

Exploring the Effects of Habit Strength on Scholarly Publishing: A Decomposed Perspective  
on the Theory of Planned Behavior

Corresponding author:

Lars Moksness

Tromsø School of Business and Economics and University Library

UiT – The Arctic University of Norway

Hansine Hansens veg 18

9019 Tromsø, Norway

[lars.moksness@uit.no](mailto:lars.moksness@uit.no)

+4777644154

Svein Ottar Olsen

Tromsø School of Business and Economics

UiT – The Arctic University of Norway

Hansine Hansens veg 18

9019 Tromsø, Norway

[svein.o.olsen@uit.no](mailto:svein.o.olsen@uit.no)

+4777646133

## **Abstract**

Governments and other funding bodies are increasingly requiring that research articles are being made available as open access (OA). Researchers appear positive to the premise of OA but are reluctant to fully embrace the model. Decisions are heavily influenced by attitudes and publishing norms, however another reason for the relatively low OA adoption is that publishing habits are anchored to non-OA journal publishing. Still, only limited research has been undertaken to explore the effects of habit strength in relation to scholarly OA and non-OA publishing. The present research investigates the role of habit strength in a decomposed theory of planned behavior perspective in a Norwegian sample of researchers. A latent factor model is applied and analyzed within a structural equation model (SEM) perspective. The results provide valuable insights to practitioners and policy makers and can constitute a framework from which to design future studies and develop policies.

**Keywords** – Open access, psychology, scholarly publishing, theory of planned behavior, TPB, habit strength

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# Exploring the Effects of Habit Strength on Scholarly Publishing: A Decomposed Perspective on the Theory of Planned Behavior

## 1. Introduction

At present, there are two broad methods for research dissemination by scholarly articles, open access (OA) and non-open access (non-OA). The major difference between the two is that while OA literature is freely available to consumers, non-OA literature is available only at a cost (e.g., for a journal subscription or single article download). The European Commission stated in the Europe 2020 strategy recommendation of 2012 (European Commission, 2012) that “publicly funded research should be widely disseminated through open access publication of scientific data and papers” (p. 2). Although the premise of OA seems reasonable and beneficial to the progress of science, adoption of the publishing model has been slow (Björk, 2017). Researchers are reluctant to fully embrace the model due to insecurities about the overall quality of OA material and an apparent lack of incentives that would reward the switch from non-OA to OA, although some suggestions are in the pipeline (European Commission, 2017). Even with the advent of the Internet and the prospect of transitioning journals to digital media, researchers and publishers both feared the consequences and the possible erosion of scientific journals (Odlyzko, 1995). At present, however, few researchers appear to think twice about journals being digital.

Many actions performed on a daily basis are the results of habit (Wood & Rünger, 2016) and these automated behaviors have the advantage of reducing the cognitive load of decision-making (Ouellette & Wood, 1998). Scholarly publishing activities are influenced by familiarity with journals, scope, impact factors, editorial boards, and requirements that facilitate researchers' decisions on where to submit their articles (Extejt & Smith, 1990; Knight & Steinbach, 2008; Watkinson et al., 2016). Research has shown that familiarity and experience are important factors in habit formation (Lally, Wardle, & Gardner, 2011) and also

pertaining to scholarly publishing (Knight & Steinbach, 2008). One contemporary challenge surrounding scholarly publishing is to shift how we think about dissemination, accessibility, and funding. Digitalization only shifted the medium of dissemination, while accessibility challenges how we think of the nature of dissemination itself. Habits, however, are firmly anchored in what we are used to, and that is traditional non-OA publishing. Consequently, the publishing climate remains favorable toward maintaining the status quo irrespective of increasing demands by governments and funders to enable OA for research. To the authors' knowledge, no empirical studies have been undertaken to systematically investigate the role of habit strength (Verplanken & Orbell, 2003) in explaining or predicting scholarly OA or non-OA publishing intention and behavior.

Several theories, factors, and antecedents are competing to explore or explain the process leading up to submitting an article to a journal (Dulle & Minishi-Majanja, 2011; Khalili & Singh, 2012; Moksness & Olsen, 2017; Park, 2009). Attitudes (Xia, 2010), perceptions of trust (Watkinson et al., 2016), quality (Craft, 2016), normative influences (Migheli & Ramello, 2013), and incentives (van Dalen & Henkens, 2012) are among the frequently used explanations for publishing intention or behavior. Even personality traits and identity are facets that in certain dimensions set researchers on different paths and underpin variations in decision-making (Busse & Mansfield, 1984; Feist, 1998). A line can be drawn between actions that are inherently elaborative and those that are automatic, of which attitudes and intentions are the former and habits are the latter (Ouellette & Wood, 1998; Wood & Neal, 2007). However, the knowledge about how these factors influence or drive publishing intentions and behavior in any larger sample of researchers is at best limited.

The theory of planned behavior (TPB) is an influential framework for measuring and explaining a wide range of human activities and behaviors (Armitage & Conner, 2001; Fishbein & Ajzen, 2010), and habit is one of the constructs used to approach a deeper

understanding of planned behavior (De Bruijn, 2010; Verplanken, Aarts, Knippenberg, & Moonen, 1998). Prior work has investigated the multidimensionality of attitudes, norms, and behavioral control, which subsequently lead to the expansion of the TPB (for an extensive record, see Fishbein & Ajzen, 2010). The vast body of literature investigating the TPB ensures replicability of its basic structure, further enabling extensions to be tested with some measure of confidence (Armitage & Conner, 2001).

Thus, the aim of the current study is to contribute to the emerging research stream that systematically investigates the deeper attitudinal and behavioral structure involved in OA and non-OA scholarly publishing (Dulle & Minishi-Majanja, 2011; Khalili & Singh, 2012; Moksness & Olsen, 2017; Park, 2007). This article operates with broad definitions of OA and non-OA journals. This study also utilizes a theory of planned behavior (TPB) (Fishbein & Ajzen, 2010) framework with the goal of exploring alternative models within the context of OA intentions and behavior. Subsequently, the traditional model will empirically test intention to submit to non-OA journals and non-OA publishing behaviors. We include an adapted habit automaticity subscale based on the Self-Reported Habit Index (SRHI) (Gardner, Abraham, Lally, & de Bruijn, 2012; Gardner, de Bruijn, & Lally, 2011; Verplanken & Orbell, 2003). The models will be tested within a latent factor structural equation modeling approach in a sample consisting of 1,588 researchers from the major universities in Norway.

