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ORIGINAL EMPIRICAL RESEARCH

Examining post-purchase consumer responses to product automation

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Abstract

Automation is increasingly being introduced into a variety of consumer products, ranging from vacuum cleaners to autonomous vehicles. While automation provides convenience and efficiency benefits consumers value, related evidence suggests it can also undermine post-purchase consumer product responses of importance to managers (e.g., brand loyalty). Using insights derived from Amazon customer reviews, a survey of product owners, a virtual reality lab, and two vignette experiments, we formally explore this possibility and find that automation is indeed a double-edged sword. That is, we uncover that automation has undesirable effects on post-purchase outcomes because it interferes with psychological ownership formation. We also find that, depending on consumer identity motives (e.g., task-related vs. technology-related) and product design affordances (e.g., a remote access feature), this effect can be strengthened, weakened, or even reversed. Our findings offer managers needed guidance on how to counter automation's dark side through identity-based targeting and product design.

Keywords Automation · Psychological ownership · Identity · Design affordances · Text analysis · Propensity score matching

As technological advances extend automation's reach into myriad product categories, such as lawn mowers, pet feeders, baby rockers, and cars, consumer demand for such products is only likely to intensify. This expectation is borne out in recent sales data that reveal widespread adoption and increasing demand for products in categories on the leading edge of automation. For example, 2019 revenues for robotic vacuum cleaners were estimated at $3 billion and are expected to triple in less than a decade, while automated lawn mowers currently account for $351 million in yearly revenues and are expected to grow 22% per year through 2025 (Grand View Research, 2019, 2020).

Automation, which decreases or eliminates the need for human participation in a variety of labor-intensive tasks, provides consumers many obvious benefits, with convenience and efficiency the most notable among them (De Bellis & Johar, 2020; Parasuraman et al., 2000). These benefits are not without psychological cost as research provides evidence of *pre-purchase* resistance to automated products rooted in the threat they represent to consumers' identity and in the perceived loss of control associated with delegating tasks to machines (e.g., Leung et al., 2018; Mende et al., 2019; Puntoni et al., 2021; Rai, 2020). Despite evidence of automation's pre-purchase dark side (e.g., Xu & Mehta, 2022), extant literature has yet to empirically consider whether these pre-purchase psychological costs persist *post-purchase* to the detriment of *consumer product responses* marketers value, such as product satisfaction and brand loyalty (Brown

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& Dacin, 1997). Our aim in this research is to fill this knowledge gap.

With that end in mind, we build on van Doorn et al. (2017) and Jörling et al. (2019) and adopt psychological ownership theory as a lens to explore post-purchase consumer product responses to automation. Specifically, we posit that, by decreasing consumer interaction with products, automation inhibits *psychological ownership* formation (i.e., it reduces consumers' cognitive and affective sense of felt ownership for a product; Pierce et al., 2003). We further argue that this reduction in psychological ownership has undesirable consequences for post-purchase attitudinal and behavioral consumer responses, which are accentuated when consumers' identity is rooted in the task being automated (i.e., a *task-related* identity) but ameliorated when it is tied to being a technologically savvy consumer (i.e., a *technology-related* identity). Finally, we argue that design *affordances* (i.e., product features such as remote access) can be used to counteract the effects of automation on consumer psychological ownership and its downstream effect on product related attitudes and behaviors. We test and find broad support for these ideas in a multifaceted set of field and lab studies that leverage data from Amazon customer reviews, a survey of automated and non-automated product owners, a virtual reality lab, and two vignette experiments.

Our theorizing and findings contribute to the literature in several meaningful ways. First, to the best of our knowledge, this research is the first to empirically investigate the post-purchase impact of automation on consumer product responses. While prior research has addressed the implications of automation in the firm (e.g., Huang & Rust, 2018; Kaplan & Haenlein, 2019; Shankar, 2018; Xiao & Kumar, 2021; Xu & Mehta, 2022) & examined how consumers react to automation at the point of purchase (e.g., Kim et al., 2022; Luo et al., 2019; Mende et al., 2019; van Doorn et al., 2017), research has largely ignored the post-purchase consequences of product automation. This is a noteworthy omission considering that consumer–product relationships develop in the post-purchase phase, such that the effects of automation are most likely to manifest then. By acknowledging the importance of the post-purchase phase, our research offers a novel perspective, rooted in psychological ownership theory, on why and when automation can undermine consumer product responses of importance to marketers.

Second, we establish that psychological ownership is the central mechanism through which automation undermines various post-purchase consumer product responses, including emotional attachment, product satisfaction, product maintenance, and brand loyalty. In doing so, we extend the psychological ownership literature beyond the pre-purchase and initial utilization phase (e.g., Atasoy & Morewedge, 2018; Stoner et al., 2018) to demonstrate its usefulness for explaining post-purchase outcomes following product usage.

Third, we answer calls for research to consider the role of consumer identity motives as a determinant of psychological ownership (Hulland et al., 2015; Uysal et al., 2022). In answering this call, we proceed from the perspective that identity is a multifaceted phenomenon (Gao et al., 2020; Reed et al., 2012), such that automation may threaten certain aspects of consumers' identity (i.e., task-related identity; Puntoni et al., 2021) but be entirely congruent with other identity elements (i.e., technology-related identity). Beyond demonstrating that identity motives moderate the effect of automation on psychological ownership, our work underscores the importance of acknowledging the multifaceted nature of identity when evaluating its impact on psychological ownership formation.

Finally, while we offer a new perspective into the post-purchase dark side of automation and the role of identity, we also demonstrate how firms can incorporate design affordances into products to mitigate these harmful outcomes. That is, we build on the work of Baxter et al. (2015) to provide an initial empirical demonstration of the impact of design affordances (i.e., features that encourage consumer interaction with a product) on psychological ownership formation. Our findings suggest that features that provide consumers with temporal and spatial control over a product can serve to either offset or exacerbate the effects of automation on psychological ownership, contingent on consumer identity motives. This finding thus offers nuanced insight regarding why and when product design can overcome the post-purchase dark side of automation.

Literature review

Stemming from the Greek word *matos*, meaning "acting of oneself," automation refers to a decrease or elimination of the need for human intervention to accomplish a task (Parasuraman et al., 2000). By extension, automated products are "characterized by the delegation of manual tasks to technology" and are intended to take over tasks from consumers that typically require time and effort (De Bellis & Johar, 2020, p. 75, see also Leung et al., 2018). Increasingly, task automation is being facilitated though the integration of artificial intelligence (AI) into a variety of consumer products. For example, AI-powered washing machines now lessen human participation in clothes laundering by detecting soil levels to automate the process of optimizing water levels, detergent quantity, & washing cycle.

While AI represents a broad class of technologies designed to replicate or exceed human intelligence and abilities, different forms of AI can facilitate the automation of tasks by enabling products to learn from, adapt to, and even interact socially with their environments (e.g., as in the case of virtual assistants such as Siri and Alexa). Our focus here is on products that leverage these and related technologies to

automate consumer tasks via what the literature refers to as "mechanical AI," "mechanical intelligence," "task automation," and/or "robotic process automation" (Davenport et al., 2020; Hollebeek et al., 2021; Huang & Rust, 2018, 2021). Beyond replacing human labor to maximize efficiency, automated products are intended to decrease variability and error (Granulo et al., 2021; Huang & Rust, 2018; Mende et al., 2019). That is, automated products commonly rely on the pairing of rules-based AI with physical sensors to standardize repetitive, mundane, or labor-intensive tasks while reducing consumer involvement (Hollebeek et al., 2021). Due partly to their focus on task standardization, automated products (such as those we examine here) are often limited in their ability to learn and adapt.

Puntoni et al. (2021) advance a framework that explicates how consumers experience their interactions with various forms of AI. We examine what these scholars refer to as "delegation," or the automation of a task on a consumer's behalf. Puntoni et al. (2021) reason that while delegation affords convenience and allows consumers to spend more time on activities they enjoy, it also has a potential dark side that promotes undesirable consequences (Davenport et al., 2020; Huang & Rust, 2021; Leung et al., 2018; Mende et al., 2019). Specifically, Puntoni et al. (2021) argue that task automation can lead consumers to feel they have been replaced, which threatens their sense of accomplishment and identity. Similarly, Leung et al. (2018) posit that because demonstrating important skills is central to an individual's identity, consumers are less likely to adopt automated products in identity-relevant domains.

Beyond threatening consumers' identity, research suggests automation can also contribute to a reduction in perceived or actual control, which has been linked to consumer anxiety and the rejection of new products (Gill, 2020; Mende et al., 2019; Rai, 2020). For example, prior research finds that consumers are uncomfortable with and resist transferring control to autonomous devices or robots (Castelo et al., 2019; Longoni & Cian, 2022) because the underlying technology is a "black box" that lacks transparency and is "inscrutable" (Puntoni et al., 2021; Rai, 2020). Furthermore, related research suggests consumers are less likely to delegate or cede control to technology when the task involves decisions that are perceived to be subjective or require intuition, empathy, and gut instinct (Castelo et al., 2019; Davenport et al., 2020).

