

Reviewing Technology Habits to Validate a Measurement Scale for Habitual Use of Voice Assistants

Palak Kanojia¹, Prof. Ashish Chandra²

Abstract

Purpose- Habitual behaviour is being studied from over a century in inter-disciplinary context. Advent of digital economy has disrupted the deep rooted habits and formed newer ones in a short span of time. Information systems research attempts to study various dispositions and behavioural patterns of technology users. Theories of social sciences have stemmed into a new branch of study 'Digital Psychology.' Digital marketers are not just interested in observing the patterns of users but also in investigating why users are showing such patterns.

Methodology- A two-step approach was followed to understand the changing paradigm of habitual use in context of technology. Firstly, a narrative review analysis of habitual use of technology has been conducted to explore the present literature and the underlying concepts of habit formation. Using the systematic review of literature, a content analysis of major theories is done in this study to evaluate the existing information system research. Various measurement scales were compared for various dimensions. In the second study, a measurement scale was finalised comprising of multiple root constructs and it was tested for reliability using Cronbach's Alpha. The six-item scale was validated by examining its relationship with frequency as single item measurement using Spearman's correlation.

Findings : A measurement scale was tested and considered appropriate for future research in

technology. The six-item scale was validated to study habitual use of voice assistants.

Contribution- Various IS theories have been explored along with theories of habitual use to explore the decision making process of technology users. The study suggests the scope of future research in the direction of digital psychology. A measurement scale was tested and validated for further use in the context of technology.

Keywords: habits, habitual use, technology, digital habits, review, test-retest reliability, scale validation

Introduction

Our actions are guided by the ideas and perceptions we have about any object or subject. These ideas could be a product of habits. We often tend to resist new ideas which we perceive as threat to our habits and perceptions. The oldest mentions of habit is found in 1890s, in which Ledger (1893) emphasized on the importance of habits in the belief system of humans. The ideas that people have are because of the closely held habits instead of logic. Habits and perceptions may also result in resistance to change and new ideas. A habit is defined as "fixed way of thinking, willing, or feeling acquired through previous repetition of a mental experience" from a psychological viewpoint (Andrews, 1903, p. 121). Yu (1991) proposed that humans "have habitual ways of thinking, acting, judging, responding, and dealing with problems, which form our habitual domain (HD) when taken together.." However, Verplanken & Wood

¹Research Scholar, Department of Commerce, Delhi School of Economics, University of Delhi
phone- 9899095431, e-mail- kanojiapalak1@gmail.com

²Professor, Department of Commerce, Delhi School of Economics, University of Delhi
e-mail- dr.ashishchandra@gmail.com

(2006) argued that many actions performed regularly may not necessarily be habitual. Habit consists of certain features and therefore it is important to differentiate among multiple overlapping concepts. De Houwar (2019) suggested that definition of habits and habitual behaviour should be selected carefully as each one takes a different perspective which reflects in the measurement and also posits challenges in the empirical study. "Habitization is a process, with no clear demarcation point when strong habits have formed." (Wood & Runger, 2016, p. 295).

Gardner (2015) defined Habitual behaviour as "any action, or sequence of actions, that is controlled by habit." (p. 282). Habits are often linked to learning and are acquired in a systematic order in array of psycho-physical hierarchy. Lower order habits are seen as elements of higher order habits. Bryan & Harter (1899) researched the acquisition of habits in terms of speed, accuracy and automaticity in operating telegraph. This has been one of the oldest studies in habituation of technology. Any habits which have been acquired fully have physical and psychological concurrence. Bayer & LaRose (2018) coined the term "tech habits" as they are distinct in terms of contexts. Technologies are working beyond the spatial as well as time context. Most of the environmental settings are stable under the purview of tech habits. External cues may arise from the technology itself and trigger the behaviour providing a wide variety of potential action behaviours.

Purpose of the study: An attempt has been made to look into the studies on human behaviour in digital environment from beginning till present. The study finds the research gaps in the prior research on habits in context of technology. Operationalization of habitual use was based on the literature review to find the adequate measurement scale to study habits in the context of technology. Main objective of the study is to validate the scale of habitual use.

