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Yes, but not now! Why some users procrastinate in adopting digital product updates

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ABSTRACT

Users of digital products (such as mobile apps or software) are frequently offered new versions in the form of updates. While updates can deliver benefits, they may also interfere with the ongoing use of digital products. We investigate why digital product users might delay implementing adoption intentions (which we term *adoption procrastination*) of updates. Three experimental studies show that while users may intend to adopt new versions, they deliberately delay adopting them under certain conditions. Specifically, we identify how perceived changes in the new version can trigger annoyance, leading to adoption procrastination. We further identify anticipated inaction regret as a counteracting mechanism, which reduces adoption procrastination. Our research makes theoretical and empirical contributions to consumer innovation adoption literature. First, we introduce the novel concept of adoption procrastination, expanding previously examined adoption-related decisions. Second, we propose and empirically test cognitive and affective mechanisms determining digital product users' adoption procrastination.

1. Introduction

Users of Tesla cars, Samsung refrigerators, and iRobot vacuums have one thing in common. They are regularly offered post-purchase incremental innovations for their products' digital components. Such regular updates of purchased and in-use products' digital components (often delivered "over the air") require users to make adoption decisions. Indeed, firms increasingly deploy *successive digital innovations,* referring to modifications to an already-owned digital product over time to integrate new features or capabilities (Spanjol, Xiao, & Welzenbach, 2018). Importantly, a successive digital innovation strategy can be observed across product categories and requires product owners to make the same type of adoption decision, despite the market differences that might exist among cars (Brisbourne, 2014), refrigerators (Jaffe, 2019), and vacuums (Goode, 2017).

Although successive digital innovations typically make incremental changes to existing products and should thus be readily accepted by digital product owners, evidence suggests otherwise. For example, while there are more than two million apps in the Google Play app store, only 17% of available updates are installed on the day they are published (Möller, Michahelles, Diewald, Roalter, & Kranz, 2012). About one month after iOS12's launch in 2018, 50% of iOS users still had not adopted it (Krales, 2018). Similarly, only 27% of users in North America and Europe adopted Windows 10 in the first year of its launch, and 19% of users adopted it in the second year (Pham, 2018). The question arises: *Why do users delay adopting what appear to be improvements to already owned and used digital products?* While extant innovation literature provides rich insights into who will or will not adopt a new product (Heidenreich & Kraemer, 2016; Rogers, 2010), the cognitive and affective factors driving the adoption of new versions of or updates to already owned and used digital products are understudied (Spanjol et al., 2018).

To resolve this gap in understanding, we introduce the novel concept of *adoption procrastination* and define it as *a deliberate delay in implementing a formed adoption intention*. We suggest that adoption procrastination represents a coping strategy that digital product consumers use to deal with negative emotions arising during innovation appraisals. Although seemingly innocuous, this coping strategy causes a mismatch between user experience and a firm's innovation efforts. Especially because leading firms adjust digital strategy quickly (Bughin & Catlin, 2019) and digital products often interact with each other, widespread adoption procrastination can compound this mismatch over time. For example, users of a mobile banking app might repeatedly delay adopting

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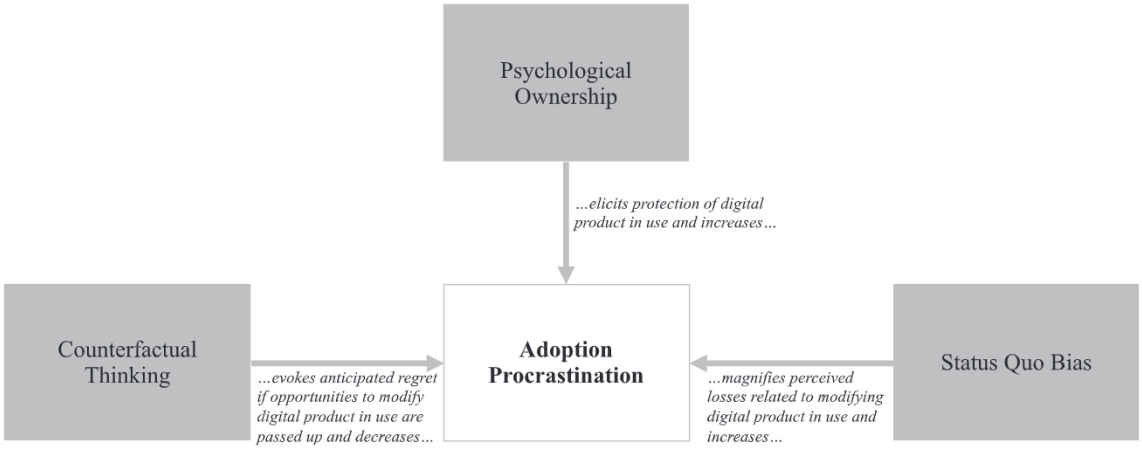

Fig. 1. Theoretical formation of adoption procrastination.

the app's updates as well as new versions of the mobile operating system the app is embedded in. For consumers, adoption procrastination can lead to non-optimized performance as well as privacy and security risks (Blaze, 2019), among others. Therefore, understanding why users might deliberately delay (i.e., procrastinate) implementing their adoption intentions for successive digital innovations, and how such procrastination might be reduced, is essential for innovation practice and scholarship.

In this research, we pose two research questions: *First, what role do perceptions of successive digital innovations (in terms of change and benefit) play in shaping users' adoption procrastination? Second, how do relevant affective and cognitive factors impact the relationship between change and benefit perceptions and adoption procrastination?* To answer these questions, we draw on three theoretical perspectives—status quo bias, counterfactual thinking, and psychological ownership—to test competing and conditional affective mechanisms (i.e., annoyance and anticipated inaction regret) between perceived change and adoption procrastination. We empirically test our hypotheses in three experimental studies because an experimental approach allows us to explore causality in proposed relationships (Churchill & Iacobucci, 2006). We use mobile app updates as the empirical context across the three studies and focus on active digital product users considering whether to update currently owned and used apps. Thus, we follow Fuchs, Prandelli, Schreier, and Dahl (2013), who distinguish between "consumers" as potential users and "users" as consumers who actively "realize [] a product's benefits by using it" (p. 77). For readability purposes, we hereafter use the labels *consumer* and *user* interchangeably.

Our research contributes to literature in three ways. First, although adoption-related behaviors have been explored extensively in innovation research (Chen & Granitz, 2012; Davis, 1985; Talke & Heidenreich, 2014), we introduce the novel concept of adoption procrastination and empirically test its antecedents. By identifying adoption procrastination as a unique adoption-related behavior, we differentiate between adoption intention (plans to adopt), adoption (actual behavior of implementing the adoption intention), and resistance to innovation (lack of adoption intention). We extend the literature by showing that adoption procrastination is formed through competing negative emotions triggered in users as they perceive greater changes resulting from digital product updates.

Second, while previous research outside the innovation adoption context suggests procrastination is driven by cognition and situational mood (Sirois, 2014; Sirois & Pychyl, 2013), cognition and affect dynamics are insufficiently investigated in the consumer adoption domain. Our research extends the literature on consumer procrastination by theorizing adoption decisions that consumers face in the digital product realm. Our findings reaffirm the need for firms to be attentive to adoption procrastination dynamics and manage launching successive digital innovations accordingly.

