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Review

Artificial intelligence and its implications for data privacy

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Abstract

Contemporary, multidisciplinary research sheds light on data privacy implications of artificial intelligence (AI). This review adopts an AI ecosystem perspective and proposes a process-outcome continuum to classify AI technologies; this perspective helps to understand the nuances of AI relative to psychological aspects of privacy decision-making. Specifically, different types of AI affect traditionally studied privacy decision-making frameworks including the privacy calculus, psychological ownership, and social influence in varied ways. By understanding how the process- or outcome-orientation of an AI technology affects privacy decision-making, we explain how AI creates privacy benefits but also poses challenges. Future research is needed across privacy decision-making, but also more generally at the intersection of privacy and AI, to help foster an ethical, sustainable society.

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Keywords

Data privacy, Privacy calculus, Artificial intelligence, Psychological ownership.

Introduction

As scholars across diverse academic areas study artificial intelligence (AI) and examine the ways in which AI technologies affect key constructs in their domains, many references are made to privacy, or individuals' vulnerability to privacy violations, as an important concern for AI research, practical application, and regulation. However, a deep appreciation for the intersection of AI with privacy remains elusive and lacks specificity, perhaps because privacy research tends to follow the development of information technologies [1**]. Nonetheless, AI technologies create significant privacy implications [2] as they rely on increasing volumes of personal data to enable sophisticated inferences and predictions [3**]. AI proliferation brings novel challenges to privacy protection in addition to exciting opportunities for privacy innovation, presenting dynamic tensions with which academics, managers, and regulators must grapple. In this investigation, we adopt an AI ecosystem perspective [3**, 4], and propose a process-outcome continuum to classify AI technologies; this perspective helps to understand the nuances of AI relative to psychological aspects of privacy decision-making. Specifically, we identify ways in which different types of AI affect traditionally studied privacy decision-making frameworks including the privacy calculus, psychological ownership, and social influence.

A process-outcome continuum of AI technologies and data privacy

AI comprises an ecosystem consisting of three fundamental, technical elements: *data gathering*, *data processing*, *and data outcomes* [3**,4] (see Figure 1). These elements "enable products and services to perform tasks typically understood as requiring intelligence and autonomous decision-making on behalf of humans" [3**; p. 132]. The first element, *data gathering*, involves information collection (e.g., through sensors, videos, or physical activity); these data can be either intentionally provided by individuals or acquired indirectly through digital footprints left by people during their routine activities (e.g., facial recognition technology in retail environments; fitness trackers) [5]. The second, *data processing*, is where these collected data are analyzed and interpreted with statistical and computational techniques (e.g., generative AI) [6]. The final element, *data output*, entails the delivery of processed information (e.g., a recommendation) or an action (e.g., functionality of autonomous vehicles) as provided to an individual user [7].

Viewed from an individual's perspective, we propose that AI technologies unfold along a continuum between two main orientations, distinguished by their emphasis

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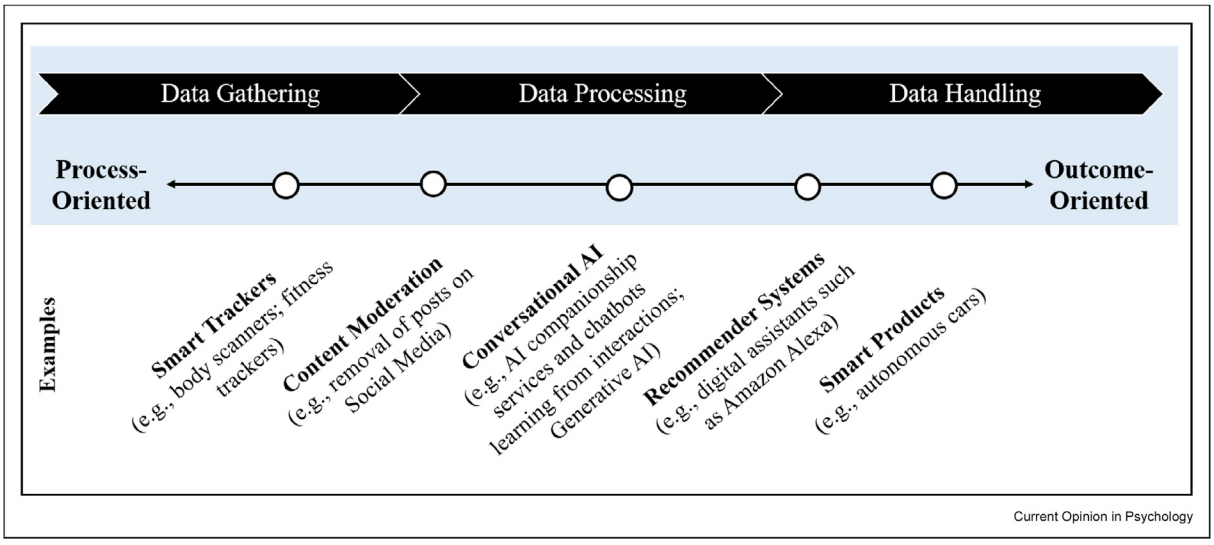
Figure 1