The preceding exposition suggests that while automation or task delegation provides consumers with convenience and efficiency benefits, it also has a potential dark side associated with identity threat and loss of control. This potential dark side is the focus of the present investigation, as we deem it has important but unexplored consequences for the marketing of automated products. To ground our investigation and highlight how our work extends the literature, Table 1 offers an overview of relevant research on product automation. Specifically, the table summarizes prior work in terms of its nature, substantive focus, sample, design, and focal measures to underscore the novel insights our research affords.

Table 1 reveals that while empirical studies on the organizational impact of automation are relatively abundant (column 1), most of that work has occurred outside the *consumer product* context (column 2). That is, research on automation has primarily addressed the effect of technology on job replacement within the firm (Huang & Rust, 2018; Kaplan & Haenlein, 2019; Shankar, 2018; Xiao & Kumar, 2021) or consumer reactions to technology in customer service or point-of-purchase settings (e.g., Luo et al., 2019; Mende et al., 2019; van Doorn et al., 2017). Of the few studies listed in Table 1 that explore physical product automation (e.g., Gill, 2020; Leung et al., 2018), all but one focus on the *pre-purchase* effects of automation, which stands in sharp contrast to the present investigation. To the best of our knowledge, Jörling et al. (2019) is the only other study to consider the post-purchase outcomes of product automation. Specifically, they investigate consumer attributions for robotic product outcomes and find consumers generally attribute positive outcomes to robots and negative outcomes to themselves, with self-attributions for negative outcomes being uniformly elevated when consumers perceive they own the product. Our research differs from Jörling et al. (2019) not only because our focus is on the impact of automation on consumer product responses (rather than performance attributions) but also because, as Table 1 indicates, we rely on a variety of data sources to explore the impact of automation among *actual consumers* after they have had an opportunity to *interact repeatedly* with a product. These aspects of our research distinguish it not only from Jörling et al.,'s (2019) foundational work but also from most other studies published to date on this topic (Table 1, columns 3, 4, 6, and 9).

The last row in Table 1 highlights how these and other differences between our work and prior research allow us to meaningfully extend the literature. Specifically, the last entry in the table underscores that our research is unique in that it simultaneously: (1) explores the impact of automation on consumer post-purchase responses (e.g., emotional attachment, brand loyalty) to physical products, (2) accounts for the important role of psychological processes (e.g., psychological ownership) and customer characteristics (e.g., task-related identity) in shaping responses to automation, (3) employs field and experimental samples, that include actual product users, to explore the effects of automation, and (4) considers consumer responses to automation after repeated opportunity to interact with a product, which is when the post-purchase effects of automation are most likely to manifest.

Table 1 Relevant literature on automation

Authors & year	Empirical	Physical consumer product	Assessed actual customers	Sample	Post-purchase customer experience	Repeated interaction with automated product	Psychological response to automation	Role of customer characteristics	Impact of automation on consumer product responses
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Van Doorn et al., 2017							✓	✓	✓
Huang & Rust, 2018									
Leung et al., 2018	✓	✓		Students, Prolific, MTurk			✓	✓	
Jörling et al., 2019	✓	✓		Potential customers, Prolific	✓		✓	✓	
Longoni et al., 2019	✓			Students, MTurk				✓	
Luo et al., 2019	✓		✓	Customers					
Mende et al., 2019	✓			Students, MTurk			✓		
De Bellis & Johar, 2020									
Davenport et al., 2020									
Gill, 2020	✓	✓		Students, MTurk					
Granulo et al., 2021	✓			Students, MTurk, Prolific				✓	
Du & Xie, 2021									
Guha et al., 2021		✓							
Huang & Rust, 2021									
McLeay et al., 2021	✓			Panel					✓
Park et al., 2021	✓			Panel				✓	
Pizzi et al., 2021	✓			Panel					
Puntoni et al., 2021							✓	✓	
Chang & Kim, 2022	✓			Panel					
Kim et al., 2022	✓			Students, TurkPrime, MTurk					
Longoni & Cian, 2022	✓		✓	Customers, students, MTurk			✓		
Xu & Mehta, 2022	✓	✓		Research panel, Students					✓
This study	✓	✓	✓	Amazon reviews, actual customers, students, Cloud Research	✓	✓	✓	✓	✓

In summary, although prior research acknowledges product automation can have undesirable consequences, our work is the first to consider the implications of this dark side for consumer product responses managers value. Importantly, we contend that because consumer–product relationships largely form after a purchase is made, psychological ownership theory can explain why automation impacts post-purchase consumer responses.

Conceptual development

Psychological ownership is defined as the implicit or explicit sense of ownership of an object and a feeling that it is "mine" (Pierce et al., 2001). Thus, psychological ownership represents a cognitive and affective state of felt ownership toward a particular object (Pierce et al., 2003). Psychological ownership theory has drawn substantial interest from marketing scholars largely because of its ability to predict attitudes and behaviors of importance to managers. Similar to van Doorn et al. (2017) and Jörling et al. (2019), who apply psychological ownership theory to explore the consequences of automating service interactions, we leverage the theory to ground our investigation of the post-purchase consumer responses associated with product automation. Specifically, as Fig. 1 illustrates, we posit that automation inhibits psychological ownership formation because it decreases consumer interaction with products (H1). This reduction in psychological ownership, in turn, is predicted to have undesirable consequence for post-purchase consumer attitudes (H2) and behaviors (H3). In addition, we posit that these undesirable consequences are accentuated when consumers' identity is rooted in the task being automated (i.e., *task-related* identity; H4) but ameliorated when identity is connected with technological savviness (i.e., *technology-related* identity; H5). Finally, we argue that design affordances can be used to counteract the effects of automation on consumer psychological ownership and its downstream effect on consumer product responses (H6). To develop our hypotheses, we rely on various aspects of psychological ownership theory most germane to our investigation, including (1) the three routes to psychological ownership, (2) known consequences of psychological ownership, (3) consumer identity as a motivation for psychological ownership, and (4) design affordances as a facilitator of psychological ownership in the presence of automation.

Automation undermines psychological ownership

Psychological ownership develops when an individual (1) gains a sense of *control* over an object, (2) acquires *intimate knowledge* about an object, and/or (3) *invests the self* into an object (Pierce et al., 2003). In the case of products, these *three routes to psychological ownership* are activated when consumers use and interact with them. The marketing literature has primarily focused on the first route, namely, the role of control in the development of psychological ownership of a product. Within this literature, *control* has been defined as consumers' ability to access a product when wanted, use it as desired (Bagga et al., 2019; Furby, 1978), and/or physically manipulate the product through touch (Peck & Shu, 2009). Consistent with prior research which suggests that delegating tasks to machines decreases feelings of control (Castelo et al., 2019; Davenport et al., 2020; Gill, 2020; Longoni and Cian, 2022; Mende et al., 2019; Puntoni et al., 2021; Rai, 2020), we anticipate that automation lowers consumer feelings of psychological ownership partly because of its effect on consumer control.

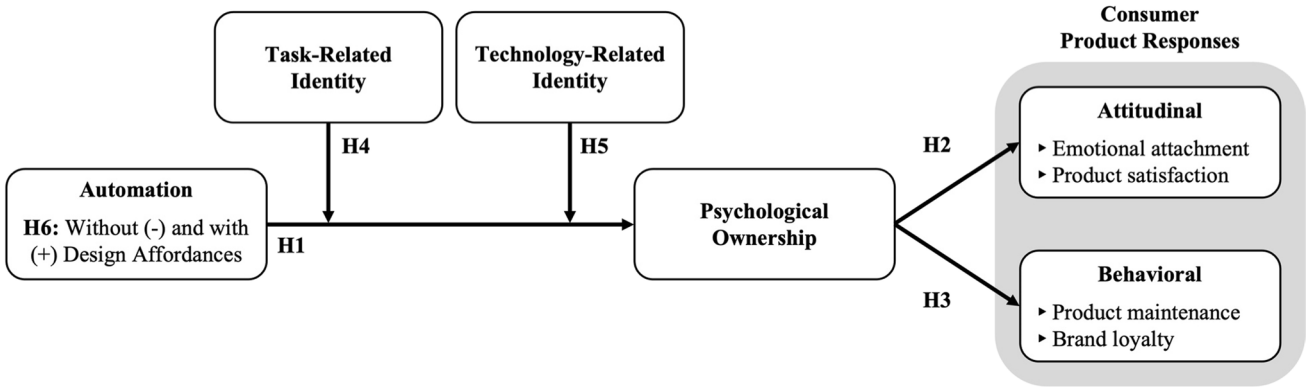

Fig. 1 Conceptual framework. *Notes*: H2 and H3 are mediation or indirect effect hypotheses. The overall effect of automation on our dependent variables is expected to be negative due to lower psychological ownership levels (- x +) that result from product automation. H4 and H5 are moderation hypotheses. H4 predicts that as task-related identity increases, the negative effect of automation on psychological ownership becomes stronger. In contrast, H5 posits that increasing technology-related identification weakens the negative impact of automation

Intimate knowledge, the second route to psychological ownership, has been the least studied and refers to familiarity with an object engendered by repeated interaction and proximity (Pierce et al., 2003). In their work outlining the antecedents and consequences of material possession love, Lastovicka and Sirianni (2011) posit that intimate knowledge develops by coming to know a product both intellectually and physically. Their research finds that individuals readily form intimate bonds with products containing visible moving parts such as firearms, bicycles, and automobiles. However, individuals struggle to form emotional attachments with products such as computers because of their complex nature. On this topic, they write (p. 337):

> [F]irearms, bicycles, and automobiles—all originated in the nineteenth century or earlier and, as such, rely on technologies with visible moving mechanical parts. Hence, because such technology is relatively more accessible to the average consumer, we believe intimacy has more of an opportunity to develop. In contrast, today's computers are based on early twenty-first-century microcircuits without visible moving parts and, as such, are undecipherable black boxes for many consumers. As a result, technology may be a barrier to intimacy for many...