Third, to the best of our knowledge, this is the first study to simultaneously examine both experienced and anticipated emotions to explain how consumers cope with the discomfort that successive digital innovations can evoke. Our findings suggest that when consumers are faced with a choice to either continue with a digital product in use "as is" or update it with a newer version, experienced and anticipated emotions counteract each other when the update is perceived as being more substantial. Specifically, our findings indicate that firms should seek to reduce user annoyance and increase anticipated inaction regret to ultimately reduce adoption procrastination.

The remainder of this article is structured as follows. First, we review literature related to adoption procrastination and advance our hypotheses. Next, we present the overall design of the chosen empirical approach. Subsequently, we describe each of our three empirical studies, including method, results, and discussion. The article concludes by discussing theoretical contributions and practical implications as well as limitations and future research opportunities for adoption procrastination and successive digital innovations.

2. Theoretical framework

2.1. Adoption procrastination: The middle ground between adoption and non-adoption

Procrastination is a phenomenon whereby one deliberately delays beginning or completing an intended action (Steel, 2007). People usually procrastinate when tasks and decisions create discomfort (Ferrari, 2001), as a means of repairing short-term mood (Sirois & Kitner, 2015). For example, consumers procrastinate in planning for retirement, buying holiday gifts, and establishing saving plans (Backman, 2018), despite knowing that delays can create negative consequences. Indeed, procrastination is universal, so much so that this phenomenon could be "too prevalent to be questioned" by academics (Steel, 2007, p.65).

To shine a light on this universal human tendency in the innovation realm, we examine procrastination in relation to consumers' adoption decisions. We define *adoption procrastination* as *a deliberate delay in implementing a formed adoption intention*, differentiating it from innovation adoption intentions and adoption behaviors (i.e., implementations of adoption intentions; see Arts, Frambach, & Bijmolt, 2011) and non-adoption as a result of resistance to innovation (see Heidenreich & Handrich, 2015). In other words, adoption represents a consumer's decision to purchase and use a new product, contingent on establishing an adoption intention (Davis, 1985; Rogers, 2010; Turel, Serenko, & Bontis, 2010). Resistance to innovation, on the other hand, represents a consumer's opposition to adopt or experience a new product (Heidenreich & Handrich, 2015; Talke & Heidenreich, 2014). As a result, adoption procrastination represents the "middle ground" between

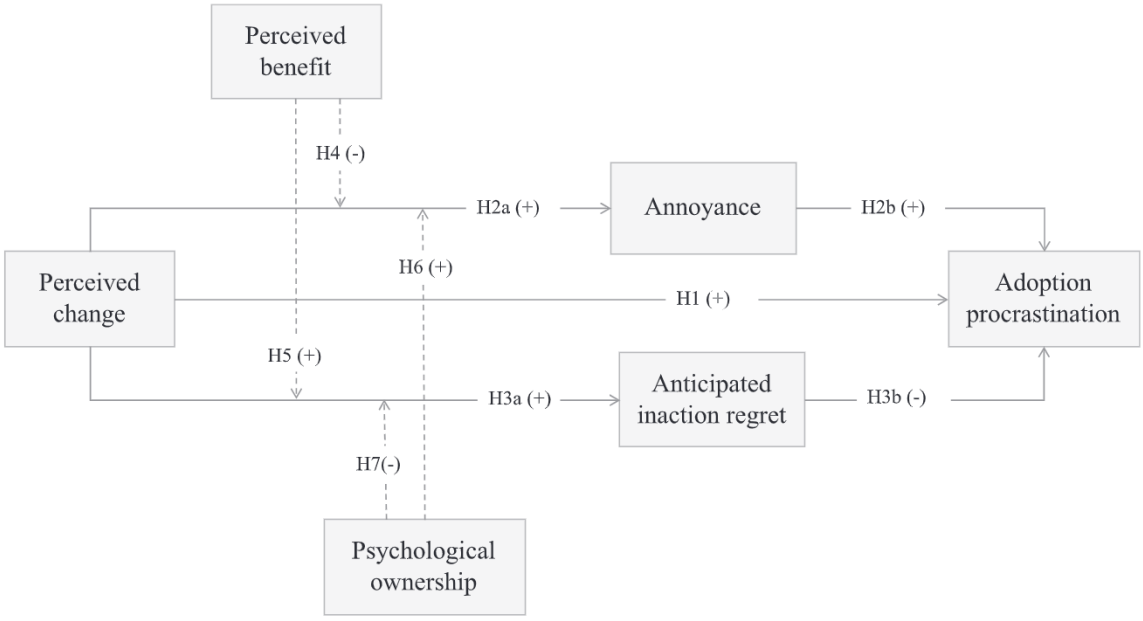

Fig. 2. Conceptual framework.

adoption and non-adoption, when intentions to adopt are formed; yet, implementing the intention is deliberately delayed.

The literature notes that intending to adopt an innovation and actually adopting are imperfectly correlated (Sun & Morwitz, 2010; Van Ittersum & Feinberg, 2010) and that intention is viewed as an imprecise predictor of adoption (Arts et al., 2011). Therefore, understanding *deliberate delays* of adoption intention implementation (i.e., adoption procrastination) provides greater insight into the complicated mechanisms of innovation appraisal and adoption-related behaviors. Next, we develop a set of theoretically grounded hypotheses, forming the basis for the proposed conceptual model (see Fig. 2). The model integrates three theoretical perspectives into consumer adoption: status quo bias, counterfactual thinking, and psychological ownership, as summarized in Fig. 1.

2.2. Hypotheses

2.2.1. Perceived change's main effect on adoption procrastination

The term *successive digital innovation* refers to modifications to an already-owned digital product over time to integrate new features or capabilities (Spanjol et al., 2018). When encountering successive digital innovations (e.g., mobile app or software updates), consumers inherently face a choice between maintaining the status quo and adopting a change to the product in use. In other words, consumers can simply keep a product's current version without having to do anything (Samuelson & Zeckhauser, 1988). Evidence on the status quo bias (SQB) (e.g., Polites & Karahanna, 2012) suggests that the product version already in use is often preferred due to consumer habits, cognitive (mis)perceptions, or psychological commitment (Kahneman, Knetsch, & Thaler, 1991; Steel, 2007). In that sense, current or "in use" versions of digital products represent the "default" option, and potential disadvantages from any changes to this default will loom larger than potential benefits (Kahneman et al., 1991). Interruptions of the status quo also elicit discomfort and potential resistance (Kim & Kankanhalli, 2009); therefore, SQB occurs when consumers perceive risks and disadvantages of decision alternatives (Samuelson & Zeckhauser, 1988; Trueblood, 2015). To avoid decision discomfort, consumers tend to procrastinate making decisions or do nothing in order to preserve the status quo (Anderson, 2003; Beswick & Rothblum, 1988; Ferrari, 1993).

In addition to new products in general, successive product generations are also subject to SQB as consumers engage in mental accounting and mental depreciation (Okada, 2001; 2006) and can thus view updating digital products already in use as a loss. Although successive digital innovations usually engender only incremental changes to extant digital products, these changes might lead users to incur extra costs in product usage. For example, a new software generation (delivered through an update) may incorporate new features or a new user interface requiring different steps or operations to use an otherwise familiar product. Such changes interrupt the status quo and threaten users' current habits, knowledge, and perceived self-efficacy of using digital products. Because built-up product knowledge, which undergirds the status quo, is interrupted by changes engendered in successive digital innovations, some products may receive positive consumer feedback during trials but fail in the market (Rivard & Lapointe, 2012). Due to the discomfort and effort of using a newer product version, we predict users will procrastinate in implementing successive digital innovations despite forming adoption intentions.