The AI ecosystem and a process-outcome continuum of AI technologies.

on different elements of the AI ecosystem (see Figure 1). On one end of the continuum lies *process-oriented AI*, which mainly focuses on data gathering and data processing (i.e., the data flow consisting of collection and submission of personal data) [8**]. Examples include smart fitness trackers, body scanners, or emotion tracking systems used in call centers. Moving to the other end of the continuum, focus shifts towards *outcome-oriented AI*, which is primarily concerned with the final output as a result of data processing (i.e., data handling involving use and access) [8**]. These technologies focus on the results of AI's functioning, such as making decisions, generating predictions, or producing intelligent output. A variety of technologies fall somewhere between these two ends where AI can include aspects of a process-orientation and an outcome-orientation, and are primarily concerned with data processing tasks as they churn collected data into meaningful and useable output (i.e., data processing via mechanical, computational, or other analytical methods). Technologies such as conversational AI, which can simultaneously collect and process individuals' input data (e.g., textual or audio requests) for interpersonal outcomes (e.g., personalized answers to these requests), fall somewhere in this middle area of our continuum. Importantly, these conversational AI learn from prior interactions which, from an individual perspective, distinguishes them from recommender systems that provide simple answers.

Privacy decision-making: psychological and social factors

Different types of AI technologies likely have deviating effects on personal privacy, defined as an individual's right to be let alone, to control access to the self or one's information, and to remain free from intrusion [9]. That is, depending on where an AI technology falls along this continuum—whether closer to the process-oriented end, toward the outcome-oriented end, or somewhere in the middle—people's perceptions of privacy may differ. While an individual may evaluate their privacy while using process-oriented AI technologies based on the nature and amount of data collected, they may judge outcome-oriented AI technologies based on the visibility and implications of the outputs, such as personalized recommendations or decisions made on their behalf. In what follows, we focus on three specific privacy decision-making frameworks with different psychological and social factors to elaborate on AI's implications for privacy.

AI and the privacy calculus

The privacy calculus model posits that individuals weigh potential benefits and risks to themselves and their personal data when deciding whether to share information with an organization [10]. However, research increasingly recognizes that various factors can interfere with a person's ability to rationally and carefully consider potential risks and benefits related to each data disclosure situation they encounter [11], many of which can be exacerbated by AI technologies [12]. Further, depending on the technology's orientation, perceptions of AI's benefits and risks may differ (i.e., process as a benefit/risk vs. outcome as a benefit/risk) [13].

Process-oriented AI technologies can affect one's ability to perform a privacy calculus especially as it relates to data gathering, which includes how an organization collects personal data. AI increasingly automates data

disclosure processes, where the data disclosure request is no longer salient but instead, is passively acknowledged at some other point (e.g., by accepting the conditions of an app's installation and usage policies) [5]. AI in data disclosure processes also may be employed in a hybrid way where a portion of the process is automated, potentially resulting in feelings of being at risk. In these settings, data are acquired online via tracking, or gathering is partly automated and supported by the individual (e.g., AI extracts data from video filmed and uploaded by human) [8**,14]. Of course, these technologies also create convenience and accuracy benefits related to the data gathering experience that can outweigh data disclosure risks (e.g., storing one's home address and credit card data for future purchases) [15].