Consistent with this line of reasoning, prior research finds that consumers react negatively to technologies that facilitate automation, such as AI and algorithms, because the technology's lack of transparency undermines intellectual intimate knowledge (Rai, 2020). Similarly, automation also has the potential to reduce physical intimate knowledge. Consider, for example, how consumers experience traditional vacuum cleaners and how automation alters their interaction with the product. A traditional vacuum provides direct feedback during operation; users can feel the weight of the vacuum in their hands, the noise provides confirmation of particles being picked up, and the pull of resistance indicates the level of suction power. Each of these interaction cues helps the consumer know the product more intimately but are absent when the product is automated. Thus, we expect automation also results in a loss of psychological ownership because it reduces consumers' intimate knowledge of a product.

The third route to psychological ownership, *investment of the self*, refers to the expenditure of time, effort, talents, and/or other resources in interactions with an object (Kirk et al., 2018; Pierce et al., 2003). This route implies that as consumers interact directly and repeatedly with a product, investment of the self into the product becomes more likely (Belk, 1988). For example, with an automated product, the potential for self-investment is lower because consumers are relatively disengaged from the product when it operates independently. Consistent with this line of theorizing, Norton et al. (2012) coin what is referred to as the "IKEA effect." Their research demonstrates that the act of assembling a product increases interaction with the product and, by extension, the investment of the self. This self-investment during assembly ultimately leads to greater feelings of ownership and higher product evaluations. Our research proposes what can be construed as the inverse of the IKEA effect; that is, we posit that because *automation reduces consumer-product interaction*, the opportunity to invest the self is limited, ultimately to the detriment of psychological ownership.

To summarize, automation has the potential to disrupt all three routes to psychological ownership. First, prior research suggests that automation decreases feelings of control (Castelo et al., 2019; Longoni & Cian, 2022; Puntoni et al., 2021). Second, intimate knowledge of automated products may not be possible because they often rely on technologies that are "inscrutable" to the average consumer (Rai, 2020). In addition, automation also reduces intimate knowledge by enabling products to operate independently, without requiring extensive physical interaction with the consumer. Finally, because the goal of product automation is to reduce effort and interaction, consumer self-investment is likely to be minimized. Consequently, we propose:

H1 Automation decreases psychological ownership.

Consequences of psychological ownership

Prior work finds that psychological ownership influences consumers' pre-purchase valuation and demand for products (e.g., Jussila et al., 2015; Peck & Shu, 2009) and tends to elicit territorial responses (Kirk et al., 2018). Moreover, Fuchs et al. (2010) demonstrate that psychological ownership enhances consumers' pre-purchase behavioral intentions related to engaging in word of mouth and caring for the product. These and other studies thus focus on the role of psychological ownership in the *pre-purchase* or product acquisition stage. We extend this literature by examining the *post-purchase* attitudinal (i.e., emotional attachment and product satisfaction) and behavioral (i.e., product maintenance and brand loyalty) consequences of psychological ownership that emerge after the consumer has had the opportunity to interact repeatedly with a product.

Attitudinal consumer responses to psychological ownership Kleine and Baker (2004) describe material possession attachment or *emotional attachment* as a multifaceted construct indicative of a relationship with a product. They posit that psychological appropriation, as manifest in psychological ownership, is necessary for an emotional attachment to an object to develop. Using related logic, Morewedge (2021) argues that psychological ownership creates a self-product

linkage that enhances consumers' emotional attachment to a product. Importantly, this same self-product linkage is expected to enhance consumers' assessment of and *satisfaction* with a product (Weiss & Johar, 2013) because any evaluation of the product reflects on the self (Fornell, 1992; Morewedge, 2021). Thus, we propose:

H2 Psychological ownership mediates the negative impact of automation on attitudinal consumer product responses, including (a) emotional attachment and (b) product satisfaction.

Behavioral consumer responses to psychological ownership Peck et al. (2021) reveal that psychological ownership increases felt responsibility for objects and promotes stewardship behaviors. This conclusion is supported by prior literature which reveals that feelings of ownership can motivate consumers to care for, preserve, and/or nurture products (Lastovicka & Sirianni, 2011; Pierce et al., 2003). In the context of our research, such motivations are reflected in *product maintenance* behaviors (i.e., the amount of time, money, and effort spent caring for a product) that aim to extend the product's life. Furthermore, the desire to nurture and preserve a product is likely to encourage consumers to extend their relationship with the product at the end of its life cycle, leading to greater *brand loyalty* upon repurchase. That is, psychological ownership encourages consumers to repurchase the same brand as their current product because doing so allows them to prolong the product relationship (Park & MacInnis, 2006). Consistent with these arguments, we thus predict that automation negatively affects product maintenance and brand loyalty through its effects on psychological ownership. Formally,

H3 Psychological ownership mediates the negative impact of automation on behavioral consumer product responses, including (a) product maintenance and (b) brand loyalty.

Identity moderates the effect of automation on psychological ownership

According to Pierce et al. (2003), consumers are motivated to purchase products that fulfill their needs (1) for efficacy and feelings of control, (2) to have a place, and (3) to express their self-identity. These motives thus represent individual differences that explain *why* consumers seek to own products. Hulland et al. (2015) note that prior work in marketing has largely focused on efficacy and efficiency motivations of product ownership, creating an opportunity for research to explore the role of other consumer motives. We pursue this opportunity here by focusing on the role of identity in consumers' post-purchase response to automation, which refers to "any category label to which a consumer self-associates either by choice or endowment (Reed et al., 2012, p. 312)." Our focus on identity is based on the recognition that product ownership is a critical way for consumers to affirm and communicate their identities (Belk, 1988; Kleine et al., 1993) and on previous research that demonstrates that when a consumer's identity is tied to the task being automated by a product, automation interferes with product acquisition intentions (Leung et al., 2018).

In H1, we predict that product automation lowers consumers' sense of psychological ownership. Here, we argue that this negative effect is exacerbated when the focal product automates a task (e.g., manual dough preparation) that is linked or tied to a consumers' identity (e.g., baker), which we refer to as a *task-related identity*. Task-related identity captures the extent to which a consumer self-associates with or defines the self in terms of a specific type of work or activity they commonly perform (e.g., lawn-mowing, feeding a pet, caring for an infant child, etc.). Leung et al. (2018) establish that people with a task-related identity (e.g., biking, baking or fishing) are initially less likely to adopt an automated product (e.g., e-bikes, automated bread makers or automated fishing poles) because it represents a threat to who they are. In fact, the greater the strength of that identity, the more they resist the automated product (Leung et al., 2018). This identity threat may eventually become secondary to the convenience afforded by automation, leading consumers to adopt such products despite initial resistance (Leung et al., 2018). However, after a product is legally owned, automation may still undermine psychological ownership formation because the threat to consumers' identity remains. This identity threat discourages them from attempting to control the product, develop knowledge about the product, and invest themselves in the product. Thus, we expect that a task-related identity exacerbates the negative effect of automation on psychological ownership by suppressing the three routes to psychological ownership. Formally,

H4 The negative impact of automation on psychological ownership strengthens as consumers' task-related identity increases.

Importantly, Reed et al. (2012) note that people can identify with multiple category labels simultaneously (Gao et al., 2020). For instance, a consumer may simultaneously identify as a mother, American, audiophile, and wine-enthusiast, as well as with tasks such as baking or balancing the family checkbook. Situational factors make some identities more salient than others (Gao et al., 2020; Oyserman, 2009; Reed et al., 2012), such that identities primed during a focal task can become the most important to a consumer at a given point in time.

In many cases, automated products involve some degree of technological innovation that primes a *technology-related*

identity, which refers to the degree to which a consumer self-associates with or defines the self in terms of being a tech-savvy, early adopter of new products. Automated products often appeal to consumers with a technology-related identity because acquiring and using products that incorporate the newest technology is identity congruent and allows them to signal this element of their identity (Kennedy & Funk, 2016). In line with the previous exposition, we anticipate that a technology-related identity is likely to weaken the negative effect of automation on psychological ownership because acquiring a product that incorporates new technology will be experienced as identity-consistent and thus encourage consumer behaviors directed toward controlling the product, developing product knowledge, and investing themselves in the product. As these behaviors promote psychological ownership formation, we predict:

H5 The negative impact of automation on psychological ownership weakens as consumers' technology-related identity increases.