## **2. Background and theoretical framework**

The veracity of the role of expectancy-value models in ascertaining publication intentions and behavior is not well-documented, albeit with few exceptions (Dulle & Minishi-Majanja, 2011; Khalili & Singh, 2012; Moksness & Olsen, 2017; Park, 2007, 2009). On the other hand, several studies have determined an array of considerations and influences that researchers contend with when selecting a publication outlet (Craft, 2016; Knight & Steinbach, 2008; Togia & Korobili, 2014; Xia, 2010). These determinants may be broadly grouped into attitudes toward the behavior, the influence of norms, and the perceived ability to perform the

behavior. The basic TPB framework describes behavior as determined by its most proximal and central component, intention. Intentions are defined as the “motivational factors that influence a behavior; they are indicators of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior” (Ajzen, 1991, p. 181). The TPB is used to explain a wide range of intentions and behaviors (Armitage & Conner, 2001; Fishbein & Ajzen, 2010), especially within health psychology (Godin & Kok, 1996), but also extending into technology acceptance and usage (Pavlou & Fygenson, 2006) and open access adoption (Dulle & Minishi-Majanja, 2011; Khalili & Singh, 2012; Moksness & Olsen, 2017).

Typically, attitudes are found to have the strongest impact on intentions followed by norms and perceived behavioral control (PBC). According to Fishbein and Ajzen (2010), the attitudinal factor consists of an instrumental and an experiential component, which reflects a cognitive/affective split. Norms are viewed as consisting of injunctive and descriptive indicators, basically a distinction between how significant others expect one to behave and how significant others actually behave. Finally, behavioral control reflects a distinction between ability and actual control to perform a behavior. Some studies suggest that the intentional antecedents, such as norms (Cialdini, 2007), could benefit from being decomposed into their respective subscales depending on the research context, a notable example being the early work on the technology acceptance model (TAM) (Davis, 1986). Other approaches allowed for crossover effects between attitudes and norms resulting in development of the decomposed TPB (DTPB) (Taylor & Todd, 1995a, 1995b). Consequently, for the purposes of the present study, the cognitive, descriptive, and perceived ability components have been retained in an adaptation of the decomposed TPB.

Research on habit encompasses a wide array of topics and has a research stream spanning several decades to behaviorism in psychology (Yerkes & Dodson, 1908). Consequently, some

different definitions of habit are found. For the purposes of the present study, we rely on the definitions proposed by Triandis (1979), Verplanken and Aarts (1999), and Gardner (2015). For instance, Triandis (1979) viewed habit as automated behavior not necessarily carried out with conscious awareness. The definition advanced by Gardner (2015) captured the nature of habit formation and activation (albeit originally intended as a definition of health-related habits), whereby “habit is a process by which a stimulus generates an impulse to act as a result of a learned stimulus-response association” (p. 1). In short, habit strength is the result of repeatedly performing a behavior that reaches a point whereby an action is performed with a high degree of automaticity (Verplanken, 2006). Thus, the present article views OA publishing habit strengths as *initially* being automated, non-effortful, and goal-directed actions (Verplanken & Aarts, 1999).

Several decades’ worth of academic publishing utilizing one publication model is arguably sufficient to establish habitual behaviors and preferences toward that model (Odlyzko, 1995). However, this did not become entirely apparent until a candidate dissemination method was introduced (Oppenheim, Greenhalgh, & Rowland, 2000), and researchers had to adapt to a changing dissemination environment. Reviewing the literature from the advent of digital media, the notion that the initial publishing model preference may be habitual becomes apparent. Habit is an influential predictor of future behavior (Wood & Rünger, 2016), a concept that arguably extends beyond the mere aggregation of the frequency of past behavior (Verplanken & Orbell, 2003). Habit is found to directly affect behavior, sometimes transcending the magnitude of the effects of the traditional TPB cognitions and intentions (Ouellette & Wood, 1998). Efforts have been undertaken to integrate habit strength in the TPB at various levels, including technology acceptance and usage (De Guinea & Markus, 2009). Habit is also suggested as a mechanism for maintaining lasting behavioral change (Gardner, Corbridge, & McGowan, 2015), a notion of particular interest in the present

study. It is a relatively common practice to examine the interactive or additive effects of habit in TPB studies (Limayem, Hirt, & Cheung, 2007; Verplanken & Aarts, 1999). However, the extant literature on OA adoption and behavior (Dulle & Minishi-Majanja, 2011; Khalili & Singh, 2012; Park, 2007) does not contain any discussion or test of the role of habit strength in explaining or predicting academic publishing intention or behavior. It is therefore pertinent to examine the possible effects of habit at various levels in our framework.

### *2.1. Alternative roles of habit (strength)*

If and how habit is related to intention and behavior within a TPB framework is not clear (Ajzen, 2002; Gardner, 2015; Limayem et al., 2007; Ouellette & Wood, 1998). For example, habit is defined as an intentional antecedent in line with attitudes, norms, and control (Honkanen, Olsen, & Verplanken, 2005), as a mediator between attitude and intention (Saba & Di Natale, 1998), and as a moderator between intention and behavior (De Bruijn et al., 2007; Gardner et al., 2015; Limayem et al., 2007). The mediation model of habit between attitudes and intention has, however, received criticism due to theoretical and methodological shortcomings according to some researchers (Limayem et al., 2007). Limayem et al. (2007) suggested that some of the studies supporting this approach suffered from not modelling habit according to its automaticity quality and relying on the frequency of behavior instead. The authors also cited an omission of an actual behavioral measure, in addition to an uncertain theoretical argument for the model, as limitations of this approach. In order to assess whether proceeding with a mediation model is fruitful, the mediating qualities of habit strength (measured as automaticity) between the traditional intentional antecedents and intentions should therefore be tested. Based on the aforementioned review, a conceptual model is proposed (Figure 1 and Figure 2) to visualize how the TPB dimensions (attitude, norms, and perceived behavioral control) relate to OA publishing habits among researchers and the effects of habit on intentions and behavior (publish OA or non-OA). Figure 1 represents the baseline model and Figure 2 shows the 4 alternative models. Model 1 tests the effects of

attitudes, norms, behavioral control, and habit as independent variables for OA intention.