H_1: Perceived change is positively associated with adoption procrastination

2.2.2. Annoyance as a mediator of the perceived change-adoption procrastination relationship

Even incremental innovation appraisals are rarely affectively neutral (Wood & Moreau, 2006). Negative emotions arising from innovation appraisals prevent innovation adoption (Beaudry & Pinsonneault, 2010). Emotions stimulate impulses to act, direct goals, and trigger approach and avoidance tendencies (Bagozzi & Pieters, 1998). Thus, emotions are important to consider when trying to understand the gap between intention and actual behavior (Sandberg & Conner, 2009).

As a commonly experienced consumption emotion annoyance is elicited when the status quo (such as enjoyment of a situation or object, agency of attaining goals, and entitled rights) is interrupted (Bailey & Konstan, 2006; Roberts, 2014). Similar to other discrete emotions ordinarily associated with an approach or an avoidance impulse (e.g., Labroo & Rucker, 2010), annoyance drives people to avoid its source (Averill, 1983). For example, consumers who are annoyed with complicated products opt for a simpler alternative (Garbarino & Edell, 1997).

Based on the SQB logic, we predict that users will become annoyed as they perceive changes interrupt digital products' status quo and that annoyance will cause users to procrastinate. When successive digital innovations increase change in products, users feel more frustrated with

losing their enjoyment of the current product design (Beaudry & Pinsonneault, 2010). For example, an update changes a digital good's regularly used features versus removing such features. It is disturbing to think about the cognitive, affective, and behavioral effort to fulfil tasks with the digital product (Wood & Moreau, 2006). As change perception increases, users are more annoyed with the interruption of controlling customized features and product experience. As mentioned earlier, annoyance drives people to avoid its source; thus, we predict that users procrastinate to cope with annoyance, delaying the implementation of their intention to adopt (i.e., intent to install) successive digital innovations.

H_2: Annoyance mediates the relationship between perceived change and adoption procrastination, such that

a. perceived change is positively associated with annoyance, and
b. annoyance is positively associated with adoption procrastination.

2.2.3. Anticipated inaction regret as a mediator of the perceived change-adoption procrastination relationship

Both experienced and anticipated emotions influence consumer decisions and behaviors (Patrick, Lancellotti, and Demello, 2009). According to counterfactual thinking literature, the thinking process to justify possible connections between causes and consequences drives affective reactions to more or less desirable alternatives (Kray et al., 2010). Anticipated undesirable alternatives in the future enhance the intentions to act now (Baumgartner, Pieters, & Bagozzi, 2008) because they involve cognitive effort and rational reasoning regarding regrettable consequences if one does not act (Hollister, 2017; Sandberg & Conner, 2009). For example, considering not being vaccinated (Weinstein et al., 2007) or not committing to a daily workout (Abraham & Sheeran, 2004) can evoke negative anticipated emotions because opportunities to reduce health risks in the future are potentially missed due to inaction.

Building on the counterfactual thinking literature, we predict that *anticipated inaction regret* (AIR)—expected regret due to missing out on benefits from successive digital innovations—will have the opposite effect of annoyance on adoption procrastination. In contrast to annoyance, anticipated inaction regret occurs when unwanted or regrettable results are envisioned if one does not act (Patrick, Lancellotti, and Hagtvedt, 2009, Patrick, Lancellotti, and Demello, 2009). Such regret can be so uncomfortable that people are motivated to pursue an action to reduce future regret (Zeelenberg & Pieters, 2007).

When change perceptions of successive digital innovations increase, AIR will become stronger because users will anticipate drawbacks of using an outdated digital product version. Thus, AIR will increase as users perceive successive digital innovations as introducing greater change. As a result, greater AIR will reduce adoption procrastination because this anticipated emotion will motivate users to avoid an unpleasant outcome and implement formed adoption intentions faster.

H_3: Anticipated inaction regret mediates the relationship between perceived change and adoption procrastination, such that

a. perceived change is positively associated with anticipated inaction regret, and
b. anticipated inaction regret is negatively associated with adoption procrastination.

2.2.4. Perceived benefit as a moderator of the perceived change-adoption procrastination relationship

When modifying digital products (i.e., launching successive digital innovations), firms seek to offer greater benefits to users. Such benefits might come in the form of updating digital content (e.g., Google Earth keeping information up-to-date) (Desai & Chulkov, 2009; Westfall, Jasper, & Christman, 2012), resolving security threats (Tversky & Kahneman, 1991), or integrating new features to enhance user experience (Kim & Kankanhalli, 2009). When users perceive greater benefits, the changes in digital products through updates are also seen as justified (Knudsen & Olsen, 2003). For example, consumers promptly adopt information systems when recognizing that a system substantially reduces work time and effort (Akter, Rahman, & Al Islam, 2016).

We predict that greater perceived benefit of digital product updates will counteract and decrease annoyance triggered by perceptions of greater change, thus reducing adoption procrastination. Although users will become annoyed because successive digital innovations might disturb their current habits, knowledge, and efficacy of digital products' ongoing use, expected benefits from digital product updates will reduce frustration (Gurman, 2018). While users may perceive digital updates as disturbances, interrupting the enjoyment of a digital product's status quo, the expected benefits (e.g., better security, interface, feature, or content) will minimize this perceived disturbance. Therefore, we postulate the following:

H_4: Perceived benefit negatively moderates the relationship between perceived change and adoption procrastination through annoyance.

Similarly, we anticipate perceived benefit to intensify AIR triggered by change perception. As a cognition-based emotion, AIR is augmented if one does not act upon a reasonable option (Patrick, Lancellotti, and Demello, 2009). Users' perceived potential benefits from a digital product update reframes the change as an opportunity for a better product experience; literature shows that opportunity strengthens inaction regret because the corrective reaction becomes obvious (Roese & Summerville, 2005). When users recognize more benefits in successive digital innovations, the counterfactual thinking of using an inferior outdated product generation becomes stronger. Thus, as benefit perceptions become stronger, perceived changes will elicit greater AIR, further reducing adoption procrastination.

H_5: Perceived benefit positively moderates the relationship between perceived change and adoption procrastination mediated by anticipated inaction regret.

2.2.5. Psychological ownership as a moderator of the perceived change-adoption procrastination relationship

Psychological ownership, defined as "[an] individual's 'gut feelings' toward an object" (Shu & Peck, 2011, p.441), is usually shaped by direct product usage (Pierce, Kostova, & Dirks, 2003). Psychological ownership is relevant to technology appropriation because it makes users believe that a digital product represents self-identity and leads to a customized use of product features (Gaskin & Lyytinen, 2012). This type of psychological attachment explains the overestimated worth of products currently owned by customers when compared to objectively more valuable alternatives (Brasel & Gips, 2014; Peck & Shu, 2009). As psychological ownership grows, people tend to have a stronger desire to control or protect product experience and are more satisfied with the current state. Thus, we propose psychological ownership as another contingency factor for the relationship between perceived change and adoption procrastination of successive digital innovations.