Design affordances as a facilitator of psychological ownership

Puntoni et al. (2021) note that products which delegate tasks should be designed in a way that allows consumers to make choices or initiate actions that foster self-efficacy and a sense of control. Indeed, they and others argue that simply allowing consumers to "customize peripheral features" may be sufficient to enhance feelings of control (Puntoni et al., 2021). More broadly, the literature identifies 16 *affordances* (i.e., design elements that facilitate a particular experience with a product) that activate one or more of the three routes to psychological ownership (Baxter et al., 2015). For example, Baxter et al. (2015) note that periodic signaling, an affordance that facilitates increased communication with an object (e.g., status updates, reminders), can help activate the intimate knowledge path to ownership. Building on this and related research, we predict that the negative effect of automation on psychological ownership, relative to traditional products, is weaker among products that incorporate design affordances than among those that do not.

Our focus here is on *temporal* and *spatial* design elements that are increasingly being added to automated products. The first affordance we consider relates to functionality that allows remote access to a product via the internet. This product feature aligns with what Baxter et al. (2015) refer to as *temporal control*, a design element that enables consumers to access a product anytime from anywhere. Because remote access increases consumer control over a product, we expect the negative effect of automation on psychological ownership to be less pronounced among products that provide for remote access than among those that do not.

The second affordance we consider focuses on features that allow consumers to control not only *when* the automated product operates but also *where* it operates and *how* it moves. For example, high-end robotic lawn mowers allow consumers to create a map of their yard within an application and specify the route the lawn mower takes. This type of affordance offers consumers what Baxter et al. (2015) call *spatial control*, or input into where and how the product operates. We anticipate that by allowing consumers to determine where and how a product operates, spatial control increases consumers' sense of control over the product and their level of investment in the product (e.g., to customize its operations). In light of this possibility, we predict that automated products which provide for spatial control are less likely to interfere with psychological ownership formation than those which do not. In sum, given that temporal and spatial affordances are expected to facilitate psychological ownership development, we propose:

H6 The negative effect of automation on psychological ownership is weaker among products that include (a) temporal and (b) spatial design affordances than among those that do not.

Empirical program

Our research approach follows the guidelines first proposed by Cialdini (1980), which suggest that important effects should be identified in the field first (Studies 1 and 2) and then subjected to confirmation and theoretical tests in the laboratory (Studies 3–5). Study 1 offers initial support for H1 through a text analysis of consumer reviews that reveals that psychological ownership is lower among owners of automated vacuum cleaners than among those who own traditional upright vacuums. Study 2 utilizes survey data collected from vacuum cleaner owners and finds support for core aspects of our model. Specifically, Study 2 reveals that product automation leads to lower levels of psychological ownership among consumers with a task-related identity (H4) and higher levels of psychological ownership among consumers with a technology-related identity (H5). In addition, we find that these effects of automation on psychological ownership ultimately impact consumer attitudes and behaviors of importance to managers (H2 and H3). Studies 3 and 4 shift to self-driving cars to demonstrate experimentally that psychological ownership explains the negative effect of automation on attitudinal consumer responses (H1 and H2). Finally, Study 5 tests the joint effects of both consumer identity (H4 and H5) and design affordances (H6) to offer nuanced insights into the factors that shape the effect of automation on psychological ownership. Table 2 provides a summary of the studies and their key features.

Study 1

To gain insight into the effect of automation on psychological ownership, we scraped and analyzed Amazon consumer reviews of traditional and automated vacuum cleaners. Our choice of product for this initial investigation was guided by the recognition that automated and traditional (i.e., non-automated) models of vacuum cleaners are widely available in the market, which would allow us to collect a sufficiently large sample for analysis purposes.

Method

We began by scraping all Amazon reviews for the top 10 best-selling vacuums in the traditional upright vacuum and robotic vacuum cleaner categories at the time of data collection. This procedure generated a sample of 52,281 reviews (14,286,994 words) that served as the foundation for our field test of H1. Informed by the procedures Humphreys and Wang (2018) prescribe, we began by developing a dictionary of words that could be used to construct a text-based measure of psychological ownership.[1] Following an iterative process, each author provided input into the list until agreement was reached. We then conducted a pre-test to assess the adequacy of the proposed text-based measure of psychological ownership (Web Appendix A). After the pre-test confirmed the appropriateness of our dictionary, we applied established text analysis procedures (e.g., Berger et al., 2020) to derive our measure of psychological ownership by quantifying the incidence of the dictionary words in each review. We then used this text-based measure of psychological ownership to test H1.

Procedures and results

Poisson regression was utilized to estimate the impact of automation (non-automated product = 0, automated product = 1) on psychological ownership, as its use is indicated in the case of count dependent variables. We began with a baseline model (model 1) that accounts for the effect of review length and brand name on psychological ownership, two established control variables in research of this nature (e.g., Lee et al., 2020). Model 2 extends this baseline model by including automation as an additional predictor of psychological ownership. Finally, as a robustness check, model 3 includes product rating as a predictor to account for the potential effect of product quality as an alternative explanation for the observed effect of automation. All models use a set of indicator variables to control for brand effects on the dependent variable.

As Table 3 shows, the results for model 1 indicate that review length (b = .003, $p < .01$) and psychological ownership are positively related, and that product brand name also contributes meaningfully to psychological ownership (with effects varying across brands). In addition, the results reveal that adding automation as a predictor to the Poisson regression (model 2) produces an improvement in model fit indicated by a reduction in Akaike information criterion values. More important, model 2 supports H1 as it reveals that automation has a significant, negative impact ($\beta = -.46$, $p < .01$) on psychological ownership. Model 3, which also presents an improvement in model fit, indicates that product rating has a positive effect on ownership ($\beta = .079$, $p < .01$), while not altering the impact of automation on psychological ownership ($\beta = -.47$, $p < .01$). These results provide initial support for H1.

Discussion

Using data scraped from Amazon customer reviews, Study 1 reveals differences in post-purchase, psychological ownership levels among owners of traditional and automated products, a finding that offers initial support for the core precept of our model. Building on this finding, we proceed to Study 2, which employs a field survey and validated measure of psychological ownership to extend the results of our initial field test.

Study 2

Study 2 is a field survey that draws on a sample of verified product owners to examine how post-purchase consumer–product relationships differ across automated and non-automated products. By virtue of its design, Study 2 allows for a more complete test of our conceptual model. As we detail next, the results reveal that, depending on whether task-related or technology-related identity motives are dominant, automation can either undermine or enhance consumer responses.

Method

Vacuum cleaners were chosen as a study context given that automated and traditional versions of the product are widely available and used by consumers. The sample was obtained through AYTM, a marketing research firm that maintains

[1] The dictionary list included the following words: "me," "mine," "my," "our," "own," "myself," and "ownership." While this list of words emphasizes cognitive aspects of psychological ownership, the pre-test suggests that our operationalization offers a valid approximation of or proxy for the construct. Importantly, our measurement approach is consistent with the notion that psychological ownership is partly reflected in cognitive consumer responses (Pierce et al., 2003).

Table 2 Study overview

Study	Sample (source)	Product category	Type of study	Other model variables (role in the model)	Dependent variables	Hypotheses tested
1	Vacuum owners (Amazon reviews)	Vacuums	Text analysis	N/A	Psychological ownership	H1
2	Vacuum owners (AYTM panel)	Vacuums	Field survey of owners	Psychological ownership (mediator) Identity (moderator)	Emotional attachment, product satisfaction, maintenance behaviors, brand loyalty	H2, H3, H4, H5
3	Students	Cars	Lab experiment	Psychological ownership (mediator)	Product satisfaction	H1, H2b
4	MTurk Cloud Research	Cars	Online experiment	Psychological ownership (moderator)	Emotional attachment	H1, H2a
5	MTurk Cloud Research	Lawn Mowers	Online experiment	Identity (moderator) Affordances (main effects)	Psychological ownership	H4, H5, H6

a consumer panel of verified product owners. To qualify, participants were required to be a current product owner and responsible for vacuuming their home, a criterion that excluded individuals who employ cleaning services. The final sample consists of 600 owners of traditional ($n = 301$) and robotic ($n = 299$) vacuum cleaners (67.2% female; $M_{age} = 45.3$, SD = 13.2).

Consumers responded to a variety of scaled questions intended to capture the constructs of interest.[2] We measured psychological ownership with items ($\alpha = .81$) adapted from Fuchs et al. (2010) that asked respondents to indicate their agreement with four statements: "This vacuum incorporates part of myself," "I feel that this vacuum belongs to me," "I feel connected to this vacuum," and "I feel a strong sense of closeness with this vacuum." We assessed emotional attachment by asking for respondent agreement, on a 7-point scale, with two items from Sivadas and Venkatesh's (1995) possession attachment scale ("I am emotionally attached to my vacuum" and "I am sentimental about my vacuum"; $r = .82$). We measured product satisfaction with a single item that gauges the degree of satisfaction with the vacuum (1 = "extremely dissatisfied," 7 = "extremely satisfied"). We assessed product maintenance by asking consumers the frequency with which they empty the dust bin, change filters, clean the brush roll, and perform other maintenance behaviors (on a 5-point scale; 1 = "never," 7 = "every time I use it"; $\alpha = .78$). To capture brand loyalty, we asked consumers to rate how likely they were to repurchase the same brand as their current product in the future on a 5-point scale (1 = "extremely unlikely," 5 = "extremely likely"). We measured task- and technology-related identity motives on a 7-point scale (1 = "not at all important," 7 = "extremely important") by asking respondents to indicate "how important it is to have a clean home" and "how important it is to have the latest technology," respectively. Finally, we also took measures related to product enjoyment, performance, and usage behaviors to explore alternative explanations for the proposed effect.

Modeling approach

Our study operationalizes automation by capturing whether consumers own an automated or traditional vacuum cleaner. Our study thus requires we estimate the effect of a "treatment" (automated vacuum) relative to a "control" (traditional vacuum) on post-purchase consumer product responses. However, because consumers in our sample chose which vacuum cleaner to purchase (and therefore were not randomly assigned to a "condition"), inferences about the true effects of automation are not possible unless the analysis accounts for self-selection into either condition (Kumar et al., 2016). With that end in mind, we follow Eggert et al. (2019) and Goli et al. (2022) and employ propensity score matching (PSM) to create treatment and control groups that are similar regarding consumers' initial inclination to purchase an automated product. PSM accounts for self-selection by minimizing the differences between the treatment and control groups on potential confounds (Ho et al., 2007, p. 201) to create comparable "statistical twins" across the two groups (Eggert et al., 2019).

As is common in PSM, we specify consumers' individual characteristics (e.g., age, income) as determinants of their propensity to belong to the treatment (i.e., automated) group. In addition, given the technological nature of the study's focal product, we include consumers' technology-related identity as another determinant of this propensity.[3] Importantly, while various PSM approaches exist for creating

[2] Web Appendix B provides a full listing of the measures used in all our research studies.

[3] We thank our anonymous reviewer for this suggestion.

Table 3 Study 1 poisson regression results

	Model 1		Model 2		Model 3	
	b	SE	*b*	SE	*b*	SE
Predictor						
Intercept	−.266***	.01	−.272***	.01	−.602***	.02
Review length	.003***	.00	.003***	.00	.003***	.00
Automation	--	--	−.456***	.04	−.474***	.04
Product rating	--	--	--	--	.079***	.00
Brand	Included		Included		Included	
Model fit statistics						
Null deviance	114333		114333		114333	
Residual deviance	82941		82818		82284	
AIC	147176		147055		146523	

B = parameter estimate; SE = standard error of the estimate. Psychological ownership is the dependent variable in all three models. In each model, a set of dummy variables was used to account for brand-specific effects on the dependent variable. Automation is coded as 0 = no, 1 = yes

AIC = Akaike Information Criterion

***$p < .01$

matched groups, we follow Ho et al.' s (2007) guidance and use machine learning to create a balanced data set using an optimal nearest-neighbor matching method (Rosenbaum, 1989). Such an approach is advantageous in the case of smaller samples, like ours, as it avoids a dramatic reduction in sample size (Ho et al., 2007).

To achieve a matched dataset while minimizing the loss of observations, we randomly selected observations from the automatic vacuum (treatment) group and used the optimal nearest neighbors approach to find similar observations in the traditional (control) vacuum owner group. We then compared the standardized mean differences in our matching variables across the treatment and control groups. If these standardized differences were not below the recommended threshold of .25 (Bommaraju & Hohenberg, 2018), we reduced the number of randomly picked observations by one and repeated the matching process until the recommended threshold was met for all variables. As Table 4 reveals, this threshold was reached at a matched sample size of 368 observations (184 in each condition) and was accompanied by a percentage reduction in bias in the matching variables ranging from 29.7–81.9%. This matched data set was used in all subsequent analyses reported hereinafter, with robustness checks that employ the full data set and different approaches for dealing with self-selection presented in Web Appendix C.

Results

Test of the moderating role of identity motives (H4 and H5) We used Hayes's (2017) PROCESS model 2 to test the impact of automation on psychological ownership, with task-related identity and technology-related identity specified as simultaneous moderators.[4] As Table 5 shows, the results provide strong support for our theorizing, as we find a significant, negative interaction between automation and task-related identity (H4: β = –.26, 95% CI: –.52 to –.00) and a significant, positive interaction between automation and technology-related identity (H5: β = .22, 95% CI: .03 to .41). Probing these significant interactions reveals that when task-related identity is "high" (+1 SD) and technology-related identity is "low" (–1 SD), automation has a negative effect on psychological ownership (β = –.47, 95% CI: –.94 to –.01).[5] In contrast, this conditional effect changes direction, i.e., becomes positive (β = .66, 95% CI: .17 to 1.17) when task-related identity is "low" (–1 SD) and technology-related identity is "high" (+1 SD).

Test of the mediating role of psychological ownership (H2 and H3) To test the downstream effects of automation, we extended the preceding model by specifying psychological

[4] Bias-corrected 95% CIs based on 5,000 bootstrap samples were used to estimate conditional, indirect and conditional indirect effects in this and all PROCESS models reported hereinafter.

[5] To facilitate interpretation of the results, task-related identity was zero-centered at 1 standard deviation above its mean (i.e., at its "High" value) and technology-related identity was zero-centered at 1 standard deviation below its mean (i.e., at its "Low" value) prior to model estimation. This centering approach produced a main effect estimate for automation that is equivalent to its spotlight effect at "low" levels of technology-related identity and "high" values of task-related identity. Under this model specification, support for our theorizing is thus suggested by a negative main effect of automation (H1), a negative moderating effect of task-related identity (H4), and a positive moderating effect of technology-related identity (H5). We thank one of our anonymous reviewers for this suggestion.

ownership as a mediator of the effect of automation on our four consumer product responses: emotional attachment (H2a), product satisfaction (H2b), maintenance behaviors (H3a), and brand loyalty (H3b). A separate analysis was conducted for each dependent variable using PROCESS model 10 (Hayes, 2017) and, as before, specified the two identity motives as moderators of the effect of automation on psychological ownership. As Table 5 indicates, the results of these analyses reveal that psychological ownership has a significant, positive effect on emotional attachment ($\beta = .84$, 95% CI: .76 to .92), product satisfaction ($\beta = .35$, 95% CI: .31 to .52), maintenance behaviors ($\beta = .21$, 95% CI: .16 to .26), and brand loyalty ($\beta = .28$, 95% CI: .20 to .35). With two exceptions noted in Table 5, automation, task-related identity, technology-related identity, and their respective product terms do not have a direct effect on any of the four outcomes investigated.

The preceding pattern of results is consistent with our expectation that automation has an indirect effect on consumer product responses through psychological ownership that is contingent on identity motives. In support of this assertion, the results reveal a significant ($p < .05$) index of partial moderated mediation for each moderator across all four dependent variables. Specifically, the index of partial moderated mediation is negative for task-related identity and positive for technology-related identity. These findings imply that automation has an indirect effect on the four outcome variables that (1) is mediated by psychological ownership (H2 and H3) and (2) differs significantly at varying levels of each moderator, with the effect becoming more negative as task-related identity increases and less negative as technology-related identity increases (H4 and H5).

Test of alternative explanations To assess the relative merits of our theorizing, we tested whether the enjoyment of using automated products and/or product performance serve as alternative explanations (beyond psychological ownership) for the effect of automation on consumer product responses. These analyses reveal that enjoyment functions as a parallel mediator; however, a separate analysis indicates that this effect dissipates as usage frequency increases. Thus, while the "fun" factor of automated products may partly offset the negative impact of automation, this effect is only temporary. Automation did not have a significant effect on our outcome variables through product performance.

Discussion

This study demonstrates that automation influences downstream consumer product responses through its effect on psychological ownership and that this effect can be either negative or positive depending on the dominant identity motive (task-related vs. technology-related). In Study 5, we revisit the moderating role of identity motives using more robust measures but, for now, turn our attention to a set of experiments that evaluate the effects of automation under more-controlled conditions.

Study 3

To replicate our core Study 1 and Study 2 finding—namely, that automation can disrupt psychological ownership formation to the detriment of downstream consumer responses— a virtual reality lab was leveraged to measure participants' experience with either a traditional or an autonomous vehicle. Thus, Study 3 tests our core propositions in a product category that is novel and relatively early in its life cycle.

Method

Participants were recruited from a departmental research pool and received course credit for completing the study ($n = 86$, 63% female). As our focus is on the effects of automation, the virtual reality lab (complete with a physical headset, steering wheel, and pedals) was designed to automate the driving experience while limiting other types of consumer–product interactions available in self-driving cars. This approach allowed us to focus on the effects of automation.

Participants were instructed to take a virtual test-drive of the vehicle by completing two laps on a virtual course. Those randomly assigned to the traditional car condition controlled the car with a steering wheel and pedals. In the automated condition, participants were told that the vehicle was self-driving and to initiate the route by saying the phrase "begin driving." On completion of the course, all participants answered questions related to the constructs of interest.

Participants rated their psychological ownership of the car by indicating their agreement with the same four items used in the two previous studies ($\alpha = 89$). We measured product satisfaction, our focal dependent variable in this study, by asking, "Based on this test drive, how satisfied are you with this car?" rated on a 9-point scale (1= "not at all," 9 = "extremely"). After responding to the satisfaction measure, participants indicated their previous driving experience, task- and technology-related identity motives (used as controls in this study),[6] and demographics.

[6] Within this limited sample, we did not have adequate power to test the moderating effects of consumer identity motives. Therefore, task-related identity and technology-related identity motives were included as control variables to account for their potential influence on attitudes toward automated products (Leung et al., 2018; Uysal et al., 2022) and psychological ownership development (Jussila et al., 2015).

Table 4 Study 2 means before and after matching

Matching variables	Means before matching			Means after matching			PRB
	Treatment group ($n = 299$)	Control group ($n = 301$)	Std. mean difference	Treatment group ($n = 184$)	Control group ($n = 184$)	Std. mean difference	
Gender: Female	.68	.72	− .09	.68	.71	− .06	34.7
Gender: Male	.32	.28	.09	.32	.29	.06	34.7
Age	42.66	47.64	− .41	42.66	44.70	− .17	59.1
Income	3.51	2.82	.49	3.51	3.19	.23	54.0
Education: no college	.09	.14	− .17	.09	.10	− .06	66.9
Education: some college	.35	.38	− .06	.35	.37	− .05	29.7
Education: undergraduate	.34	.31	.06	.34	.34	.01	81.9
Education: graduate	.09	.12	− .12	.09	.11	− .08	33.4
Education: professional	.14	.05	.24	.14	.08	.16	34.3
Technology-related identity	5.04	3.96	.70	5.04	4.67	.24	65.6

Treatment group = automated vacuum owners; control group = traditional vacuum owners; Std = standardized; PRB = percentage reduction in bias

Results

We used PROCESS model 4 (Hayes, 2017) to test the indirect effect of automation on product satisfaction through psychological ownership. This analysis reveals a negative effect of automation on psychological ownership (H1: $\beta = -.79$, $p < .03$) and a positive effect of psychological ownership on product satisfaction (H2b: $\beta = .63$, $p < .01$). Taken together, these findings offer evidence of a negative indirect effect of automation on product satisfaction through psychological ownership ($ab = -.50$, 95% CI: − 1.00 to –.08). In addition, automation was not found to have a direct effect on product satisfaction ($\beta = .39$, $p > .10$) after controlling for the effects of psychological ownership. Finally, the two control variables had significant effects on psychological ownership ($\beta_{\text{task-related}} = .19$, $p < .05$; $\beta_{\text{technology-related}} = .23$, $p < .01$) but not on product satisfaction ($\beta_{\text{task-related}} = -.03$, $p > .10$; $\beta_{\text{technology-related}} = .04$, $p > .10$).

Discussion

Leveraging the capabilities of a virtual reality lab, Study 3 finds a negative indirect effect of automation on product satisfaction in a different product category than that considered in our two previous studies. Given that participants experienced the product only once, the experimental context should be considered a conservative and encouraging test of our theorizing.

Study 4

The previous studies explored the effects of automation using Amazon customer reviews, a field survey involving actual product owners, and a virtual reality driving experience. Study 4 evaluates our theorizing using a markedly different approach, in which legal ownership is manipulated to test the relationship between automation and psychological ownership. Bagga et al. (2019) demonstrate that psychological ownership is highest among objects that are legally owned, second highest among rented objects, and lowest among those that are borrowed. They argue this occurs because, as an object moves from legal ownership to being borrowed, the three routes to psychological ownership are incrementally suppressed (Bagga et al., 2019). Thus, to the extent that psychological ownership mediates the effects of automation, borrowing (rather than owning) should undermine downstream outcomes. That is, because borrowing suppresses psychological ownership, consumer responses should be uniformly low when a product is borrowed, independent of whether it is automated or not. By contrast, when a product is owned, the effect of automation on consumer responses established in previous studies should once again emerge.

Method

As a complement to Study 3, the present study once again focuses on the context of self-driving cars. We recruited 255 (55% female, $M_{age} = 39.6$) participants through Cloud Research for a 2 (owned vs. not-owned) × 2 (traditional vs. automated) between-subjects experimental design. Participants were told to imagine they were driving to the grocery store in a car they owned or in one they borrowed from their neighbor, with the car described as being either traditional or self-driving (see Web Appendix D for scenarios). The participants then completed the study measures. We tapped psychological ownership ($\alpha = .95$) and emotional attachment ($r = .84$), our focal outcome variable in this study, using the same items as in Study 2. Finally, we

Table 5 Study 2 PROCESS model results

	Dependent variable														
	Psychological ownership (Process model 2)			Emotional attachment (Process model 10)[1]			Product satisfaction (Process model 10)[2]			Brand loyalty (Process model 10)[3]			Maintenance (Process model 10)[4]		
Predictor	*β*	LLCI	ULCI	*β*	LLCI	ULCI	*β*	LLCI	ULCI	*β*	LLCI	ULCI	**β**	LLCI	ULCI
Constant	4.35*	4.02	4.67	−.36	−.80	.08	4.23	3.74	4.71	2.75*	2.36	3.13	2.33*	2.06	2.61
Automation	−.47*	−.94	−.01	.14	−.23	.52	.10	−.31	.52	−.05	−.37	.28	.26*	.02	.49
Technology-related identity (TechID)	.29*	.15	.43	.04	−.08	.15	.01	−.12	.13	−.07	−.16	.04	.06	−.01	.13
Automation × TechID	.22*	.03	.41	−.01	−.16	.14	−.02	−.18	.15	.04	−.09	.18	.03	−.07	.12
Task-related identity (TaskID)	.28*	.11	.45	.03	−.11	.17	.05	−.11	.20	.05	−.07	.17	.06	−.02	.15
Automation × TaskID	−.26*	−.52	−.00	−.16	−.37	.05	.28*	.06	.51	.07	−.11	.26	.03	−.10	.16
Psychological ownership				.84*	.76	.92	.35*	.31	.52	.28*	.20	.35	.21*	.16	.26

Technology-related identity was mean-zero-centered at 1 standard deviation below its mean (i.e., at its "Low" value) and task-related identity was mean-centered at 1 standard deviation above its mean (i.e., at its "High" value). Given the centering of these variables, the main effect of automation reported in the table (e.g., –.47) is equivalent to the spotlight effect of automation at "low" levels of technology-related identity and "high" values of task-related identity. In all models, automation served as the independent variable and identity motives as the moderators, while psychological ownership was specified as the mediator in all Process model 10 analyses

[1] Partial index of moderated mediation for task-related identity (Index = –.22, 95% CI = –.44 to –.00) and technology-related identity (Index = .19, 95% CI = .02 to .35)

[2] Partial index of moderated mediation for task-related identity (Index = –.09, 95% CI = –.18 to –.00) and technology-related identity (Index = .08, 95% CI = .01 to .15)

[3] Partial index of moderated mediation for task-related identity (Index = –.07, 95% CI = –.15 to –.00) and technology-related identity (Index = .06, 95% CI = .01 to .12)

[4] Partial index of moderated mediation for task-related identity (Index = –.06, 95% CI = –.11 to –.00) and technology-related identity (Index = .05, 95% CI = .00 to .10)

*95% bootstrapped CI excludes 0

included measures of alternative explanations for the effect of automation (Web Appendix B).

Results

To confirm the ownership manipulation was successful, we ran an independent sample t-test with psychological ownership as the dependent variable. This analysis revealed a significant difference between the two ownership groups ($t(1,253)$, $p < .01$). The degree of psychological ownership was higher for those in the legally owned condition than in the borrowed condition ($M_{owned} = 5.31$, S.D. = 2.22 vs. $M_{borrowed} = 2.89$, S.D. = 2.11).

To test our theorizing, we ran PROCESS model 1 with car type (traditional vs. automated) as the independent variable, ownership (owned vs. borrowed) as the moderator and emotional attachment as the dependent variable. Results reveal a significant main effect of car type ($\beta = -.65$, $p = .03$) and ownership ($\beta = -1.83$, $p < .001$) as well as a significant car type x ownership interaction ($\beta = .98$, $p = .02$). Probing the interaction shows that, in the borrowed condition, automation ($\beta = .33$, $p = .23$) does not have a significant effect on emotional attachment ($M_{traditional} = 2.50$ vs. $M_{automated} = 2.83$). However, when the car is owned, automation ($\beta = -.65$, $p = .03$) has a significant negative effect on emotional attachment (H2a: $M_{traditional} = 4.33$ vs. $M_{automated} = 3.68$). Finally, we ran supplemental analyses to evaluate alternative mediators of the effect of automation on emotional attachment and found that psychological ownership is the only mediator of its effect (see Web Appendix E).[7]

Discussion

This experiment supports our contention that psychological ownership is the primary mechanism through which automation affects consumer product responses. That is, we find that when ownership is suppressed, emotional attachment is unaffected by automation. However, when consumers legally own a product, the hypothesized negative effect of automation on emotional attachment emerges. This study thus confirms our theorizing that automation interferes with psychological ownership development, ultimately undermining consumer product responses marketers value.

Study 5

Our field and experimental studies reveal that, contingent on identity motives, automation has a negative effect on psychological ownership and its downstream outcomes. Study 5 is designed to test H6, which posits that the negative effect of automation on psychological ownership is weaker among products that include temporal and spatial design affordances than among those that do not. In addition, the study is intended to offer further empirical support for our theorizing by using more robust measures to confirm the moderating role of identity motives (H4 and H5) first established in Study 2. With that end in mind, Study 5 explores automation in an emerging product category, automated lawn mowers.

Method

As recent industry reports indicate that men are disproportionately responsible for most lawn care activities (Mintel, 2020), our sample consists of men ($M_{age} = 39.5$) recruited from Cloud Research ($n = 275$). To achieve the study objectives, we randomly assigned respondents to one of four conditions: (1) traditional lawn mower (2) automated robotic lawn mower, (3) automated robotic lawn mower with *temporal* control (i.e., remote access via a smartphone app), and (4) automated robotic lawn mower with *temporal* and *spatial* control (remote access and a lawn-mapping feature). After assignment to their condition, respondents were (1) told there had been a lot of rain recently and the grass in their yard was tall and needed mowing and (2) subsequently presented with an image and description of the mowing experience for their assigned lawn mower condition (see Web Appendix F). The respondents then answered questions intended to assess the study constructs. We measured psychological ownership with the same four items as in Studies 2–4 ($\alpha = .88$) and our moderators, task-related ($\alpha = .90$) and technology-related ($\alpha = .91$) identity, with four-item scales taken from Leung et al. (2018). Sample items include "I identify myself as someone who takes pride in their yard" and "Having a well-kept yard is important to me" for task-related identity and "I identify myself as someone who is tech-savvy" and "Having the latest technology is important to me" for technology-related identity. Finally, we employed three semantic differential items (adapted from Dabholkar, 1994), to measure anticipated enjoyment, which we use in our analyses to account for novelty effects associated with the study's focal product.[8] The seven-point items were anchored by not fun/fun, not entertaining/entertaining, and not enjoyable/enjoyable.

Results

We used PROCESS model 2 (Hayes, 2017) to analyze our study data, with automation specified as a multi-categorical

[7] Alternative mediators evaluated include difficulty imagining the scenario, convenience, enjoyment, ease of use, effort, performance, and fear.

[8] Our use of this control variable is consistent with our Study 2 findings which reveal that enjoyment has a positive effect on psychological ownership development.

independent variable (1 = traditional mower, 2 = basic automated mower, 3 = automated mower with temporal affordance, and 4 = automated mower with temporal + spatial affordances), psychological ownership as the dependent variable, and task-related identity and technology-related identity as simultaneous moderators of the effects of automation. As our primary interest is in assessing the effect of automation with and without design affordances on psychological ownership, we used indicator coding for our independent variable (Hayes, 2017) with traditional mowers specified as the reference category. This coding procedure allows us to simultaneously compare the traditional mower with the three types of automated mowers, while also considering the moderating role of the two identity constructs, by introducing three main effect variables into our regression model: X1 = basic automated mower, X2 = automated mower with spatial affordances, and X3 = automated mower with temporal + spatial affordances.

As summarized in Table 6, our analyses reveal a negative main effect for X1 ($\beta = -2.06$, $p < .05$), a negative main effect for X2 ($\beta = -2.54$, $p < .05$), and a non-significant main effect for X3 ($\beta = 1.00$, $p > .10$). In addition, we find a significant interaction between task-related identity and X3 ($\beta = -.37$, $p < .05$) and a marginally significant interaction between technology-related identity and X2 ($\beta = .32$, $p = .08$). These results suggest that relative to the traditional mower, psychological ownership levels are lower for the automated product and the automated product with temporal affordances, but not for the automated mower with temporal + spatial affordances. While these main effects generally offer support for our theorizing about the negative effects of automation and the benefits of design affordances, they may be moderated by identity motives.

With that end in mind, we probed the significant interaction effects to estimate the. conditional means for psychological ownership across the various products (i.e., traditional, automated, and automated with affordances) at "low" (–1 SD) and "high" (+ 1 SD) task-related and technology-related identity levels.[9] As Fig. 2 illustrates, the results reveal that when task-related identity is high and technology-related identity is low, the traditional product generates the most psychological ownership. This result is consistent with the negative effect of automation proposed in H1 and underscores that the detrimental effects of automation are most pronounced when consumers identify with the task being automated (H4). In contrast, when task-related identity is low and technology-related identity is high, predicted psychological ownership levels increase as we move from the basic automated product to the automated product with temporal + spatial affordances. This finding supports our expectation that the negative effect of automation on psychological ownership is weaker when products include design affordances (H6), while also confirming that the negative effects of automation are weakened (even reversed) among consumers with a technology-related identity (H5). Finally, when both identities are high, the traditional product and automated product with temporal affordances engender the highest level of psychological ownership and, when both identities are low, the traditional product and automated product with spatial affordances produce the highest levels of psychological ownership. While our theorizing does not make any predictions as to what would occur when consumers highly identify with the task and technology or when they identify with neither, these results underscore the potential benefits of design affordances among those unique identity segments.

[9] Web Appendix G reports the simple slope effects derived from our probing of the interaction effects and used to generate Fig. 2. We underscore that, consistent with Hayes (2017) PROCESS model 2, the results depicted in Fig. 2 are based on the two-way interactions between automation and task-related and technology-related identity, rather than on the three-way interaction between all constructs.

Discussion

Consistent with our theorizing, the findings indicate that design affordances can be used to overcome (and even overturn) the detrimental effects of automation on psychological ownership, subject to the moderating effects of identity motives. Furthermore, in line with Study 2, we find that a task-related identity exacerbates, and technology-related identity ameliorates the negative effects of automation on psychological ownership. Finally, though not hypothesized, the results reveal that when both identity motives are "high," basic (i.e., temporal) affordances are preferable to those that provide more robust capabilities (i.e., temporal + spatial). We surmise this occurs because consumers might find it challenging to reconcile their competing identities and thus are more likely to feel ownership for products that allow them to bridge the two.

General discussion

This research explores the effect of automation on psychological ownership and, ultimately, on consumer product responses across five studies that employ diverse methods: (1) a data-scraping study using Amazon product reviews, (2) a field survey of non-automated and automated product owners, (3) a virtual reality lab, and (4) two online vignette experiments. Across these studies, we consistently find that automation undermines psychological ownership and its downstream consequences, contingent on the effects of two competing identity motives: task-related identity and technology-related identity. In addition, our research reveals that design affordances can be used to off-set and even overcome the negative effects of automation, but this too depends on operant consumer identity motives. These findings have important implications for marketing theory and practice.

Theoretical implications

Automation undermines post-purchase consumer product responses that marketers value Prior research argues that, by virtue of being an identity threat and diminishing feelings of control, automation can have a negative effect on consumer pre-purchase outcomes, most notably product adoption (Leung et al., 2018; Mende et al., 2019; Puntoni et al., 2021; Rai, 2020). Our research and its findings are novel in that they demonstrate these negative effects of automation can persist—even after consumers elect to adopt a product—and influence valued outcomes such as emotional attachment, product satisfaction, maintenance behaviors and brand loyalty. Beyond highlighting the importance of moving research on automation beyond the pre-purchase phase of consumer decision-making, our research suggests scholars should strive to identify and leverage data sources capable of offering insight into how consumers' experience with products evolves over time, as doing so is critical to a full understanding of the long-term effects of automation.

Psychological ownership mediates the effects of automation on post-purchase consumer product responses We find that psychological ownership is the central mechanism through which automation influences post-purchase outcomes. This is a novel finding as it suggests that psychological ownership plays an important role in shaping consumers' post-purchase attitudes and behaviors, a possibility that has been largely ignored in prior research, given its focus on the role of psychological ownership in the pre-purchase and product acquisition phase (e.g., Atasoy and Morewedge, 2018; Stoner et al., 2018). To scholars, this finding suggests a fruitful avenue for extending research on psychological ownership, especially with an eye toward establishing its importance relative to other factors known to shape post-purchase consumer behaviors (e.g., values, demographics, psychographics).

Competing identity motives shape the effects of automation on psychological ownership and post-purchase consumer product responses Our research answers Hulland et al.' s (2015) call for research to consider the role of consumer identity motives in shaping product ownership decisions. In doing so, we demonstrate that competing (but not mutually exclusive) identities shape how consumers respond to automation: those who identify with the task being automated (i.e., task-related identity) tend to respond negatively to automation, while those who define themselves in terms of being technologically savvy (i.e., technology-related identity) respond positively to automation. Our research thus advances new knowledge on the role of consumer identities in psychological ownership formation, while also revealing how the multifaceted nature of consumer identities both enriches and complicates understanding of their role. Our research thus implies that scholars should be cognizant of and include multiple operant identities in their own research, as is demonstrated here and in recent work on frontline marketing (Gazzoli et al., 2022).

Table 6 Study 5 effects of automation, affordances, and task- and technology-related identity on psychological ownership

Predictor	Coefficient	95% LLCI	95% ULCI
Constant	.58	−.93	2.10
X1	-2.06**	-4.10	−.02
X2	-2.54**	-4.57	−.52
X3	1.00	-1.04	3.04
Task-related Identity	.32***	.12	.51
Technology-related Identity	.15	−.09	.39
X1* Task-ID	.13	−.18	.44
X2* Task-ID	.09	−.23	.40
X3* Task-ID	−.37**	−.66	−.08
X1* Tech-ID	.15	−.22	.52
X2* Tech-ID	.32*	−.04	.68
X3* Tech-ID	.04	−.31	.39
Anticipated Enjoyment	.42***	.31	.53

X1-X3 are indicator-coded binary variables used to represent the four products evaluated in the study. Traditional mowers were used as the reference category and each of the automated mowers is represented by X1, X2 or X3. X1 = basic automated product; X2 = automated product with temporal affordances; X3 = automated product with temporal + spatial affordances

***$p < .01$; **$p < .05$; *$p < .10$

Design affordances facilitate psychological ownership formation in the presence of automation We leverage Baxter et al.' s (2015) work to explore the impact of design affordances on psychological ownership formation and find that they can ameliorate or worsen the effects of automation on psychological ownership, depending on prevalent consumer identity motives. Our research thus clarifies why and when product design can be leveraged to overcome automation's dark side. Given that our findings suggest that the benefits of design affordances are contingent on consumer identity motives, an opportunity exists for scholars to develop an identity-affordance typology capable of predicting which product design features are best-suited to promoting desirable consumer product responses across consumer identity segments.

Managerial implications

Automation is a double-edged sword For managers, our results highlight the potential benefits and perils of automation. While automated products have substantial revenue-generating potential due to the incremental consumer benefits (e.g., convenience, efficiency, reliability) they afford,

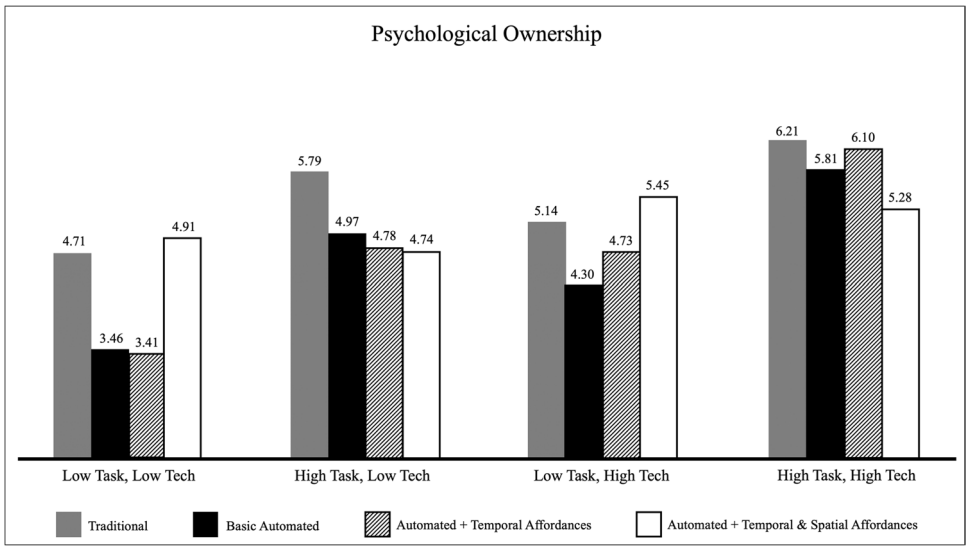

Fig. 2 Study 5 estimated levels of psychological ownership as a function of automation type and consumer identity motives. *Notes*: Each bar represents the estimated conditional mean level of psychological ownership for the different experimental lawn mowers. Traditional = traditional lawn mower; basic automated = automated lawn mower with no affordances; automated + temporal affordances = automated lawn mower with remote access; automated + temporal & spatial affordances = automated lawn mower with remote access and mapping. Consumer identity motives appear in the horizontal axis at "low" (-1 SD) and "high" (+ 1 SD) value levels, with four possible pairings of task-related identity (i.e., task) and technology-related identity (i.e., tech) presented. Consistent with Hayes (2017) PROCESS model 2, the results depicted in Fig. 2 are based on the two-way interactions between automation and task-related and technology-related identity, rather than on the three-way interaction between the constructs

our research suggests that automation can compromise post-purchase consumer product responses (e.g., product satisfaction, brand loyalty). Thus, as automation is increasingly introduced into firms' products, managers should carefully monitor post-purchase brand health metrics and deploy programs geared toward increasing consumers' interactions with their products and/or the firm in response to evidence of psychological ownership erosion.

Marketing automated products requires a focus on consumer identity motives The evidence reported herein suggests that consumer identity motives play a critical role in shaping consumers' psychological response to automation. While a task-related identity undermines psychological ownership formation in the presence of automation, a technology-related identity has the opposite effect. Therefore, marketers should make technology-related identity elements more salient in their positioning and messaging for automated products, while downplaying task-related product features and attributes that enable task automation. More broadly, our results imply that, when developing go-to-market strategies for automated products, marketers should employ segmentation schemes that consider or are based on an understanding of category-specific consumer identity motives.

Affordances can but do not always mitigate the negative effects of automation Our research findings indicate that design affordances which facilitate consumer interaction with automated products can help alleviate the negative effects of automation. However, the benefits to firms of introducing such affordances (e.g., an app that enables remote connection to and better control of a robotic vacuum cleaner) are dependent on consumer identity motives. Hence, when leveraging design affordances to promote psychological ownership development, managers should consider how the proposed affordances align with identity motives that shape consumers' product category purchase decisions. This alignment between design affordances and identity elements is critical to ensure product features can serve to promote psychological ownership development, even in the presence of automation.

Limitations and future research

To the best of our knowledge, we are the first to study empirically the post-purchase effects of automation in a consumer product domain. Therefore, while our research represents an initial step toward addressing an important knowledge gap in the literature, our work has limitations that suggest future avenues for investigation. First, our research only considers automation in a limited number of product categories in which non-automated and automated product choices are widely available. As automation continues to be introduced into additional products over time, researchers could explore whether our findings generalize to other product categories

and/or hold as product automation becomes a marketplace norm.

Second, our focus here is on how automation impacts downstream consumer product responses. However, we anticipate that automation has other likely consequences for consumers that we did not explore. For example, previous research in the workforce finds that automation disrupts not only workers' earning potential but also their sense of worth and pride in their work (Cotgrove, 1972; Erikson, 1986). Leung et al. (2018) also acknowledge that automation interferes with individuals' attributions to their own skill level and feelings of accomplishment. Therefore, future research should explore the extent to which automation impacts consumers' feelings of mastery and self-esteem and, more broadly, their well-being.

Finally, while our research considers the role of task- and technology-related consumer identities, we do not explore what role, if any, brand-related identities play in shaping consumer response to automation. It is possible, even likely, that a strong brand-related identity and psychological ownership commonly coexist, because brand identifiers are likely to have intimate knowledge about the brand and invest fully in it. We would thus anticipate that a strong brand identity could buffer the negative effects of automation on psychological ownership, unless the automation itself is in direct conflict with the brand's identity. As an example of the latter, members of the Porsche Club of America (who presumably identify strongly with the brand) objected to the firm's efforts to eliminate manual transmissions in favor of automatic ones because they believed such automation would undermine their driving experience and, ultimately, their psychological connection with the product. Research that explores the interplay between automation and brand-related identities could thus be fruitful, especially in cases when automation offers important consumer benefits but is at odds with core elements of the brand.

Conclusion

Promoting a strong psychological connection between consumers and their products helps firms achieve valued outcomes, such as product satisfaction and brand loyalty. By virtue of its negative effect on psychological ownership formation, automation can and often disrupts this important consumer–product psychological bond and its downstream effects. Our research suggests that managers can counter this negative impact of automation by emphasizing identity-congruent (vs. identity-threatening) aspects of the automated product in their messaging and by incorporating features (e.g., remote access, greater customizability) that facilitate consumer–product interaction even when the intent of automation is to fully replace consumer task involvement.

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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