Model 2a assesses whether habit fully mediates the effects of attitudes, norms, and behavioral control on OA intentions and Model 2b determines if this relationship is partially mediated.

Model 3 is reduced in order to examine the relationships between habit, intentions, and behavior (OA/non-OA). The development of the various models is presented in Figures 1 and 2.

Figure 1. Baseline model

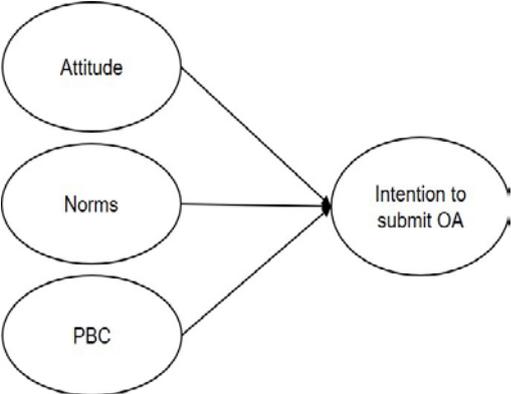
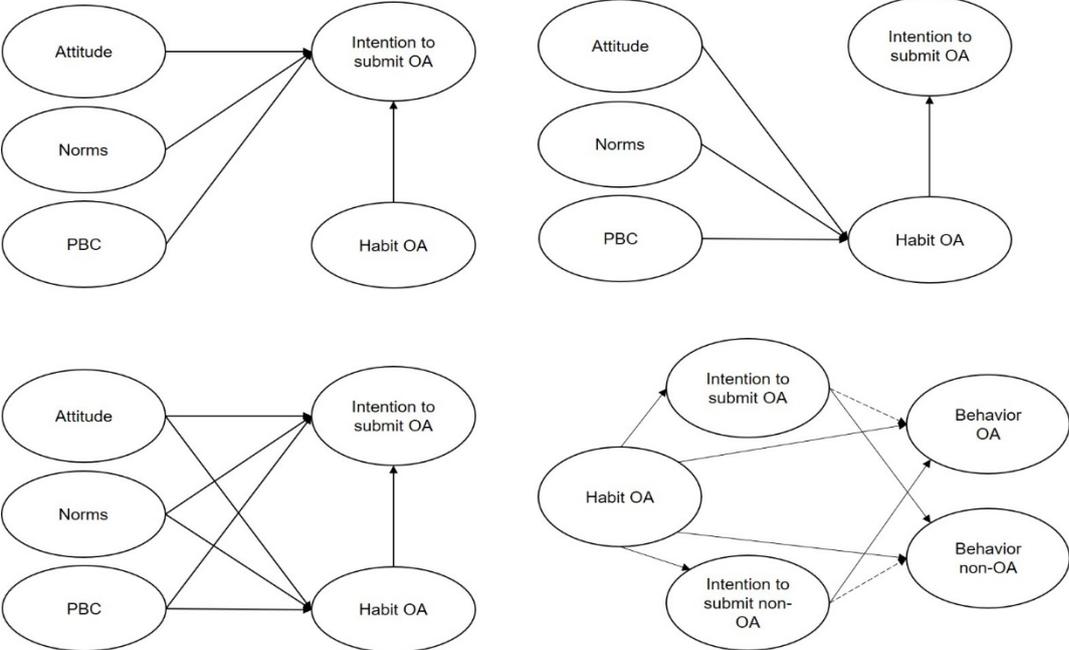


Figure 2. Alternative models



### *Habit as an extension of the theory of planned behavior*

The baseline model (Figure 1) in this study is a decomposed and parsimonious version of the TPB in which the factorial relationships are expected to be replicated along the lines of previous studies utilizing similar frameworks (Dwivedi et al., 2017; Taylor & Todd, 1995b). Recall that attitudes are typically found as the foremost predictors of intention followed by norms and behavioral controls (Armitage & Conner, 2001; Fishbein & Ajzen, 2010). As such, researchers' instrumental attitudes toward submitting research articles to OA journals is expected to significantly and positively influence OA intentions over and above the effects of descriptive norms and PBC capacity, respectively. However, in several of the TPB-related studies that examined a normative construct, the effect on intention has proven to be elusive, albeit a positive influence on behavior is reported (Dulle & Minishi-Majanja, 2011; Khalili & Singh, 2012; Park, 2007). Khalili and Singh (2012) speculated that these results could be because publishing in OA journals had not obtained sufficient social influence. Given the influence of norms throughout academia (Linton, Tierney, & Walsh, 2011; Migheli & Ramello, 2013), it is likely that the normative component will affect OA intentions as the field continues to mature.

As presented in Model 1 (Figure 2), habit strength in some studies is defined as an independent predictor of intention similar to attitudes, norms, and behavioral controls (Honkanen et al., 2005). The notion of habit in this study rests on the premise that it is an automated and not elaborative behavior even though it can be referred to as intentional (Verplanken & Orbell, 2003). This is an important distinction as both habitual intentions and intentions are goal directed per se; however, only one involves a conscious decision. Intentional behaviors do form the basis of habit development (Gardner, 2015), which also implies that habits should be able to influence future intentions and behavior (Ouellette &

Wood, 1998). For instance, Honkanen et al. (2005) suggested that the attitude intention relationship is stronger among those who have well-developed intentions. If attitudes are weak, past behavior may constitute the most salient piece of information and thus form the basis of evaluative intentions in a food context. Their results showed that past behavior (frequency) is different from habit strength (automaticity), and past behavior was found to influence intention over and above habit. Both constructs were superior determinants of intention as opposed to attitudes in their study.

