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Affordance Perception Through a Digital Mindset: A Dual Process Theory Perspective

Completed Research Paper

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Abstract

As digital technologies offer increasingly open and flexible affordances, organizations must understand how employees discover and utilize them to maximize their potential. While prior research has shown that technology-specific traits can impact affordance perception, we propose that affordance perception is affected by an individual's general digital mindset, which in turn determines how individuals make sense of pervasive digital technologies. Drawing on the dual process theory of human cognition and established affordance categories (canonical and non-canonical), we conducted a four-phase online experiment involving 189 users of Microsoft PowerPoint. Our study, which used an implicit association test, a sorting approach, and a survey, revealed that an individual's digital mindset significantly influences unconscious and conscious perceptions of non-canonical affordances but not canonical ones. We contribute by extending the affordance theory in IS, indicating that affordance perception can be seen as dual processes dependent on individual traits.

Keywords: affordances, digital mindset, perception, dual process theory

Introduction

Affordances, which embody goal-oriented possibilities for actions presented by an object to an actor (Gibson 1979), are often clearly discernible in non-digital scenarios, as exemplified by a door handle affording the action of opening a door. Yet, in the context of pervasive digital technologies, affordances become more powerful, open, and flexible (Yoo et al. 2012). For example, the varied utilization of software features, as seen in Microsoft PowerPoint, spans from constructing presentations to editing images and visualizing business processes (Ciriello et al. 2015). Hence, organizations rely on their employees and that they establish links between digital technologies, their features and components, and actions, which can lead to new product or service designs or completely new business models (Ostern and Rosemann 2021; Yoo et al. 2012). Therefore, organizations must understand how employees make sense of and discover such affordances to stay competitive or gain competitive advantages (Nambisan et al. 2017).

Prior research primarily provides insights into which affordances exist for different technologies, such as mobile technologies or cloud-based software development tools (Karahanna et al. 2018; Krancher et al. 2018), and how affordances can be actualized (Haag et al. 2022) and affect individual needs (Holzer et al. 2020). At the same time, affordance perception, describing the actual discovery of existent affordances and being a precondition for their actualization (Bernhard et al. 2013; Lehrig et al. 2019), has received relatively little attention. Recent explorative studies propose that contextual (Osmundsen et al. 2022), cultural (Bernardi et al. 2019), or external information (Lehrig et al. 2017) can affect how individuals perceive affordances. Other than that, empirical studies focus on the individual (Lehrig et al. 2019), indicating that malleable individual traits, such as self-efficacy regarding a specific technology, determine if individuals perceive affordances autonomously. However, these previous works lead to two flawed assumptions. First, these prior works view affordance perception as a deliberate reasoning process, whereas psychological literature indicates that most perception happens unconsciously (Kahneman 2011). Second, these results lead to the conclusion that the perception of all types of affordances (e.g., innovative possibilities vs. conservative possibilities of technology uses) is dependent on individual traits whose expression is dependent on the technology, neglecting the influence of other malleable traits that might affect this perception across different technologies. The digital mindset is such a trait and describes the sum of experiences and knowledge regarding digital technologies and accompanying phenomena, expressed through different entrenched thinking patterns continuously occurring in situations where digital technologies are apparent (Hildebrandt and Beimborn 2022a). With an understanding of how a digital mindset affects the perceived amount and the type of affordances, organizations are offered a powerful variable to foster affordances perception, setting the ground for their actualization and ultimately leveraging the potential offered by those technologies. Therefore, we need to understand: *What is the role of the digital mindset in affordance perception?*

We address this research question by utilizing the dual process theory of human cognition (Gawronski and Creighton 2013) and previously identified affordance categories – canonical and non-canonical affordances – that describe widely accepted typical and specific untypical action possibilities (Mettler et al. 2017; Ostern and Rosemann 2021) to distinguish how different types of perceptions and affordances are contingent upon the digital mindset of individuals. Results from a four-phase online experiment with 189 users of Microsoft PowerPoint, including two implicit association tests, a sorting approach, and a survey, suggest that the digital mindset significantly increases the unconscious and conscious perception of non-canonical affordances. We contribute by extending existing affordance theory in IS, indicating that affordance perception can be seen as dual processes dependent on individual traits. Precisely, individual differences determine how individuals make sense of non-canonical affordances, while the perception of canonical affordances remains unaffected.

In the remainder of the paper, we elaborate on the related literature on the dual process theory of human cognition, affordance perceptions, and the digital mindset. Subsequently, we develop our hypotheses, explain our methodological approach, and present our findings. Finally, we discuss our findings and integrate them into previous literature, concluding with limitations and links for future research.

Theoretical Background

Dual Process Theory of Human Cognition

The dual process theory of human cognition states that human cognition can be divided into two systems, an implicit associative and an explicit rule-based system. The implicit system is driven by associations and heuristics and is unconscious, while the rule-based system is driven by rule-based reasoning and analytics and is conscious (Gawronski and Creighton 2013; Kahneman 2011).

The implicit system, often called the automatic system, contains cognitive processes elicited unintentionally when perceiving the environment, require little cognitive resources, cannot be stopped voluntarily, and occur outside of conscious awareness (Gawronski and Creighton 2013; Kahneman 2011). Specifically, it involves the generation of coherent association patterns to the associative memory, resulting in the coherence of environmental information with previous associations (Gawronski and Creighton 2013). These processes create feelings of cognitive ease for known or familiar associations, leading to intuitive responses regarding perceived information (Kahneman 2011). Exemplarily, activities of the associative system are perceiving relationships between words (e.g., “hungry” and “food”) (Kahneman 2011). In our context, the processes of the implicit system serve as a theoretical basis to classify implicit perception based on automatic processing of sensory environmental information.

The explicit system, often referred to as the controlled system, contains rule-based reasoning processes that are elicited intentionally, require high amounts of cognitive resources, can be stopped voluntarily, and occur within conscious awareness (Gawronski and Creighton 2013). These processes generate deliberate reasoning or complex computations. When individuals process information explicitly, they logically combine it and actively seek additional information from their memory, previous experiences, or learnings. This intentional process involves following clear rules, comparing, and weighing existing facts and knowledge. Explicit perception is usually evident in complex situations that require high cognitive effort and where time is not critical (Gawronski and Creighton 2013; Kahneman 2011). An exemplary activity of the rule-based system is to check the validity of a complex logical argument (Kahneman 2011). For our study, the processes of the explicit system serve as a theoretical basis to classify explicit perceptions based on controlled processing of the sensory environmental information.

Both systems operate parallel and independently but interact with each other. On the one hand, the implicit system operates faster and biases subsequent processes of the explicit system. On the other hand, the explicit system can change how the implicit system works by setting up attention and memory (Epstein 2003).

Extant research utilizes the dual process theory of human cognition to explain and classify individuals' decision-making processes and reasoning (Evans 2003; Kahneman 2011). Further, in the IS literature, the dual process theory lays the foundation for differentiations between different usage behaviors when interacting with IT, such as different post-adoption behaviors (Kim et al. 2005; Thatcher et al. 2018) and for classifying implicit and explicit attitudes toward technologies (Serenko and Turel 2019). We link and extend these previous applications of the dual process theory of human cognition in IS research by using the theory to differentiate between implicit and explicit perceptions not only of the digital technology itself but of its potential uses, respectively, affordances.