We expect the stronger the psychological ownership of a digital product, the more annoyed consumers will be with changes perceived to be introduced in an update. As psychological ownership increases, users will exhibit a stronger desire to control the product's status quo; therefore, the sense of disruption in terms of product knowledge and goal-directed activities from an offered update will become stronger. Such strengthening occurs because psychological ownership typically emerges when users customize features and other aspects of the digital product in use (Pierce et al., 2003; Shu & Peck, 2011). Thus, perceptions of change introduced by an update will be experienced as more obtrusive to these users if customized features are perceived as under threath of being revised. The thought that firms might force consumers to accept changes in updated products will become more irritating, as consumers perceive a lack of autonomy in adoption. Such lack of autonomy in tasks to be performed has been shown to increase procrastination (Blunt and Pychyl, 2000). Therefore, we expect that consumers will procrastinate adoption because they need to cope with stronger annoyance.

Table 1
Overview of study designs (DV: adoption procrastination).

Study	Design	Change Perception Manipulations	Benefit Perception Manipulations	Mediators/ Moderators	Stimuli and Participants	Tested Hypotheses
1	Minor vs. major change	**Minor change:** "*An update is available for this app. This update will make minor changes on the app.*"**Major change:** "*An update is available for this app. This update will make major changes on the app.*"	–	**Mediator:** Annoyance	Public transportation app (subject pool)	H1 Main effect of perceived change on adoption procrastination H2 Mediation by annoyance
2	Minor vs. major change	(Same as in Study 1)	–	**Mediators:** Annoyance; Anticipated inaction regret (AIR)	Banking app (subject pool)	H1 Main effect of perceived change on adoption procrastination H2 Mediation by annoyance H3 Mediation by AIR
3	2 (minor vs. major change) X 2 (low vs. high benefit)	**Minor change:** "*An update is available for this app. This update launches a revised interface and does not change the ways that users schedule and view calendar events.*"**Major change:** "*An update is available for this app. This update launches a new interface which requires users to learn ways of scheduling and viewing calendar events.*"	**Low benefit** (following change manipulation): "*The update slightly improves this app's performance.*" **High benefit** (following change manipulation)**:** "*This update greatly improves the app's performance.*"	**Mediators:** Annoyance; AIR **Moderators:** Perceived benefit; Psychological ownership (PO)	Calendar app (MTurk)	H1 Main effect of perceived change on adoption procrastination H2 Mediation by annoyance H3 Mediation by AIR H4 Moderation by perceived benefit through annoyance H5 Moderation by perceived benefit through AIR H6 Moderation by PO through annoyance H7 Moderation by PO through AIR

Notes: DV = dependent variable; PO = psychological ownership; AIR = anticipated inaction regret.

H_6: Psychological ownership positively moderates the relationship between perceived change and adoption procrastination mediated by annoyance.

Along with the impact on annoyance, we predict that psychological ownership will weaken anticipated inaction regret activated by greater change perceptions. Consumers appraise the value of owned products to be greater than their actual market value as psychological ownership grows (Brasel & Gips, 2014). In other words, users who have high psychological ownership will be more satisfied with the status quo of digital products in use than others; therefore, they will be less concerned with the counterfactual negative consequences if procrastinating adoption of successive digital innovations. When psychological ownership increases, users identify to a greater extent with digital technology by tailoring content, features, and designs (Anderson & Agarwal, 2010), making them less motivated to change such identities. Consequently, psychological ownership reduces AIR triggered by change perceptions; thus, adoption procrastination is likely to intensify. Fig. 2 summarizes our hypotheses and conceptual model.

H_7: Psychological ownership negatively moderates the relationship between perceived change and adoption procrastination through anticipated inaction regret.

3. Empirical studies

To test the proposed conceptual model of adoption procrastination, we selected mobile applications (apps) and app updates for two reasons. First, more than 190 billion apps were downloaded and over $100 billion were spent in app stores by users worldwide in 2018 (Sydow, 2019). Second, mobile apps are continually updated. For example, Amazon and Walmart updated their apps 20 to 25 times in 2014 to improve app rankings (Danova, 2015). App updates represent a successive digital innovation strategy (Spanjol et al., 2018), delivering repeated incremental innovations in digital products. Aiming to improve overall consumer experience, app updates can integrate or launch new customer interface designs, revise or complement existing features, and fix issues. Not adopting app updates might not only lead to consumers unable to access an optimized product but also leave them vulnerable to privacy and security threats (Blaze, 2019). Yet, app updates are frequently not installed or only with delay (Fleischmann, Amirpur, Grupp, Benlian, & Hess, 2016). Popular press indicates that users might be annoyed by frequent app updates, while others might not have the appropriate technological expertise (Montelli, 2019). Our research probes both these potential explanations.

We adopted an experimental approach to testing the proposed hypotheses because it provided a controlled testing procedure resulting in more convincing evidence than a survey without condition manipulations to test causality (Churchill & Iacobucci, 2006). All three studies were reviewed and approved by an institutional review board (IRB) at a major U.S. research university.

Table 1 provides an overview of the three empirical studies conducted. Several hypotheses were tested across multiple studies. Specifically, H_1 and H_2 were tested in all three studies, H_3 in Studies 2 and 3, and H_4 and H_5 in Study 3 (see Table 1 for further details). Testing hypotheses across multiple studies replicated the confirmation of the predicted relationships, thus strengthening the robustness of our findings and conclusions. Following the literature, we included both student and non-student samples across the three studies in order to strengthen confidence in the findings (Bayuk & Patrick, 2021; Sugathan & Ranjan, 2019; Tang & Tsang, 2020).

3.1. Study 1

This study tested the main effect of perceived change of an app update on adoption procrastination (H_1) as well as the indirect effect of

Table 2
Measures across studies.

Variables	Measurements	Reliability
Annoyance Definition: *the state or feeling of being annoyed.*	*How do you feel about the update?* (7-point scale; 1 = not at all, 7 = very much)(Adapted from Russell & Fehr, 1994; Xie et al., 2015) • Annoyed • Disturbed • Interrupted • Irritated	**Study 1:**α = 0.84 **Study 2:**α = 0.91 **Study 3:**α = 0.88
Anticipated inaction regret Definition: *the anticipated emotional consequence of foregoing a choice before decision making*	*Would you say that…* (7-point scale; 1 = not at all, 7 = very much) (Adapted from Abraham & Sheeran, 2004; Patrick, Lancellotti, and Demello, 2009) • I would regret skipping this update. • I would regret not adopting the update. • I would feel regretful if I ignored this update.	**Study 2:**α = 0.97 **Study 3:**α = 0.93
Psychological ownership Definition: *the state of mind or feeling that one has ownership over an object*	*How would you describe your relationship with this app installed on your phone?* (7-point scale; 1 = not at all, 7 = very much) (Adapted from Shu & Peck, 2011) • I feel this app is mine. • I am attached to this app. • I feel that I own this app. • This app installed on my phone reflects who I am.	**Study 3:**α = 0.88
Adoption intention Definition: *the expressed desire to adopt a new product*	*Will you adopt this update?* (0 = no, 1 = yes) (Adapted from Laukkanen, 2016)	**Studies 1, 2, and 3**
Adoption procrastination Definition: *the delay in implementing an adoption intention*	How soon will you adopt this update? (5-point scale, 1 = within 24 h, 5 = later than 6 days from today) (Adapted from Ferrari & Dovidio, 2000; Shu & Gneezy, 2010)	**Studies 1, 2, and 3**
Update expertise Definition*: the capability of updating apps effectively*	How would you rate your knowledge of mobile app updates? (7-point scale; 1 = not at all, 7 = very much) (Adapted from Mitchell & Dacin, 1996; Mishra, 2016) • I could easily use my smart phone to find information on an update. • I have a clear idea about different types of app updates. • I know very much on how to manage updates for my apps. • I have good knowledge of what updates my apps need. • I have more knowledge on app updates than other app users. • I know a lot about what updates mean to my apps.	**Study 1:**α = 0.92

perceived change through annoyance (H_2) on adoption procrastination.