Although the argument could support a direct effect by habit on intention, we suggest that certain specific research contexts, such as academic OA publishing, are governed by strong and deliberate attitudes, opinions, and normative pressures that drive intention (Migheli & Ramello, 2013). Hence, in a model wherein the traditional intentional antecedents are present, any direct effect of habit will likely be mitigated. This means that when expressing conscious intentions to submit an article to an OA journal, it is expected that the salient and influential determinants on intention for researchers are their attitudes, the observed behavior of peers, and the perceptions of their own capacity to perform the behavior. That is, intention to submit to an OA journal encapsulates an elaborative and conscious effort or probability to engage in a behavior and will be predicted by the intentional antecedents rendering habit OA non-significant as a direct determinant.

## *2.2. Habit-mediator models*

While the intentional determinants may trump the direct effects of habit on intention in this context, a question remains whether the effects of these variables can be mediated by habit within our research context. That is, does an automaticity specific habit strength subscale mediate the effects of attitudes, norms, and behavioral capacity on intention to submit to OA journals? This question forms the basis for our two habit-mediator models (Models 2a and 2b) presented in Figure 2. Recall that this approach has received criticism in part due to the apparent lack of utilizing and automaticity specific habit construct (Limayem et al., 2007).

Mediation translates to the effect on an outcome variable by one (or more) variables through one or more intervening or mediating variables (Baron & Kenny, 1986). According to Baron and Kenny (1986), full mediation occurs when an antecedent variable only has an indirect effect on an outcome variable through and intervening or mediation variable. Partial mediation, on the other hand, occurs when the direct effect of an antecedent variable is reduced but not rendered non-significant by the presence of a mediator. The TPB provides a good example for both full and partial mediation (Fishbein & Ajzen, 2010): the effects of both attitudes and norms on behavior are fully mediated by intention, whereas PBC is often modelled as being partially mediated by intention, which means it can have a direct effect on behavior as well.

In order to explore this effect, we should first conduct an examination of the possible antecedents to ascertain whether they can generate habits. Instigating a task can be intentional; however, the continuation of a series of habitual actions as a result of the intentional act may themselves be unintentional (Verplanken & Aarts, 1999). Additionally, some researchers have considered any given habit as a behavioral script that acts a mediator between situational cues and behavior (Klößner & Matthies, 2004). This viewpoint hails from the examination of the script concept by Abelson (1981), whereby scripts act as a knowledge structure and habit is a response program. For instance, the act of preparing a manuscript to submit to a favorite journal consists of several behavioral steps, from the simplest (opening the browser) to the more complex (literature search) and so on. The habitual behavior is, according to Klößner and Matthies (2004), the result of these behavioral scripts and would constitute submitting the manuscript to a journal.

Habits are suggested to relate to constructs that are relatively stable over time. Several antecedents such as prior use (of an IT), perceived value, satisfaction, importance, and norms have previously been identified (Bayer, Campbell, & Ling, 2015; Chiu, Hsu, Lai, & Chang,

2012; Hsiao, Chang, & Tang, 2016; Klöckner & Blöbaum, 2010; Lankton, Wilson, & Mao, 2010; Limayem et al., 2007). Bayer et al. (2015) suggested that connection norms (in relation to an IT) has the potential to activate habits dependent on salience. Norms would appear to be the foremost contenders in relation to OA publishing (Migheli & Ramello, 2013) perhaps due to the observed behaviors of peers and the existence and influence of “invisible colleges” in academia (de Solla Price & Beaver, 1966; Price, 1971). These normative structures possibly have more powerful direct effects on instigating automatic habitual behavior than inquiring about researchers’ conscious attitudes about whether enabling OA to one’s own research is, for instance, good or bad. Thus, we may indeed find that habit is generated by the intentional antecedents we employed, in particular norms. What is uncertain is the level of influence of each construct and whether habit channels these influences to an intention to submit an article to an OA journal.

Furthermore, if habit fully mediates the independent variables, we would find that they are no longer significant predictors of intention when habit is introduced into the model, and whether the relationship is partially mediated we would observe a reduction in their respective effects on the mediator while still retaining a significant effect on intention (Baron & Kenny, 1986). For instance, Hsiao et al. (2016) investigated the mediation effects of habit and satisfaction on continuance usage intentions of mobile apps by perceived enjoyment and social ties. Although their results showed that the mediated effects were stronger through satisfaction, habit also proved to significantly mediate the effects of the independent variables.

### *2.3. Decomposed dual behavioral model*

Our third model includes self-reported publishing behavior (OA and non-OA). This model includes non-OA behavior since university scholars have several outlets for publishing their articles. When a publishing habit has been formed, it likely influences both cognitions about where to submit articles (intention) and actual publishing behavior. This relationship will also

be determined by the individual researchers' level of habit strength, for instance, weak or emerging OA publishing habits may inconsistently influence the outcome (OA or non-OA publishing). Another possibility is that publishing behaviors undergo some process of routinization in order to become habitual (Gardner, 2015), and researchers are likely in different stages of the same habit-forming process at the same time. Routinization does not, however, necessarily equate habituation (Ajzen, 2002), and routinized behavior likely requires less cognitive effort to change.

Habit is a contributor of future intentions and behavior (De Guinea & Markus, 2009; Ouellette & Wood, 1998). De Guinea and Markus (2009) suggested that an intended task can trigger habitual IT usage in that achieving the overarching task or goal necessitates the use of a computer, the Internet, and text-editing software. Although the actions of using a computer are habitual, they need not be intentional to achieve the goal in this context. Situational or environmental cues may trigger habitual behaviors (Bargh & Ferguson, 2000). The behaviors may initially be intentional; however, the perpetuation of further behaviors can be unintentional (Verplanken & Aarts, 1999). Khalili and Singh (2012) recognized that possessing sufficient IT skills is necessary in order to successfully use OA, and Togia and Korobili (2014) cited unfamiliarity with the OA publishing model and how to find suitable OA journals to publish in as some of the major constraints in researchers' OA usage. Expanding on this line of reasoning, we see that submitting an article to a known journal is likely facilitated by some, if not most, of the steps in the process being habituated and thus performed automatically.