Affordance Perception

Affordances describe goal-oriented action possibilities of an object that are available to an actor, enabled by properties of the object, the environment, and the actor (Gibson 1979). That is, this relational affordance lens describes that while objects may possess the same properties, their utility, i.e., how they can be used, may differ, contingent upon the actor and the environment (Hutchby 2001; Markus and Silver 2008). In the context of digital technologies, affordances describe possibilities of actions that arise in the relationship between an IT artifact and a goal-oriented actor. This relational interpretation of affordances is used to depict generativity of IT features (Lehrig et al. 2019). Affordances of IT artifacts are more flexible and open than those of non-IT artifacts, and their realizations can lead to strong convergences and generativity (Yoo et al. 2012). Affordances follow a three-step process of existence, perception, and actualization (Bernhard et al. 2013; Ostern et al. 2020). There may be various potential actions that emerge for an actor with an IT artifact (affordance existence), but only a few are recognized (affordance perception), and hardly any are performed (affordance actualization) (see Figure 1). Hence, the existence of potential affordances is independent of their perception, which would be a necessary precondition for the subsequent actualization of the affordance (Bernhard et al. 2013).

Existent affordances are always relational and can be categorized as canonical or non-canonical (Mettler et al. 2017; Ostern and Rosemann 2021). Canonical affordances describe affordances that were determined by wider social frameworks and socio-cultural norms. In other words, canonical affordances describe typical, widely known, and accepted use cases of IT artifacts that are perceived similarly by most people (Mettler et al. 2017). Exemplarily, creating presentations with Microsoft PowerPoint describes a canonical affordance. Non-canonical affordances describe action potentials solely offered to a specific user or user group. In other words, non-canonical affordances describe specific use cases of IT artifacts that are not typical for the artifact (Mettler et al. 2017; Ostern and Rosemann 2021). Exemplarily, editing photos with Microsoft PowerPoint describes a non-canonical affordance. Typically, an individual will perceive a subset of several canonical or non-canonical affordances of the overall existing potential affordances This perception describes the process where actors interpret, recognize, and evaluate action possibilities as such that are offered to them in relation to the artifact (Ostern and Rosemann 2021) (see Figure 1). Based on the underlying dual process theory, these processes can be implicit or explicit in their nature (Gawronski and Creighton 2013).

Implicit perception describes to what extent existent non-canonical or canonical action possibilities are associated as coherent with previously associated action possibilities of the same or similar technologies. For instance, an individual who accidentally used a smartphone as a flashlight may find the affordance of "using a smartphone as a flashlight" readily available in their associative memory, resulting in faster and more effortless processing of this action possibility. Hence, the affordance of using the smartphone as a flashlight is not cognitively surprising anymore but familiar and, through this coherence, processed faster and with less cognitive effort (cf. Gawronski and Creighton 2013). Given this cognitive ease, some existing affordances are perceived as actual action possibilities (smaller circle in Figure 1). In contrast, others are not, being inconsistent with existing associations, therefore cognitively surprising and effortful (larger circle in Figure 1)(cf. Gawronski and Creighton 2013). In contrast, explicit perception refers to the extent to which individuals perceive different existing affordances as action possibilities after applying rule-based conscious evaluation based on their experiences, logical combinations of sensory environmental information, and actively assessing information from their memory and experiences. This intentional process involves following clear rules, comparing, and weighing existing facts and knowledge (Gawronski and Creighton 2013).

Perception of those affordances is a key activity, as affordances need to be perceived in order to be acted upon, making it a prerequisite for affordance actualization (Bernhard et al. 2013).

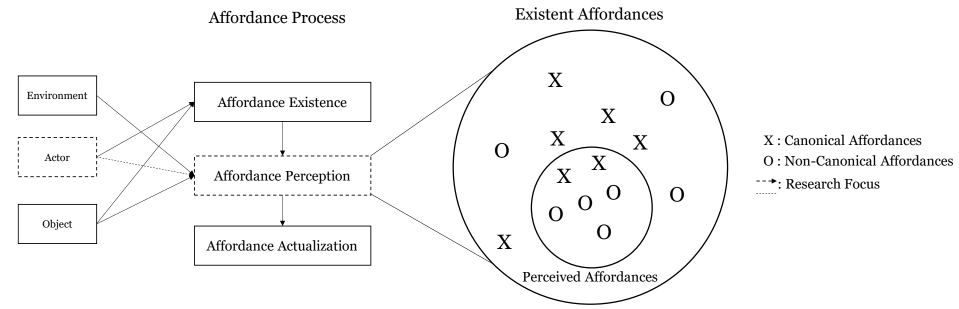

Figure 1. Affordance Perception as a Subset of Existent Affordances

Previous research has predominantly focused on investigating the existence and actualization of affordances within the IS discipline. Specifically, studies on affordance existence have examined the action possibilities of different systems (e.g., mobile technologies or cloud-based software development tools) (Karahanna et al. 2018; Krancher et al. 2018). Research regarding affordance actualization mainly revolved around the mechanisms responsible for realizing these affordances within organizations (Haag et al. 2022), how affordance actualizations occur (Seidel et al. 2013), and their effects, such as supporting motivational (Holzer et al. 2020) and personal needs (Karahanna et al. 2018), supporting societal goals (Faik et al. 2020), or job performance (Haag et al. 2022).

However, empirical investigations on the perception of affordances are scarce. Although qualitative studies suggest that external information (Bernhard et al. 2013; Lehrig et al. 2017), organizational culture (Bernardi et al. 2019), and contextual factors (Osmundsen et al. 2022) can influence affordance perception, there are few quantitative empirical results. Lehrig et al. (2019) indicate that traits that describe individual inclinations, such as self-efficacy and external information use, can affect how affordances are perceived. However, their study only differentiates between the way affordances are perceived and employs explicit measurement methods, leaving it unclear whether individual differences influence the nature of the perceived usage possibilities (Ostern and Rosemann 2021). Furthermore, the results do not provide any insights into how technology-independent IT-specific traits may influence such perceptions, which can help explain different perceptions independent of situation and used technology and showed to have higher explanatory power for how IT artifacts are perceived in other contexts (Davis and Yi 2012; Maier et al. 2019). Further, previous studies treat affordance perception as a deliberative process with high cognitive effort. At the same time, it is unclear to what extent implicit perception plays a role, which may have stronger effects on affordance actualization as constantly affecting behaviors (Kahneman 2011).