As part of the privacy calculus, research shows that people evaluate the outcomes of data handling or use by recipients, even though they lack control of this data management phase (i.e., data gathering control resides with an individual while data handling is managed by an organization) [8**]. Organizations need to train and improve AI through machine learning, which requires access to large volumes of data. Often, these data are handled by third-party brokers who may perform various data management tasks with the original organization's first-party data [6]. Consumer-facing conversational AIs such as chatbots, provide better responses to queries by "learning" on other users' questions, searches, and other sensitive data [16,17] and by integrating personal data across retail platforms [18]. Accordingly, even if an organization strives to be transparent about how personal data will be handled following data gathering, these data may be repurposed, aggregated, sold, or acquired by other entities [2]. This makes rational consideration of data disclosure benefits and risks especially challenging for individuals [19**]. It follows that when the privacy calculus is employed relative to new, outcome-oriented AI technologies, individuals sometimes decide that sought-after personalization and recommendation benefits of using such products or technologies do not offset the risks. Research on personal digital assistants (e.g., Apple's Siri or Amazon's Alexa), for instance, shows that recommendation outcomes do not always counterbalance perceptions of risk [20–22].

Privacy, AI, and psychological ownership

Social scientists and legal scholars increasingly infuse conversions about data privacy with concepts of personal data ownership, autonomy, and control regarding an organization's data use. The central idea is that people treat their personal data as an extension of themselves and violations of privacy can be perceived as violations of personal boundaries [23]. Ownership of one's data also implies that an individual sets desired limits on a hypothetical continuum that spans data sharing and data privacy, with the ideal balance based on personal preferences for the perceived value gleaned from disclosure versus protection [24]. Accordingly, process-oriented and outcome-oriented AI technologies challenge people's ability to engage in autonomous decision-making regarding their data ownership preferences [25], but these technologies also offer solutions.

Processes-oriented AI technologies can assist individuals with complex data gathering tasks as explained above, distilling abstract information into meaningful inputs for useful applications. Organizations that are transparent in such practices can align users' psychological ownership of their data during data gathering and processing with elements of control (e.g., opt-out choices) and by requiring informed consent to organizations' statements that reveal their data gathering, processing, and outcomes intentions [26]. Moreover, data disclosure can be affected by AI's increasing capacity for feeling intelligence, making it important for organizations to be cautious in how AI is used (or misused) to encourage data sharing [27]. Conversational technologies that can exploit specific emotional states may create situations where people reveal greater quantities or more sensitive types of data because of the feelings experienced during a data disclosure request [28**]. Questions of data ownership become even more complex when individuals disclose personal information of others, either intentionally or unintentionally [29]. Psychological ownership frameworks for studying privacy traditionally have considered personal preferences, although, new perspectives seek to expand to relevant others [30*].

With regard to outcome-oriented technologies, AI's ability to deploy large-scale models using anonymized data offers great promise for psychological ownership perspectives of personal data, especially given evidence of the importance of protecting one's identity in such considerations [31,32]. Personalization and recommendation systems trained on the anonymous data of meaningfully similar individuals provide better search results [6], and algorithmic recommendation systems can enhance feelings of personal autonomy and control and provide better marketplace choices [33]. However, questions of ownership become murky for outcomes generated using certain types of data and AI technologies, such as those collected via smartwatches and other wearable devices people use to achieve personal health goals [34]. Further, it is unclear who owns products created mutually between an individual and an AI technology, such as artwork created by generative AI. The outcomes people seek using such technologies, and supported by AI, may overshadow concerns for privacy and data protection and also present significant regulatory challenges [35].

Privacy, and AI and social influence

Although privacy decision-making often is considered an individual psychological process, it is important to acknowledge the various social forces, peer influences,

and even societal norms that can shape these processes. Privacy questions influenced by AI are both individual and collective in nature, especially when personal decisions for data sharing can spillover to others [18**]. In this section, we examine how AI interacts with social factors to shape individuals' data privacy considerations [36], again considering how AI technologies spanning process-oriented to outcome-oriented challenge and support individuals' privacy decision-making.