Ouellette and Wood (1998) suggested that the frequency of previous behavior is likely to have a favorable effect on future intentions, although the frequency of past behavior is not necessarily an optimal proxy for habit (Limayem et al., 2007). The authors noted an important distinction, however, between behaviors that are performed daily or weekly and annually or

biannually. Intentions were in this regard found to be the strongest predictors of future behavior when the behavior is performed infrequently. Intuitively this makes sense, when considering that the likely most salient feature of a behavior that is performed frequently and in a stable context is the repeated performance of the behavior itself. This is probably due to some form of recency effect (Murdock Jr, 1962) whereby the most accessible memory of a frequently performed behavior is also the easiest to retrieve. However, this effect can also be due to weak attitudes (Honkanen et al., 2005). Publishing research articles is arguably an activity that takes place infrequently and thus should result in a more pronounced effect by intentions rather than habits on behavior in our study.

A strategy to reduce confounding by the traditional independent variables is to deconstruct the model and assess the relative contribution of habit strength in a habit-intention-behavior structure. Individuals can publish their work in either OA or non-OA or both and with different valences and levels of habit strength. In a study utilizing a similar framework as the present article, Şimşekoğlu, Nordfjærn, and Rundmo (2015) found that car use habit strength reduces both public transport use intention and behavior. The investigators discovered that individuals who have developed a habit for car use associated more barriers with using public transportation than their health-promoting counterparts who possessed no car use habit. Similar to OA adoption then, where the ideal outcome is arguably a public good, an established and disparate habit may indeed have negative consequences.

Comparative strategies have previously been used in exploring or understanding the deeper structure of TPB or reasoned action frameworks (Dwivedi et al., 2017; Pavlou & Fygenson, 2006; Taylor & Todd, 1995a, 1995b). Although the decomposed TPB (Taylor & Todd, 1995b) in reality expands the number of factors that are typically assessed in a TPB model, our intention is to reduce the factors in order to isolate the effect of habit.

### **3. Research methodology**

#### *3.1. Participants and procedures*

The survey was sent to 19,649 recipients in September 2017 and the sample consisted of researchers from the major academic institutions in Norway. Email addresses were collected from the institutional websites. Some websites did not allow the differentiation between scientific and administrative staff, resulting in email invitations being sent to recipients who did not fit the scope of the study. However, information about the surveyed institutions showed that the total number of scientific staff was 14,255 in 2016 (Regjeringen, 2017). The participants received an email invitation with a link to a web questionnaire. A requirement for participation was experience with scholarly publishing (have published or will publish scholarly articles). A total of 1,588 responses were received, which approximates an 11% response rate. Initial data screening and pre-analysis determined which items should be dropped from further analysis.

### *3.2. Measurements*

Publishing behavior was assessed by one item for each publishing paradigm, whereby the respondents indicated the frequency of their own publications in either OA or non-OA journals over the prior 2-year period. The items were measured on 10-point scales where 1 = 0 publications and 10 = more than 10 published articles. We opted for a frequency measure to be able to differentiate the behavioral criterion from the automated habit subscale. Only the words OA and non-OA were different in the item texts; *“How many articles would you say that you have published in OA journals within the last 2 years?”*

Intention to submit to either an OA or a non-OA journal was measured on 7-point scales (1 = extremely unlikely to 7 = extremely likely) comprising 3 items each. The items reflected that one will try, intend, or plan to submit articles to OA/non-OA journals. A sample item is: *“I will try to submit research articles to non-OA journals within the next 2 years.”* The formatting of the items followed the recommendations of Fishbein and Ajzen (2010) and similar items have previously been utilized in research on OA adoption (Khalili & Singh, 2012).

*Attitudes* were measured on 7-point bipolar scales where the respondents first read the text “*For me, submitting articles to OA journals is...*” and then were asked to indicate if this is “*useless – useful, bad – good, foolish – wise,*” or “*unimportant – important.*” These items have been found to reflect the cognitive or instrumental attitude component (Fishbein & Ajzen, 2010). *Descriptive norms* were measured by two items on 7-point scales where the respondents indicated the level of agreement with statements concerning the OA publishing frequency of their peers and to what extent they believed researchers they know publish in OA journals regularly. A sample item is “*Most researchers I know submit their research articles to open access journals regularly.*”

The 5-item automaticity specific subscale of habit strength was based on the Self-Reported Behavioral Automaticity Index (SRBAI) (Gardner et al., 2012) that was extracted from the 12-item Self-Report Habit Index (SRHI) (Verplanken & Orbell, 2003). This scale has demonstrated good construct, convergent, and predictive validity with the SRHI (Gardner et al., 2012). The scale utilized in the present study was adapted to the research context. Item selection was based on the work of Gardner et al. (2012) who used expert assessments to reduce the number of items in the SRHI to reflect automaticity. Items were measured on 7-point scales and the following text preceded the items: “*The decision to submit an article to an OA journal is something...:*” “*I do automatically,*” “*I do without thinking,*” “*I would find hard not to do,*” “*That would require effort not to do it,*” and “*I start doing before I realize I am doing it.*” The SRBAI is found to perform well across studies (Gardner et al., 2012).

## **4. Results**

### *4.1. Reliability and validity of measures*

Prior to further analyses, a confirmatory factor analysis (CFA) was conducted to ascertain construct reliability and validity. The results are displayed in Table 1. Initial analysis of the unconstrained measurement model indicated the normed chi-square exceeded the recommended threshold of  $< 5$  (CMIN/DF = 7.48; df = 131). Other fit indices showed the

model fit the data well (CFI = 0.96; TLI = 0.95; RMSEA = .064) and was within recommended thresholds (Kline, 2011). The modification indices indicated possible problems with the covariance between three items in the habit scale. Constraining the variance of these items and conducting the CFA again reduced the normed chi-square to within bounds while slightly improving the overall fit (CMIN/DF = 4.45; df = 131; CFI = 0.98; TLI = 0.97; RMSEA = .047). Internal consistency of the items was confirmed by the composite reliability and variance extracted scores. These numbers should be greater than 0.70 and 0.50, respectively. The discriminant validity for the constructs is indicated by the square root of the AVE exceeding the correlations and are displayed in bold in Table 2 (Fornell & Larcker, 1981). Table 3 shows the correlations and descriptive statistics for the measurement model and all values are significant except for PBC and non-OA behavior ( $r = -0.02$ ). Habit strength OA displays a significant and moderately strong correlation with all OA constructs, including OA behavior ( $r = .16 - .55$ ), while being negatively associated with both intention non-OA ( $r = -.49$ ) and behavior non-OA ( $r = -.32$ ).