Design/Approach: A narrative review analysis of habitual use of technology has been conducted to explore the present literature and the underlying concepts of habit formation. Various IS theories will be explored along with theories of habitual use to explore the decision making process of technology users. Content analysis of major theories is done in this study to evaluate the existing information system

research. Multiple items from the appropriate scales were adapted and validated for the reliability of habit measurement.

Literature Review

Up to 1930s habits were viewed as biological mechanism caused due to instincts. This evolutionary perspective emerged as Darwinism in philosophy. By 1980s the economist notions of choices were dominating the literature on habit. However, psychological stances were ignored for a long time and were studied briefly changing the ontology of studies in habits. Recently, economist views have started gaining the popularity again in the studies. The studies of how individuals make choices and exhibit behaviours in social structures are rising again with habits as underlying constructs (Hodgson, 2010). Although recent studies have started focusing on online customer experience lately, most of the research studies in this area are limited to technology adoption and usage only. However, the subject offers much more in terms of multiple dimensions like ethics, addiction, habits and engagement in the context of the online environments leading to a vast arena of digital psychology for academic research.

Many researchers coincide the idea of habit and addiction with each other. Behavioural addiction has been defined as "A repeated behaviour leading to significant harm or distress. The behaviour is not reduced by the person and persists over a significant period of time. The harm or distress is of a functionally impairing nature" (Kardefelt-Winther, et al., 2017, p. 1710). Addiction studies have been prominently studied to examine the information systems adoption (Roberts, Thatcher, & Klein, 2006) and overuse of certain internet applications for example problematic use of mobile phones (Graben, Doering, Jeromin, & Barke, 2020). Panova & Carbonell (2018) concluded that smartphone addiction simply do not exist because of multiple reasons. Addiction is not an appropriate terminology to describe technology-related problematic behaviours. Firstly, the studies on addiction to internet, smart-phone or online gaming are behaviour related studies done on healthy individuals like students or technology users. However, addiction is a clinical terminology and the studies on addictions should be done in clinical settings only after addiction is diagnosed with correct measurement tools. The screening tools used to diagnose addiction to technologies

are self-reported and designed arbitrarily. Frequency of use of technology is used as tool to measure addiction but the concept of frequency overlaps with habitual use and hence habit is a more appropriate term in this scenario.

Aagaard (2020) argued that technology addiction is not an appropriate term instead we should call it habits even though it directs towards problematic use it should be called bad habits. They indicated that addiction is a medical term and therefore this phenomenon of behavioural change due to technology usage implies an unconscious behaviour and merely a lack of self-control. They criticized neuro-behaviourism as it accounts for only pathological aspect of the technology. This approach sees the extremism in technology use as psychologically problematic use of technology and focuses on exploring the ways to combat technology addiction. However, the approach is limited till the bad effects of technology and fails to see the technology as a functional object ignoring the consumerism aspect it carries totally. It focuses on the dysfunctional part of the digital psychology without taking considering other aspects with respect to marketing orientation. It deliberately points towards the harmful affects of technology which may not be generalised over majority of technology users.

According to Kardefelt-Winther, et al. (2017) common behaviours shall not be pathologized to identify it as an addiction. They suggested exclusions to update the operational definition of behavioural addiction and thus behaviours such as excessive mobile phone use or frequent use of social networking sites cannot be diagnosed as addiction merely on the basis of frequency of usage or repetition. It shall be identified as problematic use or bad habit and thus the conceptualization of habitual behaviour must be distinguished from technology addiction as latter is significantly persistent and harmful in nature.

Repeated behaviour is seen as important characteristic when habit is defined as “a propensity to behave in a particular way in a particular class of situations” (Hodgson, 2010, p. 3). Many studies have measured the habitual behaviour through repeated actions and

automaticity as in UTAUT2 (Venkatesh, Thong, & Xu, 2012). Gardner (2015) contended over the conceptual definition of habit as behaviour as habit cannot be termed as the cause of itself. Habit as features of frequent or regular behaviour is incorrect due to lack of explanatory process. Frequency should not be the only criteria to measure habit strength as the habits “can be automatic yet infrequent”. However, this previous study was limited to ascertaining the role of habit in health behaviours and other domains of behaviour were ignored.

