopt-Use}} = .91 > r_{\text{BI.Adopt-Use}} = .67$, $p < .00$, $z = 4.00$, one-tailed), and low facilitating conditions ($r_{\text{BE.Adopt-Use}} = .85 > r_{\text{BI.Adopt-Use}} = .58$, $p < .01$, $z = 3.22$, one-tailed). This indicates that subjects who responded to BE measures formed a more accurate estimation of their likelihood to adopt, and then use, the application. On the other hand, subjects who responded to BI measures tended to overstate or understate their intentions to adopt, and then use, the application.

Conclusion

These results extend the literature discourse on the boundary conditions of BE versus BI predictive ability for new technology adoption/use in consumer settings. Specifically, this study aims to further current understandings of two sources of impediments in the new technology adoption/use, namely 'experience' and 'facilitating conditions', on the predictive ability of BE and BI. This paper seeks to explain why the predictive ability of BE is greater than BI in situations when internal or external impediments are low. Subjects who responded to BI measures overstated their estimations of adopting/using the new technology when they foresaw internal impediments (low experience).

Meanwhile, BI measures induce underestimations when subjects foresee external impediments (low facilitating conditions). In addition, it is confirmed that BI's predictive ability is weaker when the adoption/use of new technology is subject to impediments. On the other hand, the predictive ability of BE remains strong/stable regardless of whether or not there are impediments that may challenge the adoption/use of new technology. Findings confirm that it is particularly important to identify the best predictor of adoption/use in certain situations, and to provide a basis for designing an intervention to increase new technology adoption/use; thus, supporting Mahardika et al.'s (2018) study that argue BE as a better predictor of new technology adoption compared to BI.

The findings of this study would be beneficial for various contexts, particularly the retail environment. According to Inman and Nikolova (2017), retailers are faced with an increasing array of potential technologies although retail technology capabilities are currently high. These authors noted that continual innovation and new technology (e.g., iBeacons, mobilePOS, Near Field Communications and Internet of Things) are critical in creating a sustainable competitive advantage. However, not all individuals are open to new technologies, particularly without a proper conditioning or a carefully designed intervention. This study would shed a light in understanding what should retailers do in encouraging consumers to adopt new technology. More importantly, the efficacy of BE (compared to BI) could help retailers minimize unnecessary cost as the accuracy of prediction improve.

Theoretical Implications

Empirical findings from the two experiments have confirmed the efficacy of our hypotheses, and thus provide important contributions to the literature. The empirical support in this paper indicates that it is the perceived control of internal and external impediments that induce such

overestimations (or underestimations) of BI. Subjects could be thinking that they can easily access additional technology-related information and stimuli to overcome the default low-experience situation. In reality, this may require resources (such as time) that, if scarce, could prevent the effort from being made. However, BI measures have a limited ability to activate subjects' awareness of this reality. Instead, subjects who responded to BI measures form an estimation of their desire rather than the feasibility of obtaining additional technology-related stimuli or information. For external impediments, subjects may be thinking that they have no chance of intervening in a company's process and resources (i.e. compatibility with other technology); thus, they exaggerate their underestimations of their BI to adopt/use the technology.

A comparison of the effects of internal as opposed to external impediments on the formation of BE and BI estimations needs to be extended to ensure the generalisability of the results. Marketing scholars should attempt to identify other factors that are relevant as internal and external impediments to new technology adoption/use in consumer settings. For example, it could be productive to investigate the effects of self-efficacy (internal impediments) and subjective norms (external impediments) on the predictive ability of BE and BI. Self-efficacy determines a person's perception of whether s/he can perform technology-related tasks; thus a person with high self-efficacy is more likely to perceive s/he can perform such tasks (Olivier and Shapiro, 1993). Self-efficacy becomes an impediment when a person does not possess the necessary skills to perform technology-related tasks. It would be interesting to examine whether BI measures lead to an exaggerated overestimation of a person's ability to overcome the disadvantage of having limited skills. On the other hand, subjective norms often describe a person's motivation to act in accordance with behaviours approved by others (Karahanna and Straub, 1999). Subjective norms become impediments when a person perceives that people important to her/him do not approve of her/his technology-related decision. It would be worthwhile to investigate whether subjects who respond to BI measures will understate their estimations to adopt/use new technology when social/peer approval is low.