Table 1. Standardized confirmatory factor analysis coefficients and construct reliabilities

Constructs and indicators	Factor loadings	Composite reliability	Variance extracted
<b>1. Attitudes OA</b>			
<i>(For me, submitting articles to OA journals is...)</i>			
Useless – useful	.89		
Bad – good	.87		
Foolish – wise	.86		
Unimportant – important	.85		
<b>2. Norms OA</b>		.89	.80
Most researchers I know submit their research articles to open access journals regularly.	.87		
Of the researchers you know, how many submit their research articles to open access journals regularly?	.91		
<b>3. Perceived behavioral control OA</b>		.76	.52
How much personal control do you feel you have over submitting your research articles to open access journals?	.60		
How confident are you that you will be able to submit your research articles to open access journals?	.90		
If I wanted to, I could easily submit my research articles to open access journals.	.63		
<b>4. Habit strength OA</b>		.89	.61
<i>(The decision to submit an article to an OA journal is something...):</i>			
...I do automatically.	.89		
...I do without thinking.	.86		
...I would find hard not to do.	.73		
...that would require effort not to do it.	.70		
...I start doing before I realize I am doing it.	.72		
<b>5. Intention to submit to an OA journal</b>		.98	.94
I will try to submit research articles to OA journals within the next 2 years.	.96		
I intend to submit research articles to OA journals within the next 2 years.	.99		
I plan to submit research articles to OA journals within the next 2 years.	.95		
<b>6. Intention to submit to a non-OA journal</b>		.97	.91

I will try to submit research articles to non-OA journals within the next 2 years.	.94
I intend to submit research articles to non-OA journals within the next 2 years.	.98
I plan to submit research articles to non-OA journals within the next 2 years.	.95
<b>7. Publishing behavior OA</b>	
How many articles would you say that you have published in OA journals within the last 2 years?	-
<b>8. Publishing behavior non-OA</b>	
How many articles would you say that you have published in non-OA journals in the last 2 years?	-

Table 2. Correlations and descriptive statistics for constructs in the measurement model

N = 1,588	Mean	SD	1	2	3	4	5	6	7	8
1. Attitude	5,21	1,55	<b>.87</b>							
2. Norms OA	3,18	1,52	.55	<b>.89</b>						
3. PBC OA	4,98	1,43	.28	.41	<b>.72</b>					
4. Habit strength OA	2,74	1,44	.48	.55	.28	<b>.78</b>				
5. Intention OA	4,87	1,96	.67	.63	.42	.46	<b>.97</b>			
6. Intention non-OA	5,07	1,96	-.35	-.42	-.16	-.49	-.28	<b>.96</b>		
7. Behavior OA	3,10	2,69	.20	.36	.20	.16	.33	-.06	-	
8. Behavior non-OA	4,28	3,19	-.28	-.24	-.02 <sup>ns</sup>	-.32	-.13	.42*	.32	-

\*  $p > 0.05$ ; *ns* = not significant; remaining correlations significant at the  $> .001$  level;

OA/non-OA int. = intention to publish open access/non-open access; bold numbers in the diagonal indicate the square root of the AVE

#### 4.2. Structural analysis and model testing

Structural equation analyses were performed on all models, and the results are shown in Table

3. First, an analysis was conducted on the intention to submit to an OA journal model

(baseline model). In this model, the attitudes, norms, and behavioral capacity explain the intentions. Fit indices indicated good overall fit (CMIN/DF = 4.14; DF = 48; CFI = 0.99; TLI = 0.99; RMSEA = .044). The predictors of intention explained approximately 56% of its variance. In the next step, habit OA was included as an independent variable of intention (Model 1), with the result that the overall fit dropped slightly as opposed to the first model (CMIN/DF = 4.98; DF = 48; CFI = 0.98; TLI = 0.98; RMSEA = .050) and the path between habit and intention was non-significant ( $\beta = .04, p > .05$ ). The variance explained in intention was 56%.

In Model 2a, we assessed whether forcing habit as a full mediator between attitudes, norms, and behavioral capacity would fit the data. In this instance, the normed chi-square was high (CMIN/DF = 12.09; DF = 110) indicating poor fit as also suggested by the increase in RMSEA (.084), which narrowly exceeded the upper bound for acceptable fit. Conversely, both CFI (.95) and TLI (.93) remained above the recommended thresholds. The explained variance in intention dropped to 25%, while attitude, norms, and PBC explained 38% of the variance in habit. Model 2a is rejected due to poor fit. Model 2b allowed for paths to be opened from attitudes, norms, and PBC to intention, thus assessing full and partial mediation in one model. Overall fit improved from that of Model 2a (CMIN/DF = 4.98; DF = 48; CFI = 0.98; TLI = 0.98; RMSEA = .050) and the explained variance in intention was 57% while the explained variance in habit was reduced slightly to 33%. However, the path between habit and intention was non-significant ( $\beta = .04, p > .05$ ), suggesting that habit does not mediate the effect of attitudes, norms, and behavioral capacity on intention.

Model 3 explored the effects of habit in relation to both OA and non-OA intention and behavior. Model 3 fit the data well as indicated by the fit indices (CMIN/DF = 2.52; DF = 52; CFI = 0.99; TLI = 0.99; RMSEA = .031). The path coefficients show that habit significantly influences both intentions to submit an article to an OA ( $\beta = .50, p < .001$ ) and a non-OA

journal ( $\beta = -.52, p < .001$ ). A significant and negative effect was also found by habit on non-OA behavior ( $\beta = -.20, p < .001$ ), suggesting that OA habits reduce non-OA publishing behavior. The variance explained in the final model was 24% and 23% in non-OA and OA intentions, while 19% and 11% was explained in non-OA and OA behavior, respectively.