3.1.1. Method

We adopted public transportation tracking apps as stimuli in the experimental design and recruited participants from a student subject pool at a large urban Midwestern U.S. university. Receiving one class credit for completing the study, our respondents represented users of public transportation apps. Students at this university are known to extensively use public transportation apps. The university website, for example, features a list of various public transportation apps in the "Student Life" section, indicating that commuting is a major and often daily part of the student experience. The university also offers a shuttle tracking app to students.

Because we were interested in understanding current users' mobile app update adoption dynamics (rather than non-users' adoption intentions), participants first indicated whether they were smartphone users and whether they used public transportation tracking apps. Those participants who did not use smartphones and a transportation tracking app were thanked and their surveys were terminated. The remaining 111 participants were asked to select the most frequently used public transportation tracking app from a list. Those who did not recognize any apps on the list were asked to enter the name of their most frequently used transportation tracking app in a designated text box.

After answering a few questions about using the selected public transportation tracking app, participants were randomly assigned to one of the two manipulated update conditions (minor vs. major change). We textually manipulated change conditions as "This update will make minor (vs. major) changes on the app." In this way, the app update manipulations fit any of the apps selected as most frequently used by participants. Subsequently, respondents rated how they felt about the update by answering four questions measuring annoyance (α = 0.84)

Table 3
Summary of cell means, standard deviations, and findings.

Variables and main findings	**Study 1 (n = 75)**			
	Minor change	**Major change**		
Annoyance	1.875 (1.102)	2.554 (1.293)		
Adoption procrastination	1.680 (1.068)	2.490 (1.574)		
Main finding	H1 and H2 were supported. Results showed that an increased perceived change led to increased adoption procrastination (H1) and that perceived change increased annoyance, leading to a higher chance of adoption procrastination.			
	Study 2 (n = 154)			
	Minor change	**Major change**		
Annoyance	2.151 (1.262)	2.747 (1.504)		
AIR	4.197 (2.017)	5.282 (1.912)		
Adoption procrastination	2.390 (1.415)	3.000 (1.599)		
Main finding	H1 and H2 were replicated, and H3 was tested and supported. Perceived change has (a) a direct main positive effect on adoption procrastination and (b) indirect effects through both annoyance and anticipated inaction regret, in the opposite direction of each other.			
	Study 3 (n = 429)			
	Minor change	**Major change**	**Low benefit**	**High benefit**
Annoyance	1.811 (1.080)	2.401 (1.475)	2.175 (1.423)	1.922 (1.108)
AIR	2.863 (1.825)	3.287 (1.718)	2.690 (1.776)	3.461 (1.719)
Adoption procrastination	2.460 (1.422)	2.810 (1.479)	2.790 (1.512)	2.400 (1.357)
Main finding	H1 to H3 were replicated, and H4 to H7 were tested. All hypotheses were supported except H7. Results showed when perceived benefit is high, perceived change triggers less annoyance and more anticipated inaction regret than when perceived benefit is low. When psychological ownership is high, perceived change triggers more annoyance, but the moderation effect is insignificant for anticipated inaction regret.			

Notes: Numbers in parentheses represent standard deviations; AIR = anticipated inaction regret.

Table 4
Study 1 mediation results.

	Model 1 DV: Annoyance		Model 2 DV: Adoption procrastination
Regression Results			
Perceived change	0.679**		0.519*
Annoyance	–		0.416**
R^2	0.076		0.211
F value	6.004***		9.634***
Indirect Effect	**Effect**	**SE**	**95% CI**
Perceived change → annoyance → adoption procrastination	0.283	0.157	[0.028, 0.638]

Notes: * $p < .1$, ** $p < .05$, *** $p < .01$; SE = standard error; CI = confidence interval.

(adapted from Russell & Fehr, 1994; Xie, Bagozzi, & Grønhaug, 2015). Next, participants indicated whether they intended to adopt the app update. If indicating an intention to adopt the app update, participants (n = 75, 41.3% female) saw the adoption procrastination question. Adoption procrastination was measured by asking participants how soon they intended to adopt (i.e., install) the update (1 = within 24 h, 5 = later than 6 days from today) (adapted from Ferrari & Dovidio, 2000; Shu & Gneezy, 2010). Finally, participants answered questions about their expertise to update mobile apps (α = 0.92) (adapted from Mishra, 2016). An overview of all measures, along with their alpha coefficients, used across the three studies is provided in Table 2.

3.1.2. Results and discussion

First, we checked the effectiveness of the two manipulated app update conditions (minor vs. major change) by measuring perceived app change with a question that asked how much participants thought the update would change the app (1 = not at all; 7 = very much). An independent samples t-test showed the manipulation was successful (t(1,73) = 3.745, $p < .001$). Perceived change was rated significantly higher in the major change condition (M = 4.490, SD = 1.346) than in the minor change condition (M = 3.342, SD = 1.300).

Next, we investigated whether gender and mobile operating system affected adoption procrastination. To do so, we conducted a 2 (perceived change: low vs. high) × 2 (gender: male vs. female) ANCOVA on adoption procrastination with mobile operating system (Android vs. Apple) as a covariant. Results showed a significant impact of perceived change (F(2, 70) = 6.794, p = .011). However, neither gender (F(2, 70) = 1.186, p = .280) nor mobile operating system (F(2, 70) = 1.275, p = .698) influenced adoption procrastination significantly; thus, we excluded them from consideration in the remaining analyses.

We tested perceived change's effect on adoption procrastination with an independent samples t-test (t(1,73) = 2.589, p = .002). Results revealed users were more likely to procrastinate installing the update when they perceived it would make a major (M = 2.490, SD = 1.574) versus minor change (M = 1.680, SD = 1.068) in the mobile app. Thus, H_1 was supported. Table 3 summarizes main findings across our three studies.

Next, we tested annoyance as the main effect's mediator (H_2) using the PROCESS SPSS (Model 4) with 5,000 bootstrapping samples (Hayes, 2017), whereby perceived change was the independent variable, annoyance was the mediator, and adoption procrastination was the dependent variable. The results showed that greater perceived change led to greater annoyance (b = 0.679, t(1,73) = 2.450, p = .017) and that annoyance increased procrastinating adoption of the app update (b = 0.416, t(1,73) = 3.405, p = .001). Mediation's confidence interval did not include zero at the 95% confidence level (CI = [0.028, 0.638]). Thus, H_2 was supported. The mediation analysis results are summarized in Table 4.

To rule out an explanation that app update expertise instead of annoyance mediates the relationship between perceived update change and adoption procrastination, we conducted another PROCESS analysis (Model 4) with 5,000 bootstrapping samples (Hayes, 2017), where perceived change is the independent variable, annoyance and update expertise are potential mediators, and adoption procrastination is the dependent variable. Results showed update expertise did not mediate the relationship between perceived change and adoption procrastination because the confidence interval included zero (b = -0.069, 95% CI = [-0.261, 0.057]). Annoyance's mediation effect (b = 0.266, 95% CI = [0.015, 0.609]) was not substantially changed by including update expertise.

In summary, Study 1 demonstrated that perceived app update change has a direct main effect on adoption procrastination and an indirect effect through annoyance. Thus, consumers are more likely to be annoyed with an app update that makes a major change to the app and, hence, procrastinate about adoption. The results also indicated that update expertise did not explain the relationship between perceived app update change and adoption procrastination.