Next, the longitudinal experimental design in this paper helps to explain the stability of BE versus BI estimations. The results show that BE estimations are more stable than BI when perceived control over the behaviour is high. When perceived control over the behaviour is low, both BE and BI are not stable. However, subjects who responded to BE measures made more accurate estimations than for BI regardless of the perception of control over the behaviour. Results also show that subjects who responded to BE measures have a

more consistent adoption-use relationship than subjects who responded to BI measures under all conditions. This is important since it explains why someone who adopts a mobile application might not necessarily use it (Straub Jr. and Burton-Jones, 2007). A person's intention to adopt a new technology is sometimes based more on desire, rather than a careful calculation of whether s/he actually needs the technology. On the other hand, subjects' BE or expectations are based more on careful estimations toward the utility of the targeted application.

Finally, BE can be employed along with BI as a predictor of new technology adoption/use rather than BI alone in both consumer and organisational settings. Venkatesh et al. (2008) explained the different roles of BE and BI in organisational settings. Technology adoption in consumer and organisational settings involves varying degrees of uncertainty in the decision-making process. Organisations adopt new technology that suits their needs and resources, not necessarily adapting to the individual user's needs, which limits the number of options available to users. This limitation reduces uncertainty in their decision-making, since some factors that influence users' decisions are already controlled by the organisation. In contrast, consumers encounter the more uncertainty when they attempt to deal with anticipated or unanticipated impediments that challenge their actual adoption. BE is found to be a better predictor of technology adoption than BI when the degree of uncertainty is high (Venkatesh et al. 2008). Thus, it should be particularly effective in consumer settings but also in organisational settings marked by high uncertainty.

Managerial Implications

Marketers could reformat the approach for designing the interaction between consumers and technology. It is found in this study that subjects overstate their intentions to adopt/use new technology when they have had limited experience with the targeted new technology. It is important to minimise this overestimation, which will potentially improve the ability to predict their actual behaviour. In so doing, marketers should make available to consumers as many technology-related stimuli as possible, and at the same time motivate them to actively try/seek the stimuli being presented. In the retailing context, retailers could provide incentives in order to motivate the consumers to try new technology. Retailers could also design technology-related stimuli in conjunction with popular attractions or well-known animation. The technology stimuli could also be provided in the form of simple as well as familiar in-

store technology such as free wifi and digital signage. It could become a conditioning stimuli for consumers before adopting a new in-store technology (i.e. Internet of Things).

Moreover, this study found that subjects understate their intentions to adopt/use new technology when facilitating conditions are low, thereby decreasing the consistency between intentions and actual adoption/use. The consistency could be improved if marketers allow consumers to have easy access to the information regarding technology-related resources such as information on network coverage and signal reception quality in covered areas, guidelines for system and technical troubleshooting, etc. By using BE as a more accurate predictor of adoption, retailers could further identify whether a specific investment to improve facilitating conditions is justifiable or not. Developing an app with two different operating systems (i.e., iOS and Android) could be expensive. Certain markets in developing countries (e.g., Indonesia) have an extreme unequal number of users between the two operating systems (i.e., the number of iOS users is miniscule compared to the number of Android users). Therefore, the cost per person will be relatively high for retailers to develop and maintain the iOS app. In this sense, it would be important for retailers to ensure the facilitating conditions are properly established with efficiency in-mind.

Study Limitations

As has been previously mentioned, the present research is not without limitations. The first notable limitation is the manipulation design for facilitating conditions for Experiment 1. Subjects were instructed to check a long list of mobile device brands and models and indicate whether they could find their mobile device in the list. If they did, they were required to self-report it in the questionnaire. As the list was quite long and consisted of more than 30 mobile device brands and models, some subjects might have experienced selective attention and failed to locate their mobile device on the list. There is also the possibility that they consciously neglected the instruction and proceeded to the next section of the questionnaire without checking the list. Second, Experiment 1 recruited student participants, some of whom are international students for whom English is not their first language. It is particularly important to have participants with a high level of English comprehension in this study since we test two constructs (BE and BI) the items of which may appear to be similar to non-native speakers. Finally, this paper employed a within-participation Pearson correlation to examine the predictive ability of BE in comparison with BI and to examine the consistency between actual adoption and use. According to Conner et al. (2000), using within-participation Pearson

correlations to measure stability may have some potential limitations. In particular, if the number of data points is fewer than five, there is a strong tendency for all items to obtain the same value.

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