Table 3. Model testing

Paths	Std. $\beta$	Basic Model		Model 1 (ETBP)		Model 2a (HMMa)		Model 2b (HMMb)		Model 3 (DDBM)		
		<i>P</i> -value	Std. $\beta$	Paths	Std. $\beta$	<i>P</i> -value						
										H-I <sub>a</sub>	.48	**
A-I <sub>a</sub>	.46	**	.46	**	-	-	.44	**	**	H-I <sub>b</sub>	-.49	**
N-I <sub>a</sub>	.31	**	.31	**	-	-	.29	**	**	H-B <sub>a</sub>	.03	.241
PBC-I <sub>a</sub>	.16	**	.16	**	-	-	.16	**	**	H-B <sub>b</sub>	-.20	**
A-H	-		-	-	.28	**	.26	**	**	I <sub>a</sub> -B <sub>a</sub>	.32	**
N-H	-		-	-	.38	**	.36	**	**	I <sub>a</sub> -B <sub>b</sub>	.04	.141
PBC-H	-		-	-	.08	.005	.07	.011	.011	I <sub>b</sub> -B <sub>a</sub>	.05	.132
H-I <sub>a</sub>	-	-	.04	.097	.50	**	.04	.097	.097	I <sub>b</sub> -B <sub>b</sub>	.36	**
<i>Model fit:</i>												
CMIN/DF	4.14		4.98		12.09		4.98				2.52	
CFI	.99		.98		.95		.98				.99	
TLI	.99		.98		.93		.98				.99	
RMSEA	.044		.050		.084		.050				.031	
R <sup>2</sup> I <sub>a</sub>	.56		.57		.25		.57				.23	
R <sup>2</sup> I <sub>b</sub>	-		-		-		-				.24	
R <sup>2</sup> B <sub>a</sub>	-		-		-		-				.11	
R <sup>2</sup> B <sub>b</sub>	-		-		-		-				.19	
R <sup>2</sup> H	-		-		.38		.33				-	

N = 1,588; \*\* =  $p < .001$ ; attitudes (A); norms (N); perceived behavioral control (PBC); habit (H); intention OA (I<sub>a</sub>); intention non-OA (I<sub>b</sub>); behavior OA (B<sub>a</sub>); behavior non-OA (B<sub>b</sub>)

## 5. Discussion and implications

The present study explored the role of habit strength and planned behavior in relation to scholarly OA and non-OA publishing. Three main models were tested, which also included non-OA intentions and behavior in the final model. The study used a TPB framework (Fishbein & Ajzen, 2010) and included habit strength measured by a Self-Reported Behavioral Automaticity Index (SRBAI) (Gardner et al., 2012), a subscale of the SRHI (Verplanken & Orbell, 2003). The frameworks were adapted to the research context of academic publishing attitudes and behaviors.

This study contributes to the emerging research on publishing behavior in several ways. First, we found that when measured alongside the traditional intentional antecedents, the effects of habit strength were rendered non-significant. A possibility is that the automaticity aspect of the decomposed habit subscale renders it void as a direct determinant of intentions in the presence of elaborative attitudinal, normative, and behavioral constructs, especially if attitudes form the basis of intentions as well as the normative pressure (Honkanen et al., 2005; Migheli & Ramello, 2013), as is the case in the present study. Potential evidence for this was found in Models 2a and 2b wherein these constructs were tested as independents of a habitual mediation of intentions. Habit was found to significantly affect intention only when it fully mediated the effects of the intentional antecedents, albeit the model did not fit the data quite well. These results support the assumptions proposed by Limayem et al. (2007), whereby the authors questioned the veracity of allowing habit to mediate any effects of the independent variables on intention.

However, an interesting discovery that emerged, especially from forcing a full mediation (Model 2a), was the superior contribution of norms over attitudes in the prediction of habit strength. Descriptive norms guide behavior by suggesting to individuals what is considered normal or typical behavior, and our findings indicate that this is an integral part of developing OA publishing habits. According to Cialdini, Kallgren, and Reno (1991), norms do not

necessarily need to be active at all times and in all contexts, as they vary in salience based on relevance and activation. This perspective fits with developing publishing habits, as the motivation to publish research papers likely is not salient with researchers at all times. For instance, discussing the implementation of a new publishing policy is likely to trigger the activation of normative considerations, leading to expressed intentions, possibly mediated by habit in some form. The analyses also showed that the researchers in the present study significantly believed in their capacity to submit articles to OA journals; however, this belief only weakly contributes to habit strength. PBC directly affects intention in all models (i.e., Basic Model, Model 1, Model 2a, and Model 2b).

Our third model constituted the most parsimonious attempt at exploring habitual publishing behavior by decomposing the model to isolate the relative contribution of habit on the dependent variables. Intention and behavior for non-OA publishing was also assessed. Decomposing the model and isolating the effects of habit was a fruitful strategy in our research context. However, this approach is in contrast to traditional decomposed TPB strategies (Dwivedi et al., 2017) wherein the belief structures of the independent variables are decomposed. It should further be noted that in Dwivedi et al. (2017), the fit indices indicated that the DTPB model the researchers tested did not perform well. A key element of decomposition appears to be the increased focus the approach provides on the respective structures (Taylor & Todd, 1995b), of which the present study finds evidence for, albeit in a simplified structure.

In our study, the results further revealed that when measured alone, habit strength does contribute to intentions, which is in line with other research (Honkanen et al., 2005; Ouellette & Wood, 1998). Habit strength OA was also found to reduce non-OA publishing behavior, while the effect of OA behavior was non-significant. The findings also confirmed the influence of OA intentions on behavior, further suggesting that if habits are formed, this may

indeed have a positive effect on publishing behavior, albeit not directly. As expected, if researchers have developed a habit of publishing in OA journals, they appear to avoid non-OA journals, as evident by the non-significant effect of OA intentions on non-OA behavior. A similar picture also emerges for non-OA intention, which only contributes to non-OA behavior without being significantly associated with OA behavior. OA habit strength, then, plays a part in forming intentions to publish in OA journals but reduces the intention to publish in non-OA journals. The effects on behavior, on the other hand, are quite different. Habit has no direct effect on OA publishing behavior, which intuitively makes sense given that they constitute different psychological outcomes (one cannot elaborate on doing something automatically). However, evidence that habit plays a part in publishing can still be found in its negative influence on non-OA publishing behavior, which also suggests it contributes to OA publishing.