3.2. Study 2

Study 2 replicates perceived change's main effect (H_1) and annoyance's mediation role (H_2) as confirmed in Study 1, with a similar yet different stimulus. Also tested was anticipated inaction regret (AIR) as a second hypothesized mediator in the relationship between perceived change and adoption procrastination (H_3).

3.2.1. Method

We adopted banking apps as stimuli in the experimental design and recruited participants from a student subject pool at a large urban Midwestern U.S. university. Students received one class credit for completing the study. According to the 2017 U.S. Consumer Payment Study, 48% of consumers ages 18 to 24 (i.e., our student sample's age bracket) use banking apps weekly or more frequently, 21% use them a few times a month, and only 13% do not use banking apps at all. As in Study 1, we required student participants to be smartphone users and to have adopted at least one banking app. Thus, our sample consisted of typical users representing the banking app consumer population, important for our study because we were interested in understanding current app users' behaviors rather than non-users'.

Two hundred qualified participants were randomly assigned to either a "major" or "minor" change condition. They were directed to choose from a list of banking apps an app currently installed and frequently used on their smartphones. An "other" choice allowed participants to name an app in a textbox if it wasn't already listed. Next, participants answered the same questions that measured annoyance in Study 1 (α = 0.91). Then, they answered three questions measuring anticipated inaction regret (α = 0.97) (adapted from Abraham & Sheeran, 2004; Patrick, Lancellotti, and Demello, 2009). Participants then indicated whether they intended to adopt the app update. As in Study 1, if answering "Yes" to the update adoption intention question, participants (n = 154, 63.6% female) were asked to answer the adoption procrastination question.

3.2.2. Results and discussion

First, we checked the effectiveness of the two manipulated app update conditions (minor vs. major change) by measuring perceived app change with a question that asked how much participants thought the update would change the app (1 = not at all; 7 = very much). An independent samples t-test results showed the manipulation was successful (t(1, 152) = 3.647, $p < .001$). Perceived change was rated significantly higher in the minor change condition (M = 3.720, SD = 1.391) than in the major change condition (M = 4.580, SD = 1.508). See Table 1 for manipulation details.

Next, we tested perceived change's main effect on adoption procrastination with an independent samples t-test (t(1, 152) = 2.432, p = .016). Participants were significantly more likely to procrastinate about

Table 5
Study 2 competitive mediation results.

	Model 1 DV: Annoyance	Model 2 DV: AIR	Model 3 DV: Adoption procrastination
Regression Results			
Perceived change	0.596**		0.636**
Annoyance			0.281***
AIR		1.085***	-0.194**
R^2	0.044	0.072	0.170
F value	7.064**	11.737***	10.255***
Indirect Effects	**Effect**	**SE**	**95% CI**
Perceived change → annoyance → adoption procrastination	0.167	0.082	[0.036, 0.356]
Perceived change → anticipated inaction regret → adoption procrastination	-0.210	0.089	[-0.412, -0.062]

Notes: * $p < .1$, ** $p < .05$, *** $p < .01$; AIR = anticipated inaction regret; SE = standard error; CI = confidence interval.

adoption in the major change (M = 3.000, SD = 1.599) than in the minor change condition (M = 2.390, SD = 1.415). Thus, H_1 was confirmed, replicating Study 1′s results.

We adopted the PROCESS SPSS application (Model 4) (Hayes, 2017) to test competing mediation effects by annoyance (H_2) and AIR (H_3) with 5,000 bootstrap samples, whereby perceived change was the independent variable, annoyance and AIR were mediators, and adoption procrastination was the dependent variable. We included gender and mobile operating system as covariates. The results showed that perceived change increased the annoyance level ($b = 0.596$, $t = 2.658$, $p = .009$) and that annoyance increased procrastinating about adopting the update ($b = 0.281$, $t = 3.399$, $p = .001$). Mediation's confidence interval did not include zero (95% CI = [0.036, 0.356]). Thus, H_2 was confirmed and the finding from Study 1 replicated. Also, perceived change increased AIR level ($b = 1.085$ $t = 3.426$, $p < .001$), in turn decreasing adoption procrastination ($b = -0.194$, $t = -3.319$, $p < .001$). Mediation's confidence interval did not include zero (95% CI = [-0.412, -0.062]); thus, H_3 was supported. The mediation analysis results are summarized in Table 5.

This study replicated perceived change's main effect on adoption procrastination and annoyance's indirect effect. It also validated anticipated inaction regret as a competing mediator influencing adoption procrastination in the opposite direction of annoyance.

3.3. Study 3

This study replicated findings (H_1 to H_3) from the first two studies with a similar but different stimulus and non-student sample. This study also tested the proposed moderators: perceived benefit (H_4 & H_5) and psychological ownership (H_6 & H_7).

3.3.1. Method

We recruited mobile app users from the Amazon Mechanical Turk (MTurk) panel, a frequently used platform to conduct academic research with consumers (Kees, Berry, Burton, & Sheehan, 2017). To ensure data quality, we followed recommendations for MTurk studies (Aguinis, Villamor, & Ramani, 2021). We used a calendar app for the stimuli. Participants were required to be living in the United States, use a smartphone, and be 18 years or older. Qualtrics automatically terminated the study if a participant did not meet all three criteria. Next, 505 qualified participants were asked to choose the calendar app from a list that reflected their most frequently used calendar app. If they selected "Other" on the list, participants provided names of calendar apps they frequently used and then were randomly assigned to a textually manipulated update condition: 2 (minor vs. major change) × 2 (low vs. high benefit).

Next, participants answered the same questions on annoyance ($\alpha = 0.88$) and AIR ($\alpha = 0.93$) as in Study 2 and a set of questions regarding psychological ownership (adapted from Shu & Peck, 2011). Adoption intention and adoption procrastination were measured in the same way as in previous studies. If selecting "Yes" to indicate an adoption intention, participants (n = 429, 53.7% female) were presented a question about adoption procrastination as in the previous studies.

3.3.2. Results and discussion

Our manipulation goals were to trigger noticeable differences in change and benefit perceptions (see Table 1 for manipulations). A two-way ANOVA analysis tested the change manipulation's effectiveness by using a 7-point scale (1 = not at all; 7 = very much) ($F(1, 425) = 44.347$, $p < .001$). Results showed that participants perceived significantly greater change in the major change condition (M = 3.820, SD = 1.759) than in the minor change condition (M = 2.730, SD = 1.593). The benefit manipulation did not significantly influence change perception ($F(1, 425) = 1.299$, $p = .255$).

Similarly, a two-way ANOVA showed the benefit manipulation was successful ($F(1, 425) = 11.292$, $p < .001$). Participants perceived significantly more benefit in the high benefit condition (M = 4.210, SD = 1.643) than in the low benefit condition (M = 3.660, SD = 1.740). The change manipulation did not significantly influence perceived benefit ($F(1, 425) = 2.106$, $p = .147$).

Next, we tested the main effects on adoption procrastination with a two-way ANOVA, and results showed both perceived change ($F(1, 425) = 4.058$, $p = .045$) and perceived benefit ($F(1, 425) = 8.692$, $p = 0.003$) influenced adoption procrastination. Specifically, participants were more likely to procrastinate about implementing adoption intentions when perceiving a major change (M = 2.810, SD = 1.479) than a minor change (M = 2.460, SD = 1.422) from the app update. Thus, these results replicated the support of H_1 found in the first two studies. In contrast, participants were less likely to procrastinate about adopting the app update when the perceived benefit was high (M = 2.400, SD = 1.357) versus low (M = 2.790, SD = 1.512). The interaction of change and benefit perceptions also had a direct significant effect on adoption procrastination ($F(1, 425) = 4.341$, $p = .038$).