Accordingly, three main problems in the existing literature stand out. Firstly, empirical research on affordance perception in IS is scarce, although affordances are only meaningful and effective if they are perceived by individuals (Bernhard et al. 2013). Secondly, it needs to be clarified to what extent technology-independent individual traits can influence perceived usage possibilities. Third, without considering implicit perception, it is challenging to determine the extent to which individuals perceive action possibilities of IT artifacts intuitively, particularly in situations that necessitate quick, impulsive actions, which constitute a significant portion of daily activities (Kahneman 2011). This limits our ability to understand the sources of actualized affordances in such contexts and highlights the importance of including implicit perception in investigations of affordances. Therefore, we close a gap in previous research and extend the corpus of empirical research on affordance perception by investigating how the digital mindset, an IT-specific but technology-independent trait, influences the implicit and explicit perception of affordances.

Digital Mindset

Mindsets describe the sum of one's knowledge and experience, leading individuals to divergent response patterns by affecting three individual sensemaking mechanisms: noticing, identifying, and interpreting (Dweck et al. 1995; Gollwitzer et al. 1990; Nadkarni et al. 2011). Precisely, different experience-based and knowledge-based association patterns when processing information change how individuals notice situations (Gupta and Govindarajan 2002; Nadkarni et al. 2011). Through combining and applying experiential knowledge when evaluating desirability and feasibility of actions, mindsets alter how individuals identify appropriate actions in situations (Gollwitzer et al. 1990; Jiang et al. 2018). Additionally, experiential knowledge forms convictions regarding things, actions, or the environment and changes how individuals interpret situations (Dweck et al. 1995). Hence, mindsets can be viewed as malleable individual traits, being trainable inclinations to notice, identify, and interpret information in a situation in particular ways that predispose actions in these situations (DeShon and Gillespie 2005; Dweck and Yeager 2019; Keating and Heslin 2015). Mindsets have been conceptualized in various contexts, such as globalization (Gupta and Govindarajan 2002), entrepreneurship (McGrath 2000), or agile environments (Eilers et al. 2022). Scholars claimed that pervasive digital technologies and their impact also require new ways of thinking (Vial 2019), respectively a 'digital mindset'.

The digital mindset describes the sum of one's knowledge and experiences regarding digitalization, which changes how individuals notice, identify, and interpret information in contexts of pervasive digital technologies, predisposing actions in such situations. It is described through different thinking patterns that reflect how individuals notice digital technologies and phenomena, estimate the feasibility and desirability of actions in digital contexts, and beliefs about digital technologies, emerging phenomena, and new working environments (Hildebrandt and Beimborn 2022a; Leonardi and Neeley 2022). Various conceptualizations of the digital mindset exist, focusing on specific thinking patterns regarding different aspects during digitalization, such as changes in the workforce (van der Meulen et al. 2020) or beliefs regarding the abilities of digital technologies (Wong et al. 2022). As our study focuses on investigating the impact of a digital mindset during users' interaction with digital technologies, our used conceptualization of a digital mindset adopts three thinking patterns of a recent digital-mindset conceptualization developed by Hildebrandt and Beimborn (2022a), which reflect digital technologies and their new combinatorial, disruptive and generative characteristics that are responsible for open, and flexible affordances in a digital context (Autio et al. 2018; Yoo et al. 2012): combinatorial, generative, and disruptive thinking.

Employing combinatorial thinking, individuals continuously identify new combinations and permutations of digital properties and features, quickly assessing their feasibility and desirability based on their accumulated knowledge and conviction towards digital technologies (Hildebrandt and Beimborn 2022a; Leonardi and Neeley 2022). Complemented by generative thinking patterns, individuals recognize the inherent agnosticism of digital technologies, allowing for flexible evaluation and realization of new functions for existing digital products, which expands their space of potential problem-solution pairs in situations involving digital technologies. Through disruptive thinking, individuals challenge established problem-solution pairs, approach problems in a problem-driven manner, and evaluate the use of digital technologies even in cases where problems have already been solved using existing mechanisms (Hildebrandt and Beimborn 2022a).

Compared to other IT-specific traits, such as personal innovativeness in IT (PIIT), which describes inclinations to try out new IT (Agarwal and Prasad 1998), or IT mindfulness, which describes the tendency to have a heightened state of involvement during IT use (Thatcher et al. 2018), the digital mindset affects no specific behavior but general sensemaking in IT-specific situations (Hildebrandt and Beimborn 2022a). Therefore, the digital mindset represents a malleable IT-specific trait that can serve as leveraging variable for several other behaviors and traits. Related research on mindsets has shown that they can significantly influence individuals' perceptions, such as in the context of risk perception (Keller and Gollwitzer 2017; Weinstein and Lyon 1999) or brand perception (Lee et al. 2019). As individuals primarily are unaware of their mindsets, formerly also referred to as implicit theory, it is reasonable to assume that they affect those perceptions both implicitly and explicitly (Dweck and Yeager 2019). In addition to primarily conceptual works on the digital mindset (Hildebrandt and Beimborn 2022a; Leonardi and Neeley 2022), some qualitative studies suggest that it affects individuals' perception of affordances (Solberg et al. 2020; Tour 2015). However, there is currently no statistical evidence to support this claim. Therefore, we aim to address this gap by investigating the extent to which mindset effects on perception also hold true for the digital mindset in the context of affordance perception.

Hypotheses Development

The dual process theory of human cognition provides the theoretical foundation for our study of affordance perceptions (Gawronski and Creighton 2013). To this end, we distinguish between implicitly and explicitly perceived affordances. As perceived affordances can be non-canonical and canonical, we investigate how implicit and explicit perception of non-canonical and canonical affordances varies depending on an individuals' digital mindset.

A digital mindset of individuals consists of entrenched combinatorial, generative, and disruptive ways of thinking, enabling individuals to constantly notice and identify new combinations, functions, or problem-solution pairs of digital technologies (Hildebrandt and Beimborn 2022a). Further, implicit affordance perception describes the cognitive processes of how existent affordances are unconsciously recognized and evaluated through associations (Gawronski and Creighton 2013).

Previous research in other contexts provides evidence that mindsets influence how sensory environmental information is perceived (Keller and Gollwitzer 2017; Lee et al. 2019). Furthermore, explorative qualitative studies in other disciplines propose relationships between the digital mindset and affordances of digital technologies (Tour 2015). This relationship appears logical, as the thinking patterns associated with the digital mindset allow individuals to unconsciously expand their problem-solution space, continuously noticing and integrating potential combinatorial, disruptive, or generative problem-solution pairs of digital technologies into their associative memory. Simultaneously, existing affordances of digital technologies are, in nature, more generative and combinatorial, describing action possibilities for combining digital products with other artifacts or deviating from typical use cases through reprogramming or using modular components in different ways (Yoo et al. 2012). Consequently, the congruence of an individual's associative memory with these new affordances is likely to increase, resulting in greater cognitive ease in processing and intuitive consideration of existent non-canonical action possibilities (i.e., including a higher amount of "O"s in the inner circle in Figure 1) (cf. Kahneman 2011). Since these thinking patterns expand the associative memory primarily around these generative and combinatorial problem-solution pairs, which are rather non-canonical (i.e., untypical) (cf. Mettler et al. 2017), implicit perception of rather canonical affordances (i.e., typical) might be less affected by the digital mindset. This also aligns with the initial definition of canonical affordances, indicating that social frameworks and sociocultural norms integrate those solutions in the associative memory (Mettler et al. 2017). Accordingly, we hypothesize:

H1: An individual's digital mindset increases the implicit perception of non-canonical affordances but not the implicit perception of canonical affordances.