According to Ouellette and Wood (1998), the manner in which habit directly contributes to future behaviors is determined by whether or not the domain in which the behavior occurs is supportive of habits. They suggested that intentions mediate habits only when behavior requires deliberate thought. This implies that a publishing habit is likely to influence behavior directly if all of the subsequent actions leading up to the behavior are habitual as well. Another point relates to whether the context remains stable over time (Gardner, 2015). Gardner (2015) noted that habit change interventions often fail given that people return to contexts whereby the implicit habit (automatic but performed infrequently) may be activated.

There are some implications for researchers, administrators, and policy makers. In the spring of 2018, the research council in Norway (NRC) signed the San Francisco Declaration on Research Assessment (DORA) ([sf-dora.org](http://sf-dora.org)). This signals the NRC's desire, among other things, to evaluate research proposals based on the quality of the publications, not the journals in which they were published. However, the journal quality system, which also constitutes

how funding is dispersed and thus incentivizes researchers to select high-level journals, is not being amended. This mismatch is likely to cause further discord among researchers and their institutions and funders, underscoring the importance of the present study. Few policy decisions that affect researchers appear to be founded on research, and in order to reduce friction in the upcoming transitional process, we not only need more research, but the research has to be implemented practically.

In a national sample of researchers, OA publishing habits were found to predict intentions to submit to OA journals and reduce publishing behavior in non-OA journals. The challenge herein is to allow habits the time to form given that producing scholarly articles is an infrequent behavior. While researchers' intentions do predict behavior, our findings suggest that this holds true for both OA and non-OA behavior, albeit comparatively weaker for non-OA behavior. Still, when the national (e.g., Norway) goal is to have all research openly available by 2024, it is worth considering that OA habit strength is the only predictor; in this study, that causes a reduction in the "undesired" behavior. Also worth noting is that when it comes to OA publishing, researchers' attitudes and normative influences are potent and override any direct effect habit may have on intentions. However, when isolating habit from these predictors, habit explains a significant portion of the intentions. This shows that when working with researchers in relation to OA publishing, it is primarily their attitudes and norms that will dictate their intentions.

It is worth considering that descriptive publishing norms, as measured in our study, may be pivotal components in facilitating the transition to open science by their direct path to habit strength. A typical approach to educate researchers about OA is by giving presentations and lectures, although this is usually done in single presentations and not at regular intervals. If a publishing habit that is connected to non-OA already exists, it is likely to remain dominant or at least reactivate when researchers return to their typical working context. A possible

solution that may facilitate the development of an OA publishing habit could therefore be to schedule workshops or seminars at regular intervals. Indeed, in reviewing the habit literature, Wood and Runger (2016) found that habit formation is more likely to occur when the desired behavior is repeated and there are interval reward schedules in place.

#### *5.1. Limitations and future research*

There are some limitations to the present study. All the data were based on self-reported online questionnaires, a method with inherent challenges that affect generalization. For instance, Krosnick (2018) suggested that respondents undergo a process that leads to an optimizing or satisficing satisfying strategy for dealing with survey items. In short, the two strategies involve the desire to engage in the survey or just answer arbitrarily so it is “good enough.” Motivation plays a key role in these processes and the lack thereof may account for incomplete questionnaires or random data. Statistical procedures such as imputation (Kline, 2011) can alleviate some of the adverse effects, but not completely. According to MacKenzie and Podsakoff (2012), the effects of common method bias can be minimized via rigorous design and partly controlled for by post hoc statistical techniques. Some suggest that post hoc tests are ineffective or too resource intensive to be feasible (Conway & Lance, 2010). As such, taking care in research design and providing evidence for the convergent and discriminant validity of the constructs is sufficient. Temporal stability is also an important criterion of a measure in a prospective study (Fishbein & Ajzen, 2010), which means that in order to predict behavior with increased certainty, the behavioral measure should be tested at a later point in time. The present study tested several models but did not assess actual behavior within a setting that allows for improved control over causality. The respondents took the survey at various times over several weeks, which means there were possible confounding factors in their environment that could not be controlled for.

Future research should strive to develop intervention approaches in cooperation with governments, policy makers, and funding bodies to maximize effectiveness. Ideally, a study

of this kind would benefit from being conducted in concert with the development and implementation of new policies and guidelines. Interventions based on solid empirical results should be designed and implemented over an extended test period to ascertain their veracity. For the development of an intervention, small-scale experiments can at an initial stage be conducted on, for instance, how people evaluate a research article when it is anonymized (i.e., the names of authors and places of publication have been removed) and whether this affects outcomes such as publishing attitudes, norms, or perceived quality. Subsequent large-scale tests can be run in a larger population by circulating anonymized research articles to respondents where information about where they are published (both OA and non-OA) and by whom is removed. This would force researchers to judge the merits of the articles by their content.

We briefly discussed how possessing sufficient IT skills is likely to facilitate publishing both OA and non-OA. The current study found that norms are the most influential contributors to habit strength, and the role of norms in academic life and publishing practices is well-documented (Linton et al., 2011; Migheli & Ramello, 2013). However, a systematic investigation of how norms influence publishing habits is notably absent. Habits are triggered by cues in the environment. The focus theory of norms suggests that greater normative salience also increases potential behavioral activation (Cialdini et al., 1991; Cialdini, Reno, & Kallgren, 1990). Applying this perspective, Bayer et al. (2015) suggested that salient norms also trigger habitual actions. Although the researchers focused on technology and the use of mobile devices, the parallels to interacting with technology or software to submit research articles are apparent. Thus, a fruitful venue for investigators to explore is the role that academic or publishing norms play in habit development.

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