Then we tested the mediation effects of annoyance and AIR using the PROCESS SPSS application (Model 4) with 5,000 bootstrapping samples (Hayes, 2017), much like in the first two studies. As expected, both annoyance (b = 0.158, 95% CI = [0.074, 0.261]) and AIR (b = -0.146, 95% CI = [-0.267, -0.033]) significantly mediated in an opposite direction the relationship between perceived change and adoption procrastination. The results showed perceived change with a direct effect on adoption procrastination ($b = 0.336$, $p < .001$), indirect effect mediated by annoyance ($b = 0.268$, $p < .001$), and another indirect effect mediated by AIR ($b = -0.343$, $p < .001$). Again, H_2 and H_3 were supported as in the first two studies.

We adopted the PROCESS SPSS application (Model 9) with 5,000 bootstrapping samples to test partial dual moderated mediations (Hayes, 2018). In this analysis, perceived change was the independent variable; annoyance and AIR were two competing mediators; and perceived benefit and psychological ownership moderated the relationships between perceived change and annoyance and AIR, respectively.

Results showed that perceived benefit and perceived change interacted negatively to influence annoyance level ($b = -0.882$, $t = -3.614$, $p < .001$), while psychological ownership interacted positively with perceived change ($b = 0.215$ $t = 2.499$, $p = .0128$). In turn, annoyance increased adoption procrastination ($b = 0.258$ $t = 5.558$, $p < .001$). The moderated mediation effects of perceived benefit (index = -0.237, 95% CI = [-0.405, -0.096]) and psychological ownership (index = 0.058, 95% CI = [0.004, 0.116]) were both significant because their confidence intervals did not include zero. Thus, H_4 and H_6 were supported.

The results also showed that perceived benefit strengthened perceived change's impact on AIR ($b = 0.622$ $t = 1.851$, $p = .060$), while

Table 6
Study 3 partial dual moderated mediation results.

	Model 1 DV: Annoyance	Model 2 DV: AIR	Model 3 DV: Adoption procrastination
Regression Results			
Perceived change	0.243	-0.233	0.336***
Perceived benefit	0.132	0.560**	
Psychological ownership	0.011	-0.302***	
Annoyance			0.268***
AIR			-0.343***
Perceived change × perceived benefit	-0.882***	0.622*	
Perceived change × psychological ownership	0.215**	0.123	
R^2	0.104	0.114	0.277
F value	9.859***	10.843***	54.307***
Partial moderated mediations			
Moderator: perceived benefit	**Index**	**SE**	**95% CI**
Perceived change → annoyance → adoption procrastination	-0.237	0.080	[-0.405, -0.096]
Perceived change → anticipated inaction regret → adoption procrastination	-0.214	0.113	[-0.453, -0.007]
Moderator: psychological ownership			
Perceived change → annoyance → adoption procrastination	0.058	0.028	[0.004, 0.116]
Perceived change → anticipated inaction regret → adoption procrastination	-0.042	0.044	[-0.131, 0.042]

Notes: * $p < .1$, ** $p < .05$, *** $p < .01$; AIR = anticipated inaction regret; SE = standard error; CI = confidence interval.

psychological ownership did not significantly interact with perceived change to make a difference in AIR ($b = 0.123$ $t = 1.042$, $p = .297$). In turn, anticipated inaction regret reduced adoption procrastination ($b =$ -0.343, $t =$ -10.04, $p < .001$). Thus, H_5 was supported because the moderated mediation confidence interval did not include zero (index = -0.214, 95% CI = [-0.453, -0.007]), while H_7 was not supported because the confidence interval included zero (index = -0.042, 95% CI = [-0.131, 0.042)]. The moderated mediation results are shown in Table 6.

Study 3 supported our argument that when benefit perception increased, users became less annoyed with change and felt stronger AIR; thus, they were less likely to procrastinate adopting the update. As expected, when psychological ownership increased, users became more annoyed with the update offer and indicated they would further procrastinate adoption. Contrary to expectations, psychological ownership did not intensify AIR, possibly because the attachment is tied directly to the current product version (Brasel & Gips, 2014; Shu & Peck, 2011), while AIR relates to undesirable future outcomes related to missing out on a different product version (Patrick, Lancellotti, and Hagtvedt, 2009). In other words, psychological ownership and AIR might be anchored in different temporal frames.

4. Implications, contributions, and future research

4.1. Discussion

Although consumers' new product adoption decisions have been extensively investigated, relatively little is known about the gap between when consumers form an adoption intention and when they implement it. At the same time, a longer gap between adoption intention and implementation can slow down market acceptance, in turn negatively influencing the new product's success (Mims, 2018). Delayed consumer adoption (i.e., lengthier adoption procrastination) can be especially problematic in digital product categories (Spanjol et al., 2018), where new versions are released more frequently. Thus, adoption procrastination leads to a delayed consumer experience of successive digital innovations and can, in turn, discourage firms from continually designing and launching such innovations (Fleischmann et al., 2016). Our research differs from extant innovation adoption literature in that it examines adoption procrastination in both cognitive and affective terms to understand complicated adoption-related behaviors in the digital world.

4.2. Conclusions

4.2.1. Theoretical contributions

This research contributes to the innovation adoption literature in multiple ways. First, it enriches knowledge of adoption-related behaviors (e.g., Chen & Granitz, 2012; Davis, 1985; Talke & Heidenreich, 2014) by introducing the novel concept of adoption procrastination, leading users of digital products to deliberately delay implementing already formed adoption intentions. By conceptualizing adoption procrastination, we integrate a widespread general human tendency (i.e., procrastination; Sirois & Pychyl, 2013) into the innovation adoption domain. Thus, our research directly responds to the call Aarts et al. (2011) issued in their meta-analysis on consumer innovation adoption: future research should "shed more light on understanding *why consumers do or do not progress from one stage in the adoption process to another, such as from intention to behavior*" (p. 143, emphasis added).

Second, our research seeks to focus more attention on cognition and affect dynamics in the consumer innovation adoption domain. To empirically demonstrate that both cognitions and emotions play essential roles in adoption procrastination, we focus on the successive digital innovations' context (itself an underinvestigated domain; Spanjol et al., 2018). Specifically, we find adoption procrastination is a coping strategy for a short-term experienced negative emotion (i.e., annoyance), which occurs when digital product users are confronted by a potentially disruptive new version. These findings enrich the consumer innovation adoption literature by identifying underlying mechanisms and distinguishing between change and benefit perceptions *and* intent to adopt successive digital innovations. Our findings support prior meta-analytic conclusions that consumers must readily recognize an innovation's relative advantage (i.e., benefits) in order to be motivated to adopt (Aarts et al., 2011).

Third, we simultaneously examine both experienced and anticipated emotions to explain how users cope with the discomfort often elicited when new versions of digital products in use are offered to consumers. Our findings suggest that when consumers are faced with a choice to either continue with a digital product in use "as is" or update it with a newer version, experienced and anticipated emotions counteract when the update is perceived as being more substantial in scope. Our examination of competing emotions complements prior studies investigating relationships between emotions and new product adoption (Wood & Moreau, 2006; Zhao, Hoeffler, & Zauberman, 2011) and calls for insights into "dual routes" of such relationships (Lin, MacInnis, & Eisingerich, 2020, p.76).