Explicit affordance perception describes the conscious evaluation and interpretation of existent affordances through the application of logical rules, comparison of facts, and active assessment information of the memory and experiences (Gawronski and Creighton 2013).

Individuals that exhibit generative, combinatorial, or disruptive thinking possess a more extensive set of experience and knowledge about how to interact with the properties of these digital technologies (Hildebrandt and Beimborn 2022a). Exemplarily, by constantly considering and evaluating combinatorial or generative solutions, those individuals may have more information and facts about how these technologies can interact, be combined, or reprogrammed (Hildebrandt and Beimborn 2022a). Therefore, these individuals possess a clearer set of rules and more information, through which more of those primary combinatorial or generative affordances of digital technologies (Yoo et al. 2012) can be perceived. Repeating the former smartphone scenario, individuals with a digital mindset might perceive such non-canonical affordance as an action possibility, as a logical combination of a previous experience, where the flash was used independently from the photo taking function, leads to the conclusion that this might be an action possibility. Similar to the effects on implicit perception, these effects might be weaker for the explicit perception of canonical affordances (i.e., typical), as these thinking patterns represent an additional set of information that refers to combinatorial, generative, or disruptive experiences. Hence, we hypothesize:

H2: An individual's digital mindset increases the explicit perception of non-canonical affordances but not the explicit perception of canonical affordances.

The iteration of the smartphone example illustrates that implicit and explicit perceptions interact with each other, forming a complementary relationship (Epstein 2003). Explicit perception can become familiar and processed automatically by repeatedly perceiving similar sensory environmental information. Conscious evaluation can override implicit perception and re-evaluate intuitive responses through rule-based evaluation. However, intuitive responses from implicit perception can also lead to distortion and biases of subsequent explicit perceptions (Gawronski and Creighton 2013). That is, intuitive responses to well-known canonical affordances can distort their explicit perception, whereas repeated explicit perceptions might lead to automatic, intuitive responses to such action possibilities. Analogously, the stronger implicit perception of non-canonical affordances resulting from increased associative memory also indicates that individuals have a greater set of experiences, making them more likely to consider these affordances a potential option after a conscious evaluation. On the other hand, repeated rule-based perceptions may lead to these non-canonical affordances being unconsciously perceived as familiar and known and less cognitively disruptive, leading to higher cognitive ease. Therefore, we hypothesize:

H3a: An individual's implicit canonical affordance perception is positively related to the explicit canonical affordance perception.

H3b: An individual's implicit non-canonical affordance perception is positively related to the explicit non-canonical affordance perception.

Method

We tested our hypotheses using an online experiment (n = 189) following a within-subject design which consisted of four phases, including two implicit association tests (IAT) to measure the strength of implicit associations towards canonical (IAT 1) and non-canonical affordances (IAT 2), a sorting approach to capture participants' explicit perceptions of the different affordances, and a survey to measure their digital mindset (see Table 1 for an overview). Additionally, we conducted a preceding study to collect (n = 100) and validate (n = 114) affordances that formed the basis for the online experiment. Online experiments combine the advantages of online studies, such as increased representativeness, with a simultaneously increased explanatory power for behavior (Fink 2022).

Pre-Study	Collection (n = 100) and validation (n =114) of formulated canonical and non-canonical affordances
Phase 1	IAT1: Implicit association test regarding canonical affordances
Phase 2	IAT2: Implicit association test regarding non-canonical affordances
Phase 3	Explicit sorting of affordances
Phase 4	Digital mindset survey and controls

Table 1. Research Design (n = 189)

We used the crowdsourcing platform Prolific for data collection, as crowdsourcing platforms are an established data collection method in IS research and have been shown to provide similar data quality to data collected in organizations (Maier et al., 2019). We followed the guidelines of Jia et al. (2017) and Connors et al. (2020) to ensure sufficient quality of crowdsourced survey and IAT data, such as filtering for workers with high acceptance rates (95%) and location in the US[1], realistic (IAT and survey) completion time frames, as well as including a minimum of two trap or attention questions in each phase of the experiment (e.g., "What is your favorite color? This is a data quality check. Regardless of the true value, please select blue.") (Jia et al. 2017; Liu and Wronski 2018). We focused on narrow IT, developed for a specific purpose, in order to be able to delimit affordances that lie outside the normal area of use. A narrow IT suitable for this context is Microsoft PowerPoint (MS PowerPoint), as it is widely established, has a narrow intended use case, but also tends to be used in various other innovative ways (Ciriello et al. 2015). In order to obtain an appropriate sample of subjects, 656 individuals were identified who regularly use MS PowerPoint to complete tasks at work (32.5%), which served as a base population for the study. 189 individuals participated in the main study, while 100 and 114 participated in the preparation studies (see Table 2 for the characteristics of the main sample).

[1] Research has shown that data from non-US workers, especially in studies of the IS discipline, were of lower quality and also failed to support long-established theories (e.g., TAM) (Jia et al. 2017).

Age (years)	18-30	28.5	Employment level	Entry level	23.3
	31-40	38.5		Associate	31.7
M = 37.12	41-50	17.0		Manager	34.4
SD = 10.98	51-60	12.0		Owner/Self-employed/ Executive level	10.6
	> 60	4.0			
Gender	Female	35.5	MS PowerPoint use per day	< 1 hour	2.6
	Male	64.5		1 hour	51.9
Level of education	Less than high school	0.0	M = 1.71 hours	2 hours	30.7
	High school	3.2	SD = 1.20 hours	3 hours	9.5
	College without degree	7.9		>3 hours	4.3
	Associate's degree	5.3	Digital technology use per week	1-9 hours	3.8
	Bachelor's degree	47.6		10-19 hours	14.3
	Master's degree	29.1		20-29 hours	21.2
	Doctoral/Professional degree	6.9		30-39 hours	23.8
				>39 hours	36.0

Table 2. Sample Characteristics in Percent (N = 189; M = Mean; SD = Standard deviation)

Phases 1 and 2: Implicit Association Tests

In order to explore individuals' implicit perception of affordances, we utilized implicit association tests (IATs) in phases 1 and 2 of the study to gauge the degree to which participants unconsciously evaluate presented affordances as either useful or useless. An IAT describes an indirect measurement based on (Greenwald et al. 2003), which can be easily implemented in online settings to measure a variety of implicit concepts (Greenwald et al. 1998; Nosek and Smyth 2011). The first IAT focused on measuring how individuals implicitly associate canonical affordances presented to them as useful or useless, while the second IAT assessed these associations in relation to suggested non-canonical affordances. In both tests, these possible use cases of MS PowerPoint (target concept canonical/non-canonical affordance) were tested against use cases that are *not* possible when using MS PowerPoint (i.e., non-affordance, which is not a concept our study targets at). The IAT records reaction times in milliseconds and therefore measures the strength of an association between a target concept (canonical/non-canonical affordances vs. non-affordances) and an attribute (useful vs. useless). During the IAT, words, respectively stimuli that represent the target concept, a contrasting non-target concept, and the attributes are displayed in the center of the screen. Subjects are required to assign them to appropriate categories on the left and right sides of the screen as quickly as possible while minimizing errors. The basic assumption is that the faster individuals associate displayed stimuli with the correct category, the higher their implicit affordance perception.