Habit formation begins with goals which motivate the repetition of action under context specific environment. Cues trigger the habitual response through memory representation in the context. Habitual action is the outcome in order to pursue the goals which are inhibited or activated by stress [inhibition factor] causing the reduced/increased motivation or perceived ability to perform (Wood & Runger, 2016). Hodgson (2010) argued that habit is a causal mechanism which must be considered as foundation for beliefs and preferences. The actions are guided by choices and beliefs of individuals based on habits and instincts. However, for understanding of impact of social structures on individuals, habit process plays a crucial role.

Verplanken & Wood (2006) suggested that there are different change strategies depending upon strength of habits. Informational downstream interventions are applied when habits are weak, a behavioural change is possible with introducing new information. However, if the habits are strong downstream intervention must be accompanied with the change in context in order to bring a behavioural change. Upstream interventions are applied at a larger scale in case of both weak and strong habits. These changes are brought indirectly or directly in the environment. Technology development is categorised as upstream intervention to change behaviour at a macro-level. Habits are significant for designing behavioural change interventions programs. Habits are predominated by the environmental cues and therefore change interventions could be introduced

in the cues itself by creating newer habits. By merely changing environmental settings may change the habitual behaviour but after the former setting resides, older habits.

Causal elements namely stimulus-driven behaviour should not be included in the definition of habit as it is difficult to verify empirically that goals don't drive behaviour. Removing the assumptions of S-R associations will make it possible to study factors mediating the habitual behaviour. Criticises the stimulus-response assumptions as it contradicts the goal-directed behaviours. The assumption that "stimulus is causally related to the behaviour" implies "that the behaviour is not a function of its anticipated consequences." (De Houwar, 2019, p. 3). Automaticity is measured by frequency of past behaviour in stable context which excludes S-R causal relationship i.e. recency effect however, poses the challenge of not being able to study the goal-directed behaviours still need to be studied. A single-dimensional habit that is solely automatic may have an insignificant association with intention to continue due to insufficient time exposure or experience. A single-dimensional habit that is solely automatic may have an insignificant association with intention to continue due to insufficient time exposure or experience (Ambalov, 2021).

Habits have the power to override the conscious intentions by the unconscious automaticity. As quoted "habit diminishes the conscious attention with which our acts are performed" (James, 1890). Experiential factors and individual traits reduce the self-regulation. In turn, deficient self-regulation drives the habitual use of technology. The underlying goals and rewards can be used as interventions to reduce or promote the habitual actions. Ayaburi, Wairimu, & Andoh-Baidoo (2019) conceptualised habitual use with two dimensions one is conscious decision to use the technology regularly i.e. routine use and the other is unconscious and uncontrolled use in terms of automaticity. Though automaticity is considered a suitable variable of habits which is easier to measure, it is still inadequate as it

renders the mental mechanisms of habitual behaviour impossible to measure (De Houwar, 2019).

Single item scales like frequency, repeated behaviour, and even single dimension like automaticity have been criticised as habit measurement scale for being inadequate and unidimensional, thus a multi-dimensional scale needs to be constructed and tested for validity. To test the relationship between frequency and the multi-item scale the following hypotheses is conceptualised:

H0: There is no correlation between habitual use of voice assistants and their reported use in frequency per week.

Methodology

Study 1: This study was a narrative review analysis using the inclusion/exclusion criteria method of systematic review following the checklist of the "preferred reporting items for systematic reviews and meta-analyses" (PRISMA) by the Centre for Reviews and Dissemination (Page, et al., 2021). Following string theory was used to search for database from the year 1995 to 2021 "((habit*) AND (technology OR internet OR online OR device* OR digital*))". The last search was conducted on 18th May 2021. Inclusion criteria is that all journal articles, conference papers, book chapters and books were included. All writings in language other than English has been excluded. Excluding the areas other than business, economics, psychology and management, 1115 research studies were extracted. Only Scopus indexed journals are used for the purpose of this study. A keyword analysis was performed to find relationships among emerging themes.