Process-oriented AI technologies supporting digital platform ecosystems can glean complex, interactive data that sheds light on ways people behave with an organization and with each other, in a detailed, ongoing fashion [5]. Data collection and analysis of interactive, social behavior can provide important scientific insights on collective decision-making, but also create significant privacy risks and can be exploited for an organization's benefit to gain access to this rich data source and to encourage behaviors that are increasingly predictable (and therefore manipulatable) in social settings [37*]. As one example, social platforms (e.g., Instagram, Facebook) where photo sharing among personal networks is highly normative gain access to rich photo images through which AI provides increasingly sophisticated technologies for making precise personal and behavioral inferences [38,39]. Conversely, AI infused into social processes regarding data gathering, specifically related to what a person chooses to post in social settings, can provide guardrails via content moderation, removing the human element from policing, which both improves accuracy and preserves the privacy of those involved in a suspicious or violating interaction [40]. Of course, AI as content moderator is imperfect, and as the volume of content in these spaces continues to grow, it will be increasingly important to maintain oversight of AI as it supports content moderation systems [41].

Outcome-oriented AI technologies can create platforms for social interactions that remove physical and geographical boundaries, fostering human and human-like connections. These technologies also create situations where, in a desire to interact with family, friends, and colleagues in social settings, people relax their privacy considerations and behave in ways that are inconsistent with their preferences [26]. Beyond family and friends, individuals increasingly engage with AI companions such as those provided by Replika AI, which can be customized visually and behaviorally through user interactions [21,27**]. As technology increasingly mimics the roles of friends or romantic partners, people often find themselves interacting with these AI technologies as they would in human relationships, sharing sensitive personal details. These technologically-powered intermediaries offer important benefits in many settings, such as in contexts or sitations where individual or interpersonal embarrassment or shame is likely [42**,43]. However, the consequences of such intimate disclosures, especially in terms of well-being and the potential for data exploitation by companies, remain largely unexamined. Perhaps unsurprisingly, the ways in which AI technologies, spanning process-oriented to outcome-oriented, influence social spaces potentially violate privacy and threaten personal well-being are focal to recently passed and pending legislation in the European Union, the United States, and elsewhere.

Conclusion

This review explored the intersection of AI and data privacy, providing a continuum spanning process-oriented and outcome-oriented AI technologies that affect the privacy calculus, psychological ownership, and social influence and weighing these technologies' challenges and benefits. Each decision-making framework reveals nuances for privacy and AI, however, there are characteristics of AI generally that affect privacy across these frameworks, including its explainability and its proneness to bias. We recommend further research, for instance, in the context of explainable AI to increase "visibility into how an AI system makes decisions and predictions and executes its actions" [44, p. 137]. Demystifying the mechanistic workings of AI can offset people's concerns with using new technologies, however, even with full disclosure, AI is subject to significant biases [45].

In conclusion, AI must be further studied as a critical issue for social sustainability within online and local communities, as well as within a broader democratic society [18**,46**]. Ethical examinations of AI rightly note the vast implications across multiple facets of our daily lives and broader societal interactions, one of which includes privacy [47*]. We agree with research calls that stress the imperative to include social scientists in the development and monitoring of AI systems [48] given their unique understanding of how people navigate privacy decision-making in relevant contexts. Thankfully, many useful psychological frameworks allow us to make sense of specific ways AI technologies, processes, and outcomes can affect important human rights and facets of well-being related to privacy. AI technologies can provide helpful tools and novel systems that preserve privacy and well-being, in spite of the challenges their intersection simultaneously presents. Yet only with deeper study and meaningful investigation will research, practice, and policy provide balanced insights toward accomplishing these goals.

Author contributions

Kelly D. Martin: Conceptualization, Writing – review & editing. **Johanna Zimmermann:** Conceptualization, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

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* of special interest
** of outstanding interest

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