4.2.2. Practical implications

Successive digital innovations modify digital technology's functionality, performance, and capabilities by updating consumers' products in use (Jahanmir & Lages, 2016). Our findings help managers understand that users procrastinate adoption not because they do not intend to adopt successive digital innovations (e.g., software or mobile app updates), but because they deliberately delay adoption as a way of coping with the discomfort that digital product updates elicit. Such discomfort can be less overwhelming if firms clearly communicate how successive digital innovations will benefit and change the digital product in use (Kim & Kankanhalli, 2009). For example, some mobile app

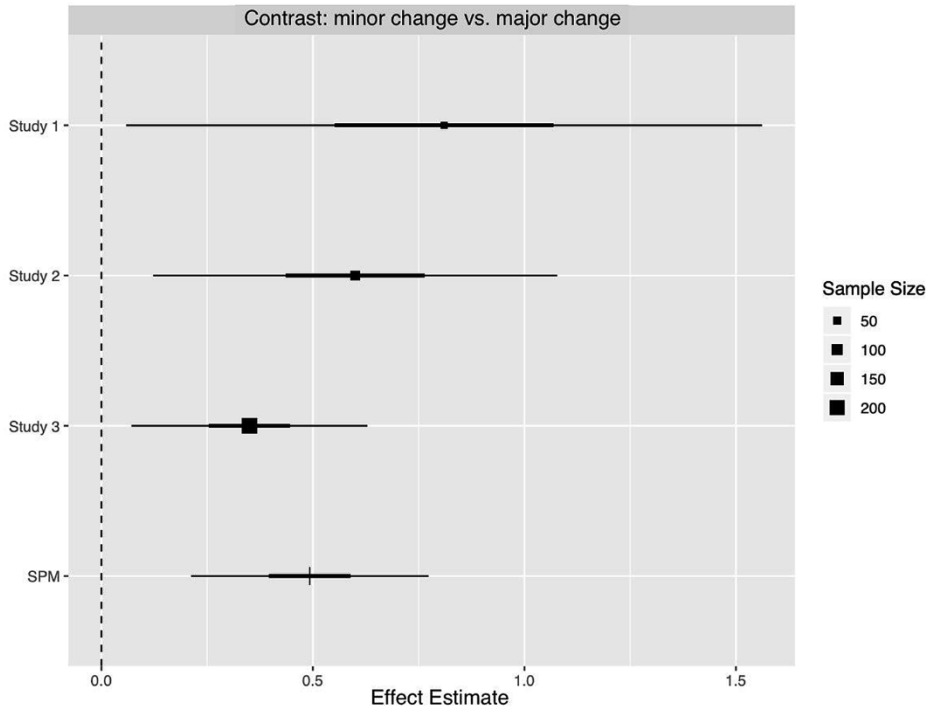

Fig. A1. Effect estimates of single-paper *meta*-analysis (SPM). *Note:* The effect estimates are given by the squares for single-study estimates and the vertical bar for SPM estimates; 50% and 95% intervals are given by the thick and thin lines, respectively. The average sample size per condition in each study is given by the size of the squares (McShane & Böckenholt, 2017). The SPM suggests the contrast attains statistical significance.

developers simply announce that an update modifies a digital product. Without further details, consumers will focus on the status quo's interruption and, thus, will be more likely to procrastinate adopting the new version.

If firms aim to reduce user procrastination in adopting successive digital innovations, they should understand that consumers are often psychologically bonded with frequently used digital products. As a result, we recommend that digital product marketers try to reduce users' sense of loss that accompanies adopting a new product version. Companies like Apple (Clover, 2021), Google (Li, 2021), and Spotify (Shanklin, 2021) have endeavored to find solutions that facilitate the adoption of updates. Therefore, testing how successive digital innovations influence customized content and features is critical before launching digital product updates. Our findings suggest that framing digital product updates as less extensive to reduce annoyance might be particularly important for users who have heavily invested in customizing the product. At the same time, digital product users will procrastinate adoption unless they realize that a product's new generation is better than the current digital product in use. Conveying what users will miss by not adopting successive digital innovations in a timely manner, in order to trigger anticipated inaction regret, is another strategy that we recommend developers consider when launching and communicating digital product updates to users.

4.3. Limitations

This research has several limitations. First, to explore under which conditions adoption procrastination might happen in individual users, we adopted an experimental approach and examined adoption procrastination at a single time point. However, the same digital product user might accelerate adoption over a certain period, particularly if others' influence becomes important (e.g., network effects).

Second, our sampling relied on college students and MTurk respondents. Although we carefully screened out non-qualified participants and ensured that the featured apps were used widely in the sampled user segments, other user categories (e.g., professionals) may procrastinate implementing innovation adoption intentions for different reasons. For example, users of apps or software in a professional work environment might be hindered in their adoption implementations by their IT department's choices to install (or not) updates. This factor is particularly relevant if the digital product under consideration is a platform that embeds other digital products, such as iOS, Android, and Windows.

Finally, we examined the adoption procrastination phenomenon in the context of mobile apps where updates are often free to users. We did so to eliminate price as a factor in adoption intentions and implementation. However, adoption procrastination might be more pronounced when innovation is pricey to adopt. In addition, automatic adoption options are increasingly available in digital products, yet users often resist such options because they cannot avoid unappealing or unnecessary new generations that lead to usage pitfalls (Kirk, Peck, & Swain, 2017). Therefore, we encourage researchers to explore such additional factors that may influence adoption procrastination in other innovation contexts.

4.4. Future research

Recommending further investigation into adoption procrastination dynamics, we highlight two possible directions. First, because digital innovation's timing and frequency may influence consumer behavior, future research should longitudinally study adoption procrastination to explore how different updates or update combinations influence adoption other users,' influences whereby adoption procrastination might be shortened or prolonged based on word-of-mouth, for example.

Second, digital platforms are recognized as an important factor in organizational performance (Porter & Heppelmann, 2014). Future research might investigate adoption procrastination at the firm and employee levels as well as the digital platform and embedded digital product levels. In addition, connected (i.e., smart) products can form a system eliciting different adoption procrastination dynamics than stand-

alone digital product updates. For example, traditionally discrete tools—e.g., tractors, tillers, and planters—are being digitally connected to create a farming network or system (Patel, 2016). Future research would benefit from exploring adoption procrastination behaviors in these small connected systems (e.g., smart homes, smart offices, etc.).

Appendix:. Single-paper meta-analysis results

We tested our results' reliability by conducting a single-paper meta-analysis (SPM). SPM is a statistical technique that synthesizes two or more studies to provide an average estimate of effects (McShane & Böckenholt, 2017). We conducted the SPM to rule out the concern that different research participants and mobile app stimuli across our three studies confounded the study's findings. As shown in Fig. A1, the reliability of perceived change's effects on adoption procrastinations is shown in the SPM figure. Each study's effect estimate is given by the thick and thin lines for the 50% and 95% intervals, respectively. The SPM estimate is given by the vertical bar, which represents zero effect. Since the SPM estimate's 95% interval does not cross the vertical bar, the SPM estimate is significantly different from zero effect, indicating the convergence across three studies. Specifically, the SPM's results suggest that perceived change increases adoption procrastination by a degree of 0.493 (with 95% CI at 0.212 and 0.907).

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