Study 2: For this study, a six-item scale (refer to table 5) was adapted from (Ayaburi, Wairimu, & Andoh-Baidoo, 2019) and (Verplanken & Orbell, 2003) who argued that single item measures of habit strength and behavioural frequency are unreliable. Therefore, first three items (hab1, hab2 and hab3) indicated frequent use and routine (repeated) use while other three items (hab4, hab5 and hab6) indicated automatic use of

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.842	.843	6

Table 1: Cronbach's Alpha

A Spearman's rank-order correlation was run to examine the relationship between users' habitual use of voice assistants and their reported frequency per week. There was a strong, positive correlation between habitual use and frequency (table 2), which was statistically significant ($r_s = 0.325, p = .001$).

Correlations				
		habit frequency		
Spearman's rho	habit	Correlation Coefficient	1.000	.325**
		Sig. (2-tailed)	.	.000
		N	558	558
	frequency	Correlation Coefficient	.325**	1.000
		Sig. (2-tailed)	.000	.
		N	558	558
**. Correlation is significant at the 0.01 level (2-tailed).				

Table 2: Spearman's Correlation

Thus, null hypotheses is rejected and it is confirmed that there is a significant positive relationship between habitual use and frequency per week. Thus, it is verified that six-item scale measures the habitual use of technology correctly. However, this study does not recommend following a single scale of frequency to measure habit, rather it is highly recommended to follow a multi-dimensional scale of habitual use.

Discussion

Multiple aspects of habits have been studied in different studies however self-reported measures of habit are still a point of conflict in empirical studies. There are many measurement related limitations with the established scales. SRHI studied in communication and IS research is inadequate as it does not include self-realisation parallel. UTAUT2 measured habit with scale suffering from similar inadequacies though it focuses on automaticity and repeated behaviour. However, operational definition of habit is limited to automaticity and past behaviour in the UTAUT2 model. Context element has not been studied from the point of view of environmental setting and therefore, a clear understanding of the triggering events have not been taken into account. Lack of inclusive measurement of habit fails to generate the knowledge on how the tech habit mechanism processes in a virtual environment. RFMMH index however concentrates on goal dependent behaviour. Even though it was suitable for media preferences, RFMMH was found to be a weak scale for context stability (Naab & Schnauber, 2016). The findings coincide with Verplanken & Orbell (2003, p. 1324) who suggested to "consider habit as psychological construct" and not merely restrict it to the behavioural frequency.

There has been an overwhelming research in tech addiction however the measurements suffer from the drawbacks of conceptualisation of "habits" as the operationalisation is from the pathological approach namely problematic use or frequency for instance overuse (Bayer & LaRose, 2018). Problematic use of technology should not be passed off loosely as addiction but should be studied in context of bad habits if there are any harmful effects the user is facing due to over indulgence in a particular behaviour related to technology use. Every technology may have a few advantages as well which are completely ignored when the term addiction is used to connote habitual behaviour. For example, smartphones have benefits like convenience, portability etc, online gaming is

used for recreational and entertainment purposes and internet provides information and connection to global network. Misuse or over use of technologies may prove to be dysfunctional but it shall not be confused with the clinical term like addictions which implies a neuropsychological context and demands similar level of interventions by psychological experts (Panova & Carbonell, 2018).

Habit is expressed as a mental process being a product of repetition however it is not an unconscious effort but are experienced under the state of consciousness. Thus habitual behaviours shall be studied as conscious process which an individual experiences both mentally and physically (Andrews, 1903). Another shortcoming of research in tech habits is lack of model or theory generalised to all technologies explaining key habit mechanisms. Instead, the studies focus on researching key attributes specific to underlying technology or device or medium being studied. Therefore, a generalised theory or model should be developed to examine tech habits.