We followed recent recommendations for IAT application in IS research in selecting the target and non-target concepts, as well as the congruent attributes (Serenko and Turel 2020). Given the theoretical nature of the target concept of canonical or non-canonical affordances, we assumed the unfamiliarity of a broad-known definition in our sample. Hence, to ensure equal understanding and avoid the use of extensive definitions during the study (Fink 2022), we relabeled the target concept categories in the test itself to "PPT Use Case" and "No PPT Use Case," providing extensive remarks that PPT stands for "Microsoft PowerPoint." However, in this paper, we remain to use the terms canonical, non-canonical, and non-affordances.

For the target concepts, non-target concepts, and attributes, a minimum of 5 representative words (stimuli) must be generated that are equal in visual and semantic processing effort (Serenko and Turel 2020). In the first preliminary study (n=100), participants were asked about canonical and non-canonical affordances using open-ended questions ("What actions do most people perform with Microsoft PowerPoint?" followed by the question "Please imagine possible actions you might perform with Microsoft PowerPoint that are unusual, different from standard usage, or not intended by the developer:") to generate initial lists of stimuli. To illustrate non-affordances, we formulated use cases which cannot be implemented using MS PowerPoint. Following a thorough review of the responses and drawing upon previous affordance research in IS regarding affordance formulations (Karahanna et al. 2018), we developed three initial stimuli lists consisting of 18 canonical affordances, 45 non-canonical affordances, and 23 non-affordances. To ensure comparable visual processing, we reformulated the terms on these lists to have similar average term lengths (# of letters used). Subsequently, all stimuli were rated by a second group of pre-study participants (n=114): all

86 collected stimuli were successively displayed with the question if the shown use case is a possible use case of MS PowerPoint. If answered with yes, the use case was rated on a scale from 1, "standard use case," to 5, "exotic use case," to determine the distance from the perceived standard use of MS PowerPoint. Using this classification and ratings, we determined 8 final validated stimuli for each target concept, exceeding the required minimum of 5 stimuli, which are similar in their visual and semantic processing. Next, synonyms with similar lengths were selected using the Merriam-Webster dictionary to form stimuli lists for the attribute (useful vs. useless), as was done in comparable IAT studies (Fink 2022). Table 3 shows the list of stimuli used in our two IATs and their classification and ratings.

	Stimuli	Avg. # of letters	Avg. (Yes vs. No)	Rating Min./ Avg./ Max.
Target Concept Category				
Canonical Affordance (IAT 1)	Conducting Trainings, Creating Lectures, Editing Slides, Knowledge Sharing, Presentation, Presenting Graphs, Sales Presentation, Slide Creation	16.13	97.50% vs. 2.50%	1.23/ 1.32/ 1.39
Non-Canonical Affordance (IAT 2)	Creating Games, Artwork Creation, Calendar Management, Creating Flip Books, Instagram Stories, Photo Editing, Puzzle Creation, Social Media Images	16.13	39.13% vs. 59.87%	3.12/ 3.48/ 4.04
Non-Affordance (IAT 1 & 2)	Data Encryption, Downloading Games, Instant Messaging, Internet Browsing, Lost File Recovery, Music Streaming, Online Payments, Virus Scanning	16	5.12% vs. 94.88%	-
Attributes				
Useful	Applicable, Beneficial, Effective, Practical, Productive, Profitable, Valuable	8.8	-	-
Useless	Ineffective, Irrelevant, Nonfunction, Purposeless, Senseless, Valueless, Worthless	9.3	-	-

Table 3. Stimuli Lists of Target Concepts, Non-Target Concepts, and Attributes

For the actual experiment, we used the open-source tool IATgen, which allows an IAT implementation in the online survey software Qualtrics and has proven to be a reliable and valid method for IATs in the online setting (Carpenter et al. 2019). Each of the two IATs performed consists of 7 sequential blocks, each starting with instructions and indicating which categories belong to the left and right keys of the user's keyboard. Figure 2 shows the IAT design as an example of the target concept of the canonical affordances as a target concept (left) and a screenshot of the application from Qualtrics, representing Block 4 of the exemplary IAT design (right). With IATgen and Qualtrics, four versions of the IAT were created in which the target categories and attribute categories were assigned to the left and right keys in different sequences to avoid confounding effects of the experimental procedure order (Carpenter et al. 2019; Fink 2022).

Block	No. Stimuli	Goal	Left Key	Right Key
1	20	Initiate target: learning target stimuli	No PPT Use Case	PPT Use Case
2	20	Initiate attributes: learning attribute stimuli	Useless	Useful
3	20	Practice combination: learning paired categories	No PPT Use Case Useless	PPT Use Case Useful
4	40	Test: congruent category pairing	No PPT Use Case Useless	PPT Use Case Useful
5	40	Reverse target: learning to switch the spatial location of the construct	PPT Use Case	No PPT Use Case
6	20	Practice: learning incongruent paired categories	PPT Use Case Useless	No PPT Use Case Useful
7	20	Test: incongruent target-attribute pairing	PPT Use Case Useless	No PPT Use Case Useful

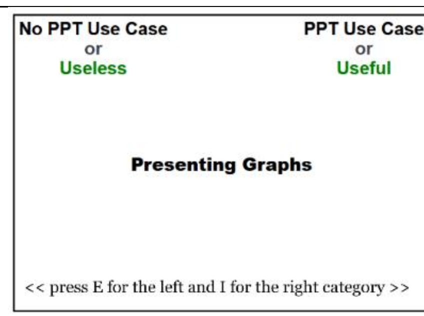

Figure 2. IAT Design (left side) and Illustration for Block 4 (right side); PPT: Microsoft PowerPoint

Using the algorithm according to (Greenwald et al. 2003), one IAT score, also known as the GNB score, was calculated for each test that was used for further analysis. GNB scores typically range from -2.0 to 2.0.

Positive GNB scores indicate that individuals implicitly associate canonical (IAT 1) or non-canonical affordances (IAT 2) as useful, whereas negative scores indicate that individuals associate them as useless.

Phases 3 and 4: Sorting Approach and Survey

In the subsequent phases of the experiment, we measured the explicit perception of affordances and the participants' digital mindset. In contrast to the implicit association tests, where individuals were instructed to categorize displayed affordances as fast as possible, we displayed all affordances (canonical, non-canonical, and non-affordances) in random order at once, asking the participants to categorize each affordance based on their opinion into "PowerPoint Use Case" and "No PowerPoint Use Case" categories without time pressure. For the analysis, we calculated the ratios of affordances categorized as "PowerPoint Use Case," creating a score representing how many canonical and non-canonical affordances were rated as useful when individuals deliberately associate affordances with categories.

Finally, the last phase of the online experiment comprised a survey-based measurement of the digital mindset and relevant control variables. We used a previously validated 12-item scale from the literature and assessed the digital mindset, consisting of 3-4 items per dimension with a seven-point Likert scale from one ("strongly disagree") to seven ("strongly agree") (Hildebrandt and Beimborn 2022b). Finally, we collected age, gender, employment level, educational status, hours of digital technology use per week, personal innovativeness in IT (4 items) (Agarwal and Prasad 1998), IT mindfulness (4 items) (Thatcher et al. 2018) and # of hours of MS PowerPoint use per day as controls. The rationale for including control variables was multi-faceted. Firstly, we sought to eliminate the influence of general differences (gender), life experience (age, level of education) and usage context (employment level). Additionally, it is imperative to acknowledge the proximity in content and conceptual dimensions between the construct of personal innovativeness in IT, IT mindfulness, and that of digital mindset (Hildebrandt and Beimborn 2022a, 2022b). To discern the distinctive effects specifically attributable to digital mindset, it becomes essential to account for the concomitant effects originating from these related traits. By doing so, we create a more refined lens to scrutinize the distinct influences of the digital mindset construct.

Data Analysis

For analyzing our data, we used SPSS AMOS to assess the validity of the digital mindset measure and SPSS statistics for conducting correlation analyses, graph reports, mean comparisons, and variance analyses to test our hypotheses. We assessed the validity of the measured digital mindset construct and assessed indicator reliability, construct reliability, and discriminant validity (Bagozzi 1981). For indicator reliability, we ensured that every item loading exceeded .71 and excluded items with loadings below that threshold (Carmines and Zeller 1979) (see Table 8 in the Appendix). We ensured construct reliability by assessing the average variance extracted (AVE), Cronbach's Alpha (CA), and composite reliability (CR), verifying that they surpassed the recommended thresholds of .50 and .70. (Fornell and Larcker 1981). Lastly, we verified discriminant validity as the AVE square root values were found to be higher than the correlations to PIIT and IT Mindfulness, and the maximum shared variance of the constructs is below the average shared variance (see Table 9 in the Appendix).

For testing our hypotheses, we assessed correlations of our measured variables, followed by groupwise comparisons, using the digital mindset (DM) as an experimental factor (Low DM/High DM) for H1 and H2 and implicit canonical affordance perception (ICAP), implicit non-canonical affordance perception (INCAP), explicit canonical affordances perception (ECAP), and explicit non-canonical affordance perception (ENCAP) as outcome variables. For H3a and H3b, we used ICAP, ECAP, INCAP, and ENCAP as experimental factors (Low/High) and outcome variables. Subsequently, we conducted several analyses of covariances (ANCOVA) for each hypothesis, including our controls as covariates, ensuring the robustness of the mean comparisons. As all our experimental factors (e.g., digital mindset) were artificially created out of continuous scales, we used the 30^{th} and 70^{th} percentile to split the groups into individuals that possess low (lowest 30%) respectively high expression (highest 30%) of the experimental factor. For ECAP and ENCAP, we split the groups across the median to ensure sufficient group sizes. Table 4 provides an overview of our descriptives and experimental factors used for the hypotheses tests.

Variables	All			Low			High		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
DM (Digital Mindset)	5.17	.97	189	3.98	.69	53	6.22	.35	58
ICAP (Implicit Canonical Affordance Perception)	.666	.42	189	.154	.24	56	1.12	.17	58
INCAP (Impl. Non-Canonical Afford. Perception)	.655	.39	189	.211	.20	56	1.10	.21	56
ECAP (Explicit Canonical Affordance Perception)	.993	.04	189	.821	.09	31	1.00	.00	158
ENCAP (Expl. Non-Canonical Afford. Perception)	.821	.28	189	.465	.2	60	.987	.04	129
Controls									
PIIT (Personal Innovativeness in IT)	5.16	1.2	189	3.56	.90	52	6.73	.28	36
ITM (IT Mindfulness)	5.24	1.1	189	3.71	.61	47	6.66	.28	41

Table 4. Descriptives for Different Tested Experimental Groups

Results

Our correlation table (see Table 5) shows that the digital mindset is significantly positively related to implicit and explicit non-canonical affordance perception in our data.

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. DM	1.00											
2. ICAP	-.061	1.00										
3. INCAP	**.267****	**.350****	1.00									
4. ECAP	.053	.017	-.050	1.00								
5. ENCAP	**.255****	.012	**.187***	**.192****	1.00							
6. Age	.005	**.241****	**.242****	.111	.137	1.00						
7. Gender	**-.166***	-.053	.012	.022	-.077	.091	1.00					
8. EDUC	-.109	.082	-.032	**.257****	.009	**.180***	.088	1.00				
9. EMPL	**.195****	.077	**.177***	-.088	.116	**.381****	-.093	.013	1.00			
10. TECH	.129	-.139	.032	-.040	-.068	**-.267****	-.054	.049	.051	1.00		
11. PPT	**.249****	-.015	.002	-.086	-.023	-.058	-.094	.031	.074	.096	1.00	
12. PIIT	**.699****	-.172	**.176***	.109	**.174***	.079	**-.258****	.137	**.247****	.126	**.264****	
13. ITM	**.670****	-.024	**.146***	.079	**.218****	.066	-.071	-.064	**.174***	.042	**.309****	**.601****

Table 5. Correlations (*: .05; **: .01; EDUC: Level of Education; EMPL: Employment Level; TECH: Technology Use in # Hours/Week; PPT: PowerPoint Use in # Hours/Day; for Further Labels See Table 4)

This relationship is supported by pairwise comparison, as shown in Figure 3, and by t-test-based comparisons in Table 6, which show that these perceptions are significantly higher for individuals with a high digital mindset vs. a low digital mindset. Considering the implicit non-canonical affordance perception (INCAP), we observe a significant increase for individuals that possess high digital mindset levels ($Mean_{High\ DM}$ = .801), relative to the low digital mindset group ($Mean_{Low\ DM}$ = .514; t = -3.943, p = .001). This effect is also significant in the ANCOVA analysis, with all controls added as covariates (see Table 7). For additional robustness, we also tested a vice versa combination, using the digital mindset as an outcome variable, providing further evidence that the digital mindset of individuals with low implicit non-canonical affordance perception ($Mean_{Low\ INCAP}$ = 4.92) is significantly lower than for individuals with high implicit non-canonical affordance perception ($Mean_{High\ INCAP}$ = 5.51; t = -3.379, p = .001). Thus, hypothesis 1 is supported.

Similar effects could be demonstrated for explicit perceptions, where a significant increase of explicit non-canonical affordance perception (ENCAP) could be observed for individuals with high digital mindset levels ($Mean_{High\ DM}$ = .888) in contrast to the low digital-mindset group ($Mean_{Low\ DM}$ = .702; t = -3.333, p = .001) (see Table 6). The ANCOVA confirmed this, and our posthoc analysis found that the vice versa combination is significant, too, showing that individuals with low ENCAP ($Mean_{Low\ ENCAP}$ = 4.94) also show lower digital mindset levels, in comparison to individuals with high ENCAP ($Mean_{High\ ENCAP}$ = 5.29; t = -2.290, p = .023). Therefore, hypothesis 2 is supported. We further found no evidence for a relationship between ICAP and ECAP, neither correlations nor group differences (see Table 5 to Table 7). Hence, hypothesis 3a is rejected.

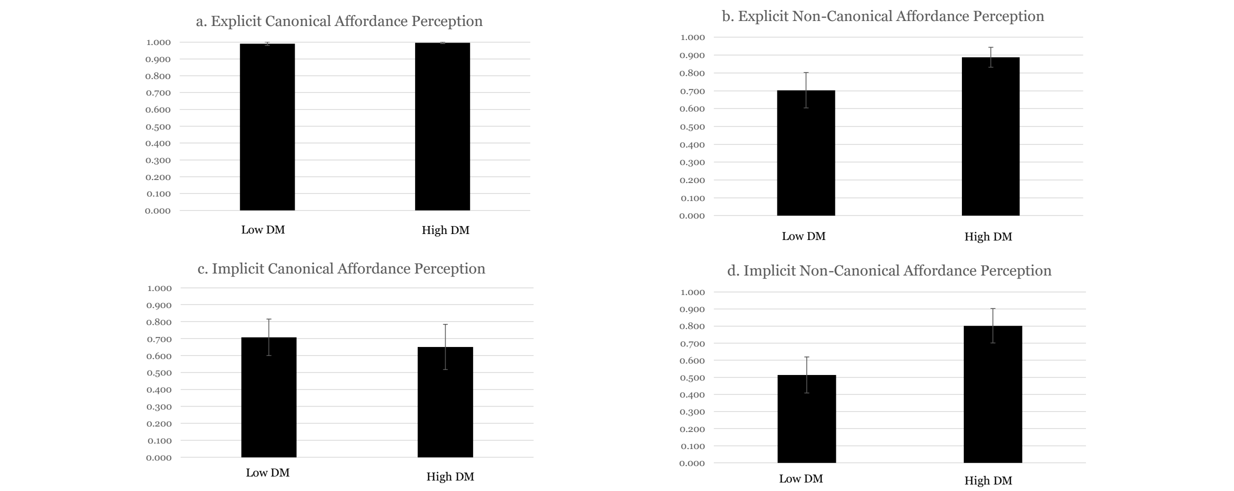

Figure 3. Differences in Affordance Perception Across Digital Mindset Levels

Lastly, we found that INCAP and ENCAP are significantly correlated (see Table 5), also supported by the pairwise comparison, proving significant differences of ENCAP for individuals with low INCAP levels ($Mean_{Low\ INCAP}$ = .769) in contrast to high INCAP levels ($Mean_{High\ INCAP}$ = .902; t = -2.626, p = 010) (see Table 6). Additionally, we found that INCAP is also lower for individuals with low ENCAP levels ($Mean_{Low\ ENCAP}$ = .569) in contrast to individuals with high ENCAP levels (Mean $_{High\ ENCAP}$ = .694; t = -2.087, p = .038) (see Table 6). This is also supported by our ANCOVA tests (see Table 7). Therefore, hypothesis 3b is supported.

Compared Groups	*Mean Contrast*	*Difference*	*t*	*p-value*
Outcome Variable: Implicit Non-Canonical Affordance Perception (INCAP)				
Low vs. High DM	.514 vs. .801	.281	-3.943	**<.001**
Low vs. High ENCAP	.569 vs. .694	.125	-2.087	**.038**
Outcome Variable: Explicit Non-Canonical Affordance Perception (ENCAP)				
Low vs. High DM	.703 vs. .888	.185	-3.333	**<.001**
Low vs. High INCAP	.769 vs. .901	.132	-2.626	**.010**
Outcome Variable: Implicit Canonical Affordance Perception (ICAP)				
Low vs. High DM	.707 vs. .650	.057	.654	.515
Low vs. High ECAP	.656 vs. .666	.009	-.054	.957
Outcome Variable: Explicit Canonical Affordance Perception (ECAP)				
Low vs. High DM	.995 vs. .997	.002	-.660	.510
Low vs. High ECAP	.989 vs. .995	.006	-.841	.402

Table 6. Mean Comparisons by Groups; DM: Digital Mindset

Outcome Variable	Source	DF	MS	F	p	PES (effect size)
Implicit Non-Canonical Affordance Perception (INCAP)	Digital Mindset	1	1.38	10.09	.002	.092
	ENCAP	1	.835	5.86	.017	.055
Explicit Non-Canonical Affordance Perception (ENCAP)	Digital Mindset	1	.695	7.79	.006	.072
	INCAP	1	.325	4.43	.038	.040
Implicit Canonical Affordance Perception (ICAP)	Digital Mindset	1	.222	1.09	.297	.011
	ECAP	1	.003	.017	.896	.000
Explicit Canonical Affordance Perception (ECAP)	Digital Mindset	1	.001	1.39	.242	.014
	ICAP	1	.000	.305	.582	.003

Table 7. ANCOVA Tests

Discussion and Conclusion

Organizations rely on their employees' perceptions of affordances to harness the full potential of digital technologies. Our study provides statistical evidence that individuals perceive digital technology affordances differently, consciously and unconsciously, depending on their digital mindset.

Our results indicate that individuals with a high expression of a digital mindset demonstrate significantly higher levels of implicit non-canonical affordance perception. This implies that those who think in combinatorial, generative, or disruptive ways are more likely to automatically process potential innovative action possibilities when approaching digital technologies. This heightened perception of innovative solutions is especially useful in situations that require quick actions or when individuals are cognitively lazy, as the set of apparent innovative possibilities that can be actualized in such situations increases. However, as hypothesized, our results also show that this effect is limited to non-canonical affordances and does not impact unconscious associations concerning canonical affordances of digital technologies. Thus, in situations where time is limited and conscious thinking is not feasible, individuals with high or low digital mindsets are equally likely to recognize common action possibilities of digital technologies to achieve their goals.

Our findings also suggest that individuals with a high digital mindset exhibit significantly higher levels of explicit non-canonical affordance perception. Precisely, individuals who consistently identify agnostic and combinatorial characteristics of digital technologies or question established problem-solution pairs, will rather assess unconventional action possibilities as useful. This suggests that in complex situations involving digital technologies and allowing for deliberative reasoning, individuals with high digital mindsets will be more likely to perceive unconventional ways of utilizing such technologies than individuals with low digital mindsets. Consistent with our previous findings and hypothesis, this effect is not evident for the explicit perception of canonical affordances, indicating that a digital mindset does not influence the recognition of well-known and established action possibilities. Hence, in the aforementioned situations, and after deliberative reasoning, individuals with low or high digital mindsets are likely to arrive at similar typical use cases that may be actualized to achieve their goals.

Furthermore, our results show a positive relationship between high levels of implicit non-canonical affordance perception and explicit perception of those same affordances. More specifically, unconscious associations formed during the processing of untypical affordances tend to influence subsequent conscious reasoning in situations where individuals have sufficient time to evaluate, making them more likely to evaluate such affordances as applicable use cases. Moreover, repeated conscious evaluations of these use cases transfer these evaluations to associative memory, increasing the likelihood of automatic perception of untypical affordances. While we could prove this effect for non-canonical affordances, we could not provide statistical evidence in case of canonical affordances. One possible explanation could be that even though individuals may not consciously associate such affordances as useful, the ubiquity of social norms and other people's use may lead individuals to perceive such affordances deliberately. Alternatively, repeated conscious evaluation of common use cases, evident when there is extensive experience with a system, may lead to the automatic transfer of evaluation of most use cases from the explicit to the implicit system of thinking. As a result, individuals do not need to engage in deliberate reasoning to assess such affordances, making the perception of such affordances an unconscious and salient process, while explicit processing remains dormant.

Our findings contribute to the literature by extending the discourse on digital affordances. While previous research focused solely on conscious deliberation (e.g., Bernardi et al. 2019; Lehrig et al. 2019), we introduced the implicit or unconscious perspective to provide a more comprehensive explanation of how individuals perceive affordances in various scenarios that require different levels of cognitive effort. Therefore, our results extend the affordance theory, indicating that affordance perception consists of conscious deliberation and unconscious associations, which can also be affected and developed. This is particularly important for future studies exploring affordance perception in situations where conscious deliberation is not feasible. Furthermore, our study, which includes both canonical and non-canonical affordances, contrasts previous qualitative works on affordances, especially affordance perception. By showing that the impact of individual differences varies across the type and nature of an affordance, we challenge previous findings that assume that these influences are generally valid for affordances, regardless of whether it represents a typical or rather untypical action possibility. Hence, we extend the affordance theory by showing that individual differences' impact on an individual's affordances perception is not universal but depends on whether an affordance is a well-known or unknown, innovative, use. Further, extant research on affordance perception investigated IT-specific traits dependent on the specific technology (cf. Lehrig et al. 2019). We extend those findings by providing evidence that developable and trainable IT-specific traits, independent of the technology at hand, significantly affect affordance perception, highlighting that the perception of affordances can be leveraged independently from a specific technology or context.

With our insights, we also make a contribution to the nascent field of the digital mindset by providing statistical evidence that this mindset alters how individuals interpret digital technologies. Building on prior conceptual works, our study extends the current understanding of the digital mindset and demonstrates that, in addition to more behaviorally specific traits such as PIIT or IT mindfulness, it has significant explanatory power for how digital technologies are perceived.

Our results also hold valuable insights for practitioners. With proven effects of technology-independent traits susceptible to training measures, organizations gain a powerful variable that may be fruitful in several ways. First, by promoting and nurturing combinatorial, generative, or disruptive thinking of employees, organizations can enhance their ability to find better solutions to everyday business problems, especially in stressful situations. Second, they can use this information to identify and train employees who are explicitly tasked with finding innovative solutions to complex problems, such as in digital innovation units, where time constraints may be less critical.

Like any empirical study, our work holds several limitations. Firstly, we sampled individuals who frequently use MS PowerPoint to complete work tasks and, therefore, have extensive experience with the software. However, as previously mentioned, differences in MS PowerPoint experiences could also play a role in affordance perception, particularly implicit perception. While we addressed this issue by using additional usage frequency controls, future studies may require more varied samples with different levels of experience to enhance the generalizability of our results. Secondly, although we used careful data-cleaning approaches and followed best practices for collecting implicit measures, the familiarity of crowdsourcing workers with implicit tasks may suppress effect sizes of IAT scores in contrast to student samples, as frequently used (Connors et al. 2020). Future studies might conduct in-lab experiments, complemented by EEG studies to retrieve a more differentiated picture of implicit perceptions regarding how technologies can be used. Thirdly, the original digital mindset construct, as conceptualized by Hildebrandt and Beimborn (2022a), is much richer than the three thinking patterns used in our study. While we have argued that the chosen subset is most relevant for digital technology affordance perception, considering other or all eleven dimensions of the digital mindset could lead to a more nuanced understanding of the investigated effects.

In conclusion, organizations must comprehend how their employees perceive the open and flexible affordances of the technologies in use, as affordance perception is a prerequisite for their actualization. Thus, we contribute to the research on digital technology affordances by demonstrating the impact of trainable IT-specific traits on the different perceptions of distinct types of affordances. Future research can build on our findings to further examine which, how, and why perceived affordances are actualized, creating a clearer picture of how organizations and their employees can leverage the potential of digital technologies.

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Appendix

Construct (Cronbach's α)	Item	Loading
Digital Mindset (.937)		
Combinatorial Thinking (Hildebrandt and Beimborn 2022b) **(.911)**	I always think about combining different (digital) components when solving problems.	.948
	When solving problems, I always consider combining different (digital) components rather than building something from scratch.	.859
	When I tackle problems, I always think about combining existing (digital) solutions.	.934
	I always notice that digital products consist of different (digital) components.	.819
Generative Thinking (Hildebrandt and Beimborn 2022b) **(.892)**	If I developed a digital product or service, I would always make sure that it could be very variably used for different unanticipated use cases.	.867
	If I developed a new digital product or service, I would always provide possibilities for alternative use cases.	.856
	When using digital products or services, I always think about what else I could use them for besides their intended functions.	.893
	I always see potential new use cases for digital products or services that go beyond their intended use.	.861
Disruptive Thinking (Hildebrandt and Beimborn 2022b) **(.892)**	I always recognize how a new digital product or service could replace established solutions.	.901
	I always see potentials for existing business models being replaced by disruptive digital products or services.	.920
	I always see potential for digital products or services to transform entire markets.	.928
Controls		
Personal Innovativeness in IT (Agarwal and Prasad 1998) **(.900)**	If I heard about a new information technology, I would look for ways to experiment with it.	.918
	Among my peers, I am usually the first to try out new information technologies.	.875
	In general, I am hesitant to try out new information technologies.	.641*
	I like to experiment with new information technologies.	.916
IT Mindfulness (Thatcher et al. 2018) **(.869)**	I am very creative when using Microsoft PowerPoint.	.851
	I have an open mind about new ways of using Microsoft PowerPoint.	.810
	I like to figure out different ways of using Microsoft PowerPoint.	.888
	I "get involved" when using Microsoft PowerPoint.	.846

**: Item dropped due to low loading*

Table 8. Measurement Items, Cronbach's Alpha, and Loadings

	Validity Tests				Correlations		
	CR	AVE	MSV	MaxR(H)	DM	ITM	PIIT
DM	.889	.728	.694	.892	**.853**		
ITM	.857	.667	.618	.862	.670	**.817**	
PIIT	.912	.776	.694	.926	.699	.601	**.881**

DM: Digital Mindset; ITM: IT Mindfulness; PIIT: Personal Innovativeness in IT; CR: Composite Reliability; AVE: Average Variance Extracted; MSV: Maximum Shared Variance; MaxR: Maximum H Reliability; Square Root of AVE bold on Diagonal

Table 9. Validity Tests