Self-reported measurement of habits are widely used and feasible in terms of academic research. However, other methods of research are highly recommended to be applied in order to explore the realistic picture of context, cues and other mechanisms in tech habits. Rieder, Lehrer, & Jung (2019) advocated the use of narratives for identifying elements and understand the participants' viewpoints towards habitual use of wearable technology. They highly suggest the use of qualitative method like narratives to study the behavioural perception of the individuals as they are free of prejudices and biases when the individual respondents are given freedom to choose the discourse and direction in the interviews. Most of the studies have been conducted from positivist approach. Thus, scientific research methods have been followed to study the phenomenon through quantitative data. Scientific inquiry, although is one of the most viable approaches suffers from the shortcomings of positivism. Although the approach has been contributing in identifying

various causal relationships, it fails to take into account the complexities of social phenomenon.

Habitual behaviour is a physical, psychological and affective process which changes the course of formation, creation, continuation and disruption in a virtual environment. The process also consists of plethora of individual experiences. Taking an interpretivist approach to understand the user experiences may facilitate in comprehending the meanings individuals ascribe to "tech habits" and their relationships with the virtual settings. It was discovered that habit, both directly and through the sensitization process, favourably influences dependency on social media use. In addition, it was observed that perceived sensitization rose as habit strength did. Additionally, perceived dependency rose as sensitization did (Soror, Steelman, & Turel, 2022).

Implications and Recommendations

The study's findings are consistent with earlier studies, showing a relationship between self-reported frequency of use and habit (Venkatesh, Davis, & Zhu, 2023). Management must therefore concentrate on researching habit as a powerful behavioural predictor. While it is necessary to improve internet technological assistance in order to provide more favourable conditions for online behaviours, programmes that emphasise the development of habits should also be given priority, thus suggesting continually monitoring the usage habits and patterns (Paiman & Fauzi, 2023). It has been observed that consumers' acceptance of roughly similar technologies is influenced by their habit of using them, hence it is crucial for management to determine how familiar their users are with similar technologies so that future product development can be based on that knowledge (Phibbs & Rahman, 2022). In the history of habit research, ontological paradigm was followed initially. Lately, epistemological paradigm was followed with positivist approach. However, a methodological paradigm might change the discourse of tech habits and mixed method research study will unlock the doors to generalised theories.

Conclusion

The six-item scale can be used extensively for measuring the habitual use of different technologies. It is not limited to any specific media and hence can be generalised over multiple technology behaviours. This study evaluates the various paradigms and suggests that habit research will evolve rapidly in the technology marketing. This study is limited to resources available on Scopus only and therefore it can be expanded to other databases as well. Cluster one has the most important implications as it recognises the various constructs which must be studied further to develop model in human computer interaction and decision making in technology marketing. Perceptions, motivation, anxiety, attention and learning. This analysis also reveals major theoretical gaps in habit research in technology. There are theoretical implications of the study making contribution in the field of neuro-science and digital psychology. tech habits will contribute in future studies on – intense experiences, technical affordances, flow, immersive engagement (Verplanken B. , 2018, p. 124). Many other variables can be explored in technology habits which are revealed through UTAUT, IS habit formation theory and Technology Threat Avoidance Theory (TTAT).

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Annexures

Summary Item Statistics					
	Mean	Minimum	Maximum	Variance	N of Items
Item Means	2.945	2.464	3.247	.072	6
Inter-Item Correlations	.472	.216	.630	.013	6

Table 3: Item Means, Correlations

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
hab1	14.42	21.688	.524	.382	.833
hab2	14.54	20.149	.652	.511	.810
hab3	14.72	19.278	.702	.519	.799
hab4	14.69	19.462	.697	.509	.800
hab5	14.78	19.881	.648	.471	.810
hab6	15.20	20.490	.509	.322	.840

Table 4: Item-Total Statistics

Construct	Root Constructs	Code	Scales	Source
Habitual Use	Frequent Use	Hab 1	I frequently use the Voice Assistant (s).	Ayaburi, Wairimu, & Andoh-Baidoo (2019)
	Routine Use	Hab 2	I regularly connect to the Voice Assistant (s)	
		Hab 3	Using Voice Assistant (s) belongs to my daily routine	Verplanken & Orbell (2003)
	Automatic Use	Hab 4	I use Voice Assistant (s) without having to consciously remember	
		Hab 5	I use Voice Assistant (s) automatically.	
		Hab 6	That makes me feel weird if I do not use Voice Assistant (S)	

Table 5: Six-Item Scale for